



## **WBLR Phase 3 (Brookleigh, Burgess Hill)**

### **DRAINAGE STRATEGY & MAINTENANCE STATEMENT**

January 2025

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## Quality Assurance – Approval Status

This document has been prepared and checked in accordance with  
 Waterman Group's IMS (BS EN ISO 9001: 2015, BS EN ISO 14001: 2015 and BS EN ISO 45001:2018)

| Revision | Status | Date     | Prepared by                                                                       | Checked by                                                                         | Approved by                                                                         |
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| P01      | S3     | 24/10/24 |                                                                                   |                                                                                    |                                                                                     |
| P02      | S4     | 25/10/24 |                                                                                   |                                                                                    |                                                                                     |
| P03      | S5     | 01/11/24 | S.Pearce                                                                          | J.Harshaw                                                                          | C.Welch                                                                             |
| P04      | S5     | 02/12/24 | S.Pearce                                                                          | J.Harshaw                                                                          | C.Welch                                                                             |
| P05      | S5     | 07/01/25 | S.Pearce                                                                          | J.Harshaw                                                                          | C.Welch                                                                             |
|          |        |          |  |  |  |

## Comments

| Revision |                                       | Status     |                                                    |
|----------|---------------------------------------|------------|----------------------------------------------------|
| Pnn      | Preliminary (shared; non-contractual) | S1         | Coordination                                       |
| Cnn      | Contractual                           | S2         | Information                                        |
|          |                                       | S3         | Review & Comment                                   |
|          |                                       | S4         | Review & Authorise                                 |
|          |                                       | S5         | Review & Acceptance                                |
|          |                                       | A0, A1, An | Authorised & Accepted (n=work stage if applicable) |

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- E. Sewage Undertaker Asset Information
- F. Proposed Drainage and Utilities Layout
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## 1. Introduction

### 1.1 Background and Context

Jackson Civil Engineering has been commissioned by Homes England (the 'Applicant') to develop the design and gain approvals for Phase 3 of the Western Bridge and Link Road (WBLR), forming a part of the wider Brookleigh (formerly the Northern Arc) development to the north and northwest of Burgess Hill.

Waterman Infrastructure & Environment Ltd (WIE) are assisting Jackson Civil Engineering in delivery of the design and gaining approvals for WBLR Phase 3.

WBLR Phase 3 requires two planning applications to be submitted:

- a reserved matters application (RMA), for the majority of the proposed scheme which falls within the Brookleigh outline planning permission (OPP, application reference DM/21/3279) red line boundary.
- a full application for a small area of the proposed scheme which falls outside of the OPP red line boundary.

An outline planning application (application reference DM/18/5114) was submitted to Mid Sussex District Council ("MSDC") in December 2018 for the Brookleigh development and was accompanied by an Environmental Statement ("ES"). This application was granted permission on 4<sup>th</sup> October 2019.

A subsequent Section 73 application was submitted in 2021 (application reference DM/21/3279) seeking amendments to the original 2019 permission. This application was granted permission on 9<sup>th</sup> December 2022.

A reserved matters application for WBLR Phase 1 was granted approval in July 2020 (reserved matters application reference DM/20/0254) and at the time of writing the Phase 1 scheme is nearing completion on-site.

The design and a reserved matters application for WBLR Phase 2 (for a section of the Brookleigh development spine road heading north from the WBLR Phase 1 A2300 roundabout (see [Figure 1](#)) is being progressed alongside the Phase 3 design and applications.

### 1.2 Document Purpose

This Drainage Strategy and Maintenance report sets out the surface water drainage strategy and maintenance requirements for WBLR Phase 3 and is submitted to discharge the OPP planning condition number 22 'Surface Water Drainage'.

For the reserved matters application there must be consistency with relevant elements of the preceding outline planning permission. As such, and for ease of comparison, this document reflects the structure of the corresponding document submitted as part of the OPA.

The approved OPA Flood Risk Assessment (FRA) by AECOM includes a surface water drainage strategy for the whole of the Brookleigh development.

### 1.3 Site Location

The WBLR Phase 3 red line boundaries (the application site boundaries) for the RMA and Full planning applications are shown in **Figures 1 & 2** respectively.

The National Grid Reference for the approximate centre of the WBLR Phase 3 scheme is 529602E, 120077N.

The nearest postcode is RH15 8GA.

Site location plans for the RMA and Full application sites are included in **Appendix A**.

Mid Sussex District Council (MSDC) is the Local Planning Authority.

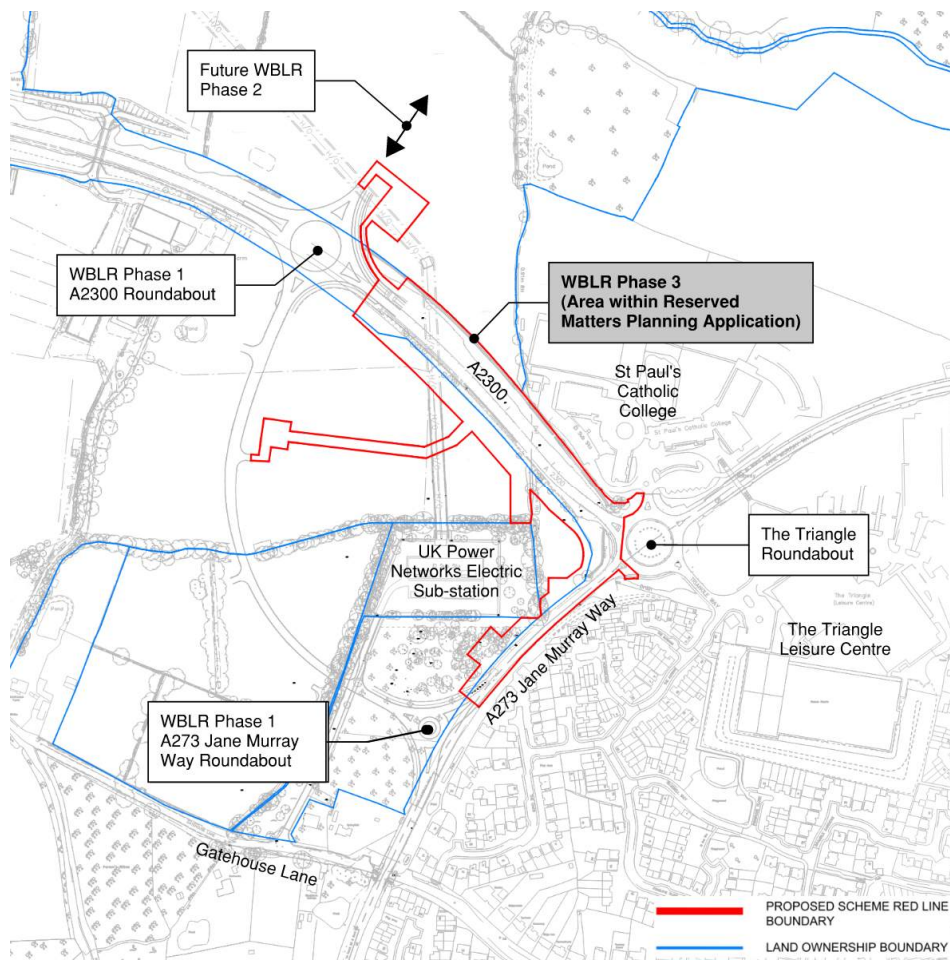


Figure 1: Application Site Boundary – RMA

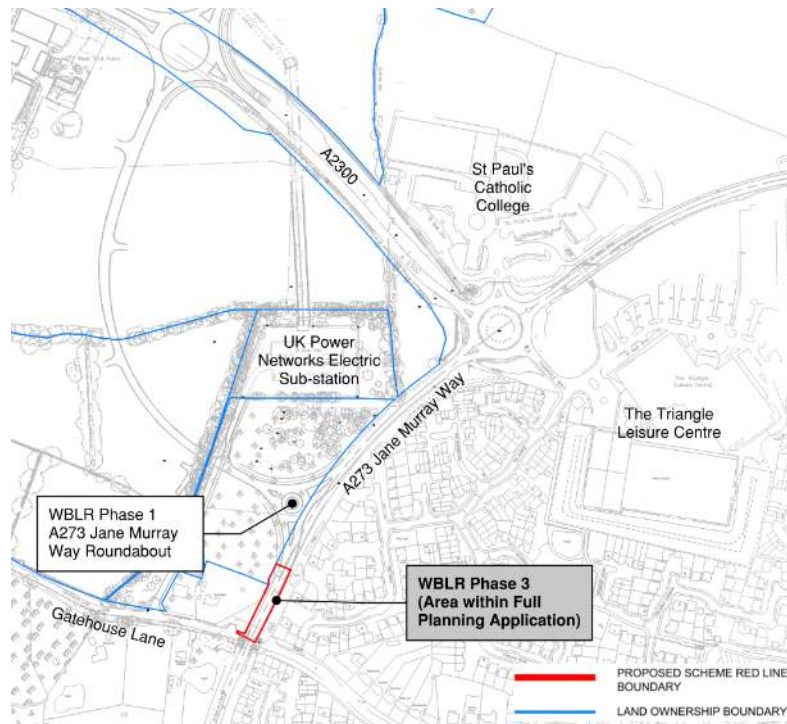


Figure 2: Application Site Boundary – Full application

## 1.4 Proposed Development

The Site is located within Burgess Hill, approximately 2km north-west of the town centre, within the administrative area of Mid Sussex District Council.

The Brookleigh Strategic Allocation Area comprises a site of approximately 200 hectares, situated between Bedelands Nature Reserve to the east of Burgess Hill and the Goddards Green Waste Water Treatment Works to the west.

The WBLR Phase 3 site lies generally to the east of WBLR Phase 1. The Phase 3 proposals connect to the Phase 1 scheme at the Phase 1 A2300 Roundabout, and the Phase 1 A273 Jane Murray Way roundabout – see Figure 1.

The main aim of the WBLR Phase 3 scheme is to provide active travel links, in the form of off carriageway pedestrian and cycle facilities, alongside sections of the existing A2300 and A273 Jane Murray Way carriageway, to improve connectivity between the Brookleigh Development and the existing Burgess Hill built-up area, and to existing active travel routes.

The proposed facilities within the RMA site are:

- Alongside the A2300 between the recently constructed WBRL Phase 1 roundabout (including a new signalised crossing of the A2300) and the existing Triangle roundabout:
  - a 3m wide shared use footway (pedestrians and cyclists) to the south side of carriageway,
  - a 2m footway and 3m cycle track to the north side of the existing carriageway, forming part of the Brookleigh 'green superhighway'.
- To the west side of the A273, between the existing Triangle Roundabout and the recently constructed WBLR Phase 1 A273 roundabout, continuation of the 3m shared use footway from the south side of the A2300.

The proposed facilities within the Full application site are:

- A shared use footway of approximately 3m width (existing constraints require this to vary slightly) to the west side of the existing A273 carriageway. This will provide a link between the recently constructed WBLR Phase 1 A273 roundabout and the bridleway public right of way route and recently constructed signalised A273 crossing at Gatehouse Lane.

An overview of the proposed layout for the WBLR Phase 3 scheme is provided in [Figures 3 & 4](#) and detailed drawings included in [Appendix B](#).

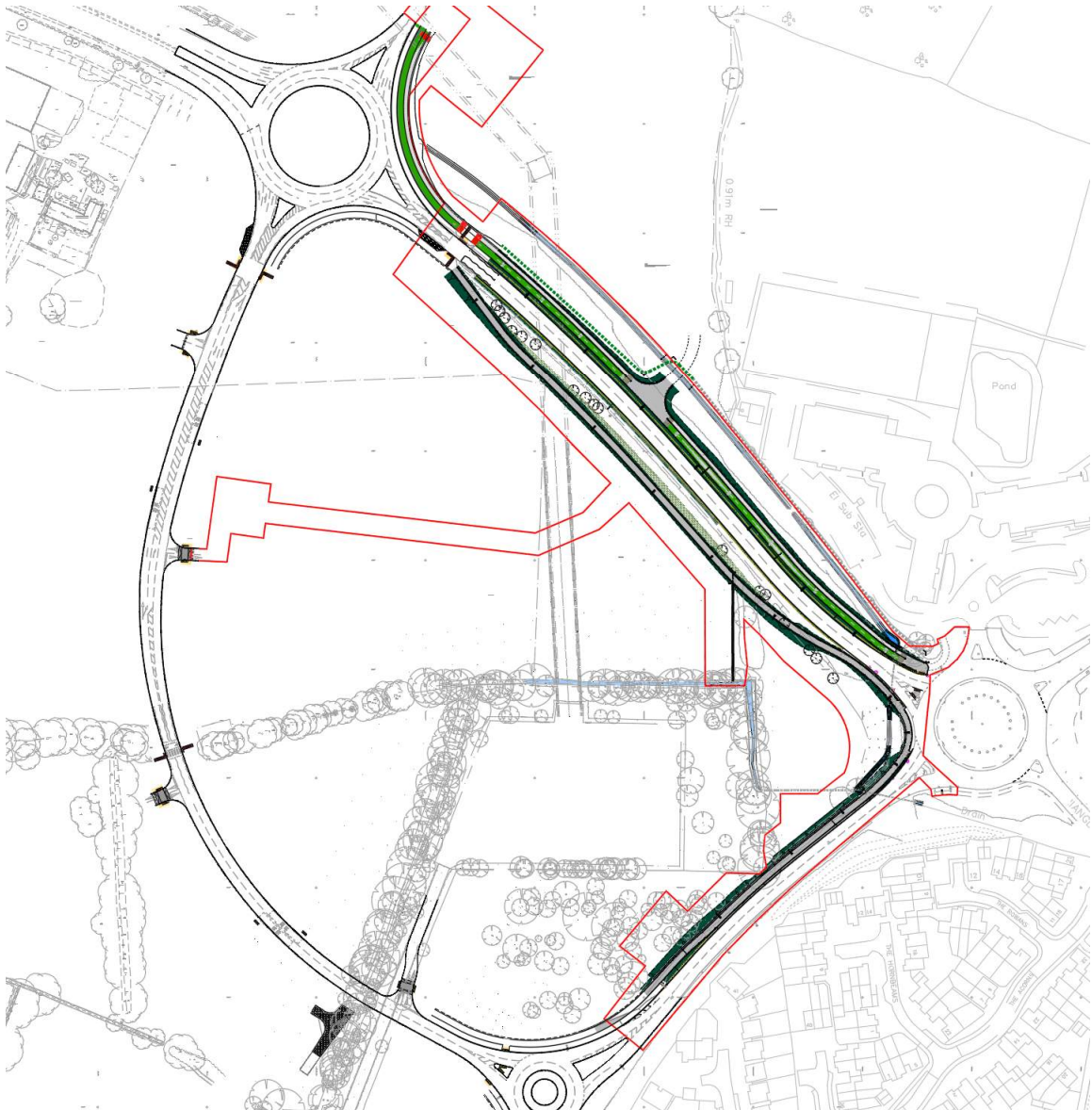


Figure 3: Proposed layout - RMA site

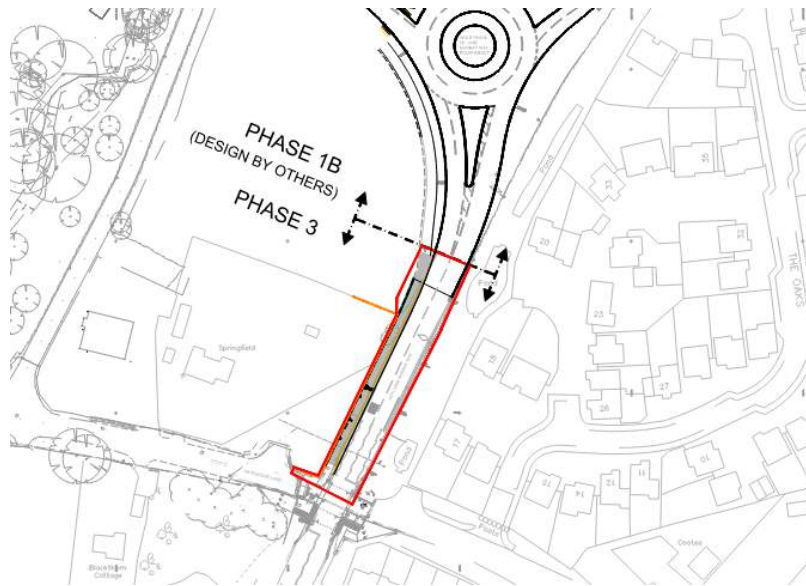


Figure 4: Proposed layout - Full application site

## 2. Design Criteria

### Surface Water Drainage Strategy

The surface water drainage system has been designed, where practicable, in accordance with the National Planning Policy Framework (NPPF) and the accompanying Guidance and Technical Standards for Sustainable Drainage Systems (SuDS).

In accordance with CIRIA SuDS Manual 2015 (Report C753), Building Regulations Part H and in line with the SuDS hierarchy under paragraph 80 of the Planning Policy Guidance underpinning the NPPF, surface water should be managed by:

- 1) Infiltration to the maximum extent that is practical – where it is safe and acceptable to do so
- 2) Discharge to watercourses
- 3) Discharge to surface water sewer, highway drain or another drainage system
- 4) Discharge to combined sewers (last resort)

West Sussex County Council (WSCC) is the Lead Local Flood Authority (LLFA) for Mid Sussex and the surrounding area. As a statutory consultee, the LLFA requires a site-specific drainage strategy that demonstrates that the drainage scheme proposed is in compliance with WSCC's sustainable drainage policies. In addition to this; any drainage strategy submitted should make reference to the relevant local plan policy and provide evidence which supports delivery of biodiversity, amenity and other benefits.

As LLFA, WSCC has the power to devolve decision making with regards to drainage and flood risk issues to Local Authorities where sufficient resource and local knowledge is available. Within Mid Sussex, the LLFA has delegated responsibility for flood risk matters to MSDC.

AECOM is responsible for the wider surface water drainage strategy for Brookleigh as set out in their FRA and Drainage Strategy Report (Dec 2018), the supplementary Flood Risk and Drainage Technical Note of 25th June 2019 and the Environmental Statement Addendum Chapter 7: Water Resources, Flood Risk & Drainage 7.1 Water Resources Consultation. As such, any strategic decisions concerning surface water management within the WBLR should be broadly in line with the principles established by AECOM under cover of their approved planning documents.

### 2.1 Foul Water Drainage Strategy

There is no proposed foul water drainage and no alteration to existing foul water drainage assets within the WBLR Phase 3 scheme. The site does not include any development proposals that would generate foul water and there is no current need for new foul drainage associated with the wider OPA development to cross the site.

### 3. Site Context

#### 3.1 Site Descriptions

The WBLR Phase 3 site covers a total area of 3.2 hectares (ha), of which the RMA application site is 3.1ha and the Full application site is 0.1ha. These areas include the proposed temporary contractors site compounds, access routes and construction working areas required to construct the scheme (as advised by Jackson Civil Engineering) within the red line boundaries.

The RMA site is partly existing highway maintained by WSCC as Highway Authority, and partly development land under Homes England ownership.

The areas of highway comprise carriageway, grass verges and dense vegetation (scrub including trees), and a small amount of existing footway. The areas of development land outside of the highway boundary comprises mostly agricultural land (modified grassland) and areas of vegetation (scrub including trees).

#### 3.2 Topography

Surface topographical data (Lidar, 1m DTM) has been used to produce a surface terrain model for the site and surrounding areas and is shown in [Figure 5](#).

Several topographical surveys have been undertaken for the Brookleigh Development, with those covering WBLR Phase 3 being a survey by 40Seven in August 2018 and a survey by Midland Surveys Ltd in 2020. The relevant drawings from each of these surveys are included in [Appendix C](#).

Where the proposed WBLR Phase 3 pedestrian and cycle facilities run closely alongside the A2300 and A273 carriageway, their proposed levels are constrained to generally follow the adjacent carriageway levels and therefore result in a need to widen the existing carriageway embankment in places. This does not apply to the proposed shared use footway to the south side of the A2300, which deviates away from the carriageway and drops down to the lower level of the adjacent field (development parcel), and generally follows the existing ground levels but is slightly elevated to minimise excavation near trees and also create a drainage swale (see discussion regarding catchment 4 in [Chapter 4](#)).

The levels of the existing carriageways in the scheme are:

- highest at the WBLR Phase 1 A2300 roundabout end of the A2300 (approx. 30.5mAOD),
- fall slightly along the A23300 towards the Triangle Roundabout (approx. 28.8mAOD),
- fall more noticeably heading southwest along the A273 from the Triangle roundabout to the WBLR Phase 1 A273 roundabout (approx. 26.5mAOD),
- and continue to fall to Gatehouse Lane crossing (approx. 26.1mAOD).

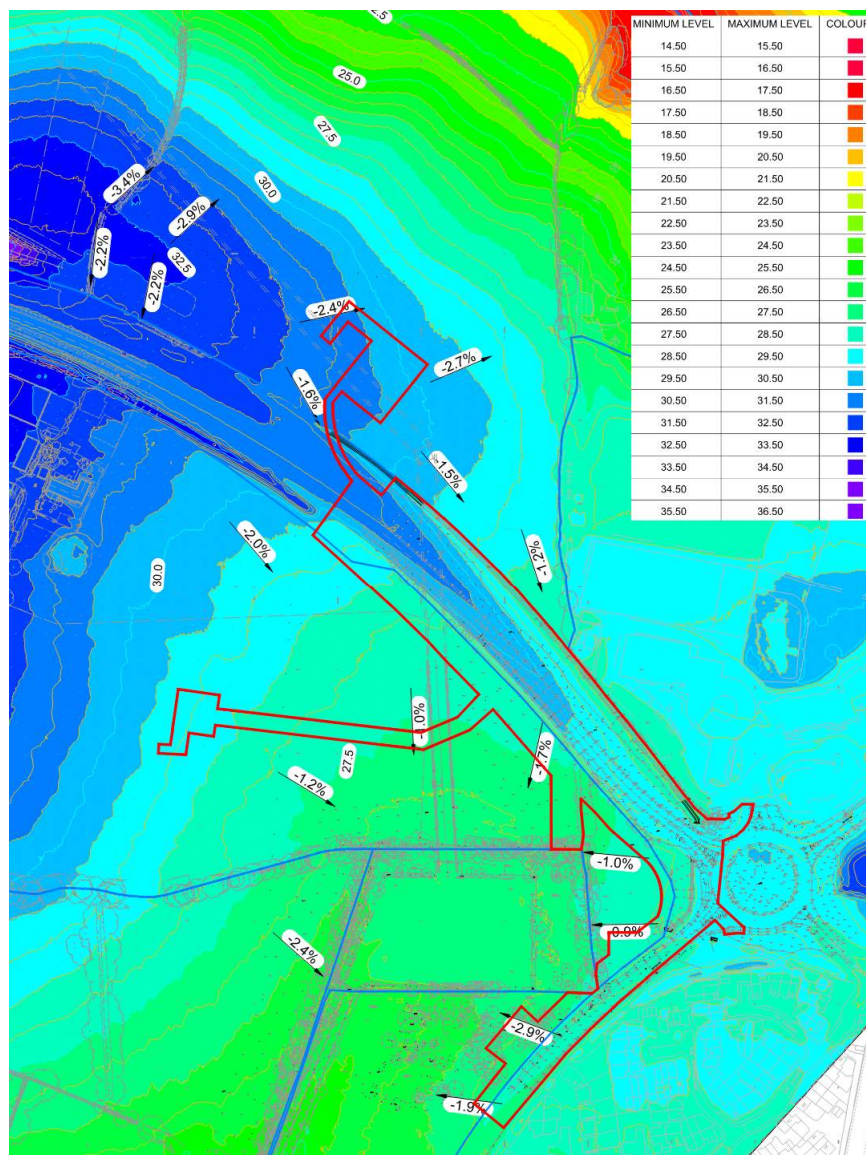


Figure 5: Surface Topography Model

### 3.3 Geology

The British Geological Survey (BGS) Mapping, Sheet 318/333, Brighton and Worthing, Bedrock and Superficial Deposits, 1:50,000 scale, 1996, has been accessed to review the site geology. No superficial deposits are noted below the site and the solid geology is indicted to consist of the Weald Clay Formation which predominantly consists of pale grey/brown Mudstone.

WIE have been provided with several ground investigation results and interpretive reports covering varying areas of the WBLR (all phases) site area. In particular, a Geotechnical Interpretive Report, June 2020, by CampbellReith provides data for the Phase 3 area.

The ground investigation and interpretative report broadly indicate that the widened carriageway will be constructed on the weathered Weald Clay with the existing carriageway embankment consisting of Made Ground which is noted as reworked natural ground and is therefore considered representative of weathered Weald Clay and has presumably<sup>1</sup> been placed as a Class 2 Cohesive Fill.

Table 1 summarises the typical site geology.

| Strata                                           | Expected Thickness (m) | Generalised Description                                                                                                                   |
|--------------------------------------------------|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Made Ground<br>(Existing Carriageway Embankment) | 2.00                   | Soft brown silty sandy clay with rootlets (assumed Class 2 Fill)                                                                          |
| Weathered Weald Clay                             | 5.50                   | Soft to firm yellow mottled grey occasionally orange gravelly silty CLAY. Gravel is predominantly mudstone. Occasional selenite crystals. |
| Weald Clay                                       | 5.50+                  | Stiff to very stiff (occasionally hard) gravelly silty CLAY. Occasional selenite crystals.                                                |

Table 1: Site Geology

### 3.4 Hydrology

A desk-study review of ordnance survey mapping notes several surface water bodies on or near the site. A site walkover has been undertaken to confirm the presence or absence of any on-site surface water features and these are identified on the Proposed Drainage Overview drawings included in [Appendix F](#).

The River Adur, classified as a Main River by the Environment Agency (EA) on their Flood Map for Planning, runs to the north of the application site (approx. 250m at closest point) and generally flows from south to west skirting the east and north edge of Burgess Hill. The river forms a confluence with Copyhold Stream to the northwest of the A2300.

The Pook Bourne, also classified as a Main River, runs to the south of the application site (approx. 550m at its closest point) and generally flows from Burgess Hill town centre in a westerly direction where it eventually meets the River Adur in Twineham 5km to the west.

The principal water feature within the site boundary is a small highway and land drainage ditch. The ditch joins an un-named tributary of the Pook Bourne at the northwest corner of the electricity substation plot. This tributary acts as the outfall for the WBLR Phase 1 attenuation basins. The ditch arrangement and main culverts are shown in [Figure 6](#) below. The Phase 1 attenuation basins are shown on the WBLR Phase 3 Proposed Drainage Overview drawings included in [Appendix F](#).

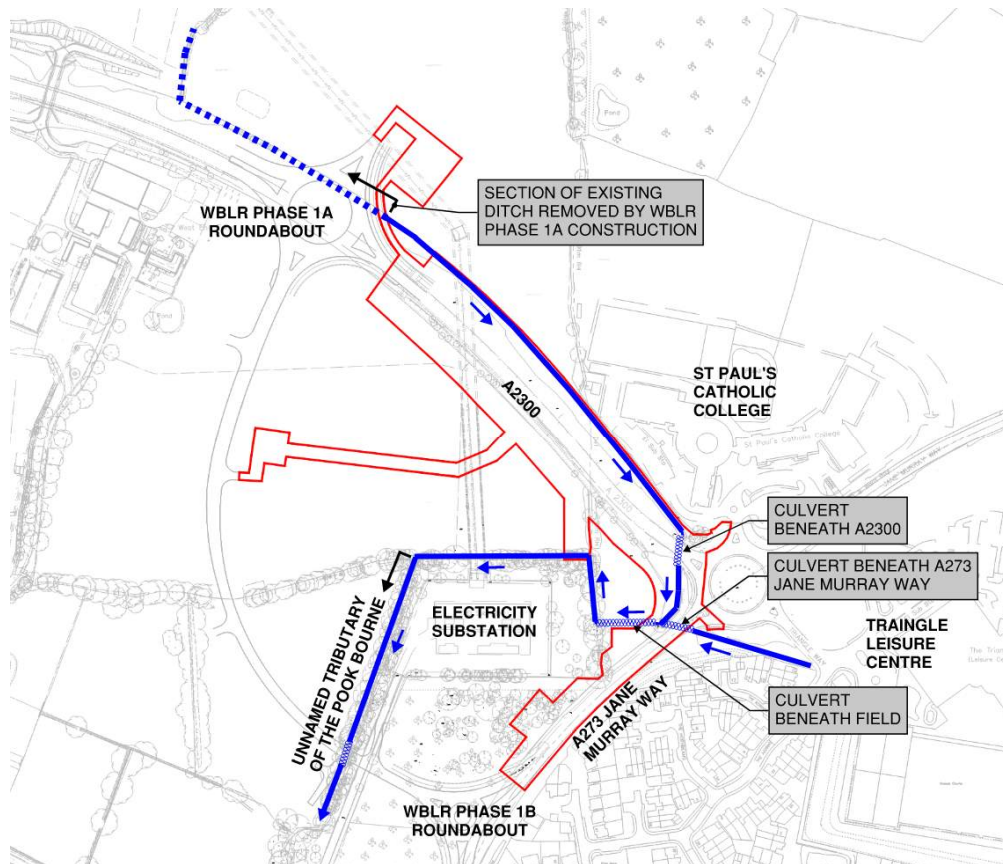


Figure 6: Highway and land drainage ditch arrangement.

Following the completion of the WBLR Phase 1 A2300 roundabout the ditch now starts just to the east of the roundabout, on the north side of the A2300. Prior to the construction of the roundabout, it continued to the northwest for approximately 170m, as indicated in [Figure 6](#).

The ditch runs parallel to the A2300 carriageway and is set back approximately 20m (possibly to have allowed for a future dualling of the carriageway). It is believed this ditch was formed when the A2300 was constructed circa. 1999, to drain a drainage catchment which flowed south and became blocked by the elevated A2300 carriageway embankment. The ditch flows to the southeast where it passes beneath the A2300 carriageway in a culvert (the 'A2300 culvert').

Having passed beneath the A2300 the ditch continues south for a short distance where a further culvert discharges into it with flows from a short section of ditch on the east side of the A273 Jane Murray Way, immediately south of the Triangle Roundabout.

The ditch then passes beneath a section of the agricultural field in a further culvert before emerging into a ditch flowing north, then west around the boundary of the electricity substation. It then connects into the unnamed tributary of the Pook Bourne flowing south along the western boundary of the electricity substation.

These ditches are classified as ordinary watercourses in the EA's Flood Maps for Planning.

It is noted that during a site walkover in May 2024, there was a small makeshift dam in place across the ditch in the northwest corner of the electricity substation (see photo in [Appendix D](#)). This makeshift dam consists of a wooden palette placed across the ditch and may have been installed to create a waterlogged area for livestock to drink.

Please refer to [Appendix D](#) for site photographs of the existing ditch and culverts.

The EA's risk of flooding from surface water map shows that the majority of the Application Site has a 'very low' risk of surface water flooding as shown in Figures 7 & 8. Part of the site, along the existing ditch line on the north side of the A2300, before it passes in culvert beneath the A2300, has 'low to high' risk of surface water flooding – which is considered further in Chapter 4 (see discussion regarding catchment 5).

It is understood that the proposed development plots alongside Phase 3 will be developed in accordance with the overall drainage strategy for the wider Brookleigh development, which will manage all drainage within the site.

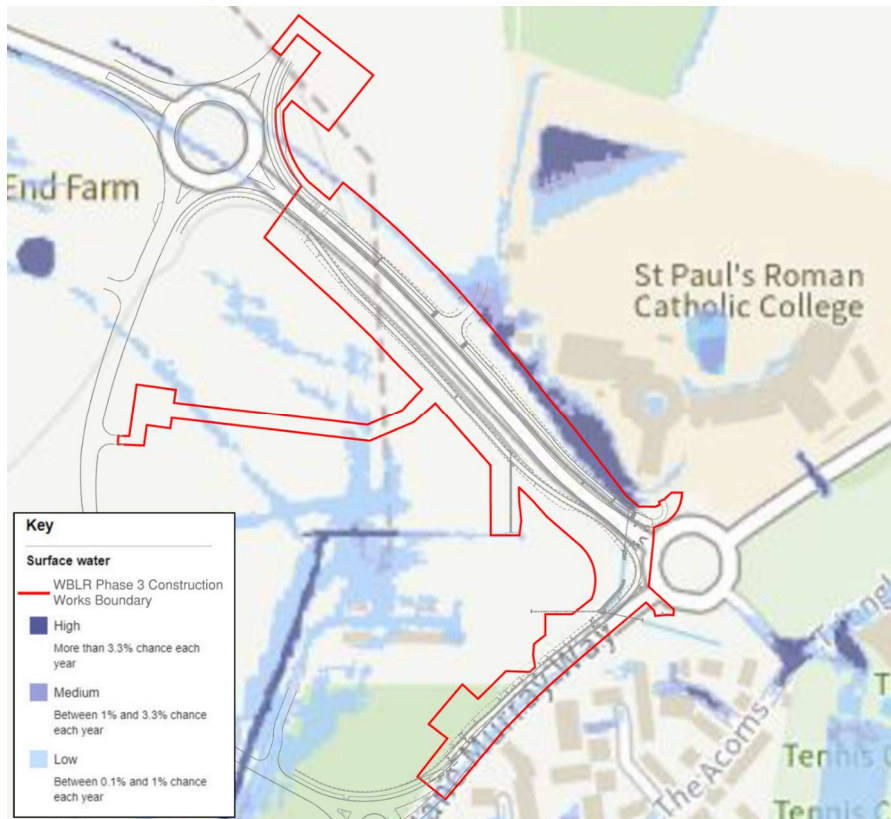


Figure 7: EA Mapping - Flooding from Surface Water – RMA Site



Figure 8: EA Mapping - Flooding from Surface Water – Full Application Site

The EA's mapping also includes flood depth information shown in [Figure 9](#), indicating that along the route of ditch the depths range from 30 to 90cm, and alongside the ditch the depths are generally below 30cm.



Figure 9: EA Mapping - Flooding from Surface Water – Flood Depths

### 3.5 Hydrogeology

The site is not located within a Source Protection Zone (SPZ).

The site is situated above an Unproductive Aquifer. The groundwater vulnerability for the site is 'unproductive'.

Groundwater levels beneath the site were investigated as part of the Ground Investigation Works performed in 2020 and 2022. These investigations demonstrated that ground water varied between ground level and 4.85m bgl however these investigations covered a wider area extending to include the River Adur.

### 3.6 Existing Drainage

Southern Water is the incumbent sewerage undertaker for the area. A review of Southern Water's Asset Records, extracts contained in [Appendix E](#), confirms that there are no surface water sewers within the red line boundary of the RMA site. There is a 450mm diameter gravity surface water sewer crossing the A273 Jane Murray Way, following the route of Gatehouse Lane, at the very southern extent of the Full Planning Application site.

There are no foul water sewers within either application site.

The natural surface water flow paths are as indicated on [Figure 5](#). In summary:

- To the north of the A2300 carriageway: the land (approx. 20m width) between the carriageway and ditch falls towards the ditch which then flows toward the culvert under the A2300 at the Triangle Roundabout. To the north of the existing ditch a localised area of the adjacent agricultural land (a Brookleigh development plot) falls south toward the ditch, with the remainder of the field then falling to the north toward the River Adur.

- To the south of the A2300 carriageway: the adjacent fields slope to the south / southwest towards the perimeter ditches around the electricity substation.
- At the corner of the A2300 and A273 (west of the Triangle Roundabout) the land slopes west toward the existing ditches.
- To the west of the A273 Jane Murray Way, between the Triangle Roundabout and the newly constructed WBLR Phase 1 A273 roundabout: the land slopes to the west, with the section nearer the Triangle Roundabout falling towards the existing ditches, and the section closer to the A273 roundabout sloping into the adjacent woodland area and towards the unnamed tributary of the Pook Bourne.

## 4. Surface Water

### 4.1 Site Constraints

A review of the site characteristics has informed the following constraints:

- Numerous existing underground utilities and proposed utilities including the undergrounding of the 132kV overhead electric cables being completed in 2024 (A2300), other new electricity supplies (A2300 & A273), a proposed new water main supply (A2300 north verge) and continuation of communications cables from Phase 1 (A273 south to Gatehouse Lane).
- Land constraints:
  - the electricity substation land creates a pinch point in the space available on the west side of the A273.
  - St Pauls Catholic College on the north side of the A2300.
  - private residential property on the west side of the A273 near Gatehouse Lane.
- Existing trees and their associated root protection areas, and a desire to minimise loss of existing trees.
- The general shape of the site which forms a long narrow corridor.
- The need to follow / tie-in to the levels of the adjacent carriageway in most of the site.
- A desire to minimise loss of development space in adjacent plots.

### 4.2 Surface Water Runoff Rates

#### 4.2.1 Greenfield Rates

The target of the overall Brookleigh development is to control discharge from the development to:

- the equivalent 1 in 1 year greenfield rate for the 1 in 1 year (100% Annual Exceedance Probability or AEP) storm event.
- Qbar (the mean annual flood flow from a rural catchment, approximately equal to the flow from a 1 in 2.3 year event) for all other storm events (<100% AEP).

The Outline Planning application FRA notes that within the overall development – actual discharge rates from specific parts of the site may vary due to constraints. This acknowledges that some parts of the development may have constraints which make it impracticable to achieve the targets whilst other areas can be easily designed to exceed them, with the overall result for the Brookleigh development as a whole being the target is still achieved.

The Greenfield runoff rates used in this report are those calculated for the adjacent approved WBLR Phase 1 site (using the IH124 method) and are summarised in [Table 2](#). A copy of the supporting calculations produced by Campbell Reith for WBLR Phase 1 and provided with the approved WBLR Phase 1 reserved matters application are included in [Appendix H](#).

| Return Period                       | Greenfield Runoff Rate<br>(litres/second/hectare) |
|-------------------------------------|---------------------------------------------------|
| <i>1 in 1 year</i>                  | <i>4.90</i>                                       |
| <i>QBar (approx. 1 in 2.3 year)</i> | <i>5.77</i>                                       |
| <i>1 in 30 year</i>                 | <i>13.27</i>                                      |
| <i>1 in 100 year</i>                | <i>18.40</i>                                      |

Table 2: Greenfield Runoff Rates

#### 4.2.2 Impermeable Area Runoff Rates

The run-off rates for a 100% impermeable catchment area have been calculated and are shown in **Table 3** below, alongside the equivalent greenfield rate for each storm event for ease of comparison. A copy of the supporting calculations for these impermeable runoff rates are also included in **Appendix H**.

| Return Period                                 | Greenfield Runoff Rate<br>(litres/second/hectare) | Impermeable Catchment<br>Runoff Rate<br>(litre/second/hectare) |
|-----------------------------------------------|---------------------------------------------------|----------------------------------------------------------------|
| <i>1 in 2 year</i>                            | <i>4.90</i>                                       | <i>44.49</i>                                                   |
| <i>QBar (approx. 1 in 2.3 year)</i>           | <i>5.77</i>                                       | <i>(FEH data not available)</i>                                |
| <i>1 in 30 year</i>                           | <i>13.27</i>                                      | <i>114.74</i>                                                  |
| <i>1 in 100 year</i>                          | <i>18.40</i>                                      | <i>146.26</i>                                                  |
| <i>1 in 100 year + 40% climate<br/>change</i> | <i>25.76</i>                                      | <i>204.76</i>                                                  |

Table 3: Greenfield and Impermeable Surface Runoff Rates

#### 4.3 Drainage Strategy

The proposed works within Phase 3 are divided into five catchment areas each with an independent drainage strategy. The catchment areas are shown in **Figure 10**, their details are provided in **Table 4**, and they are described in the proceeding sections.

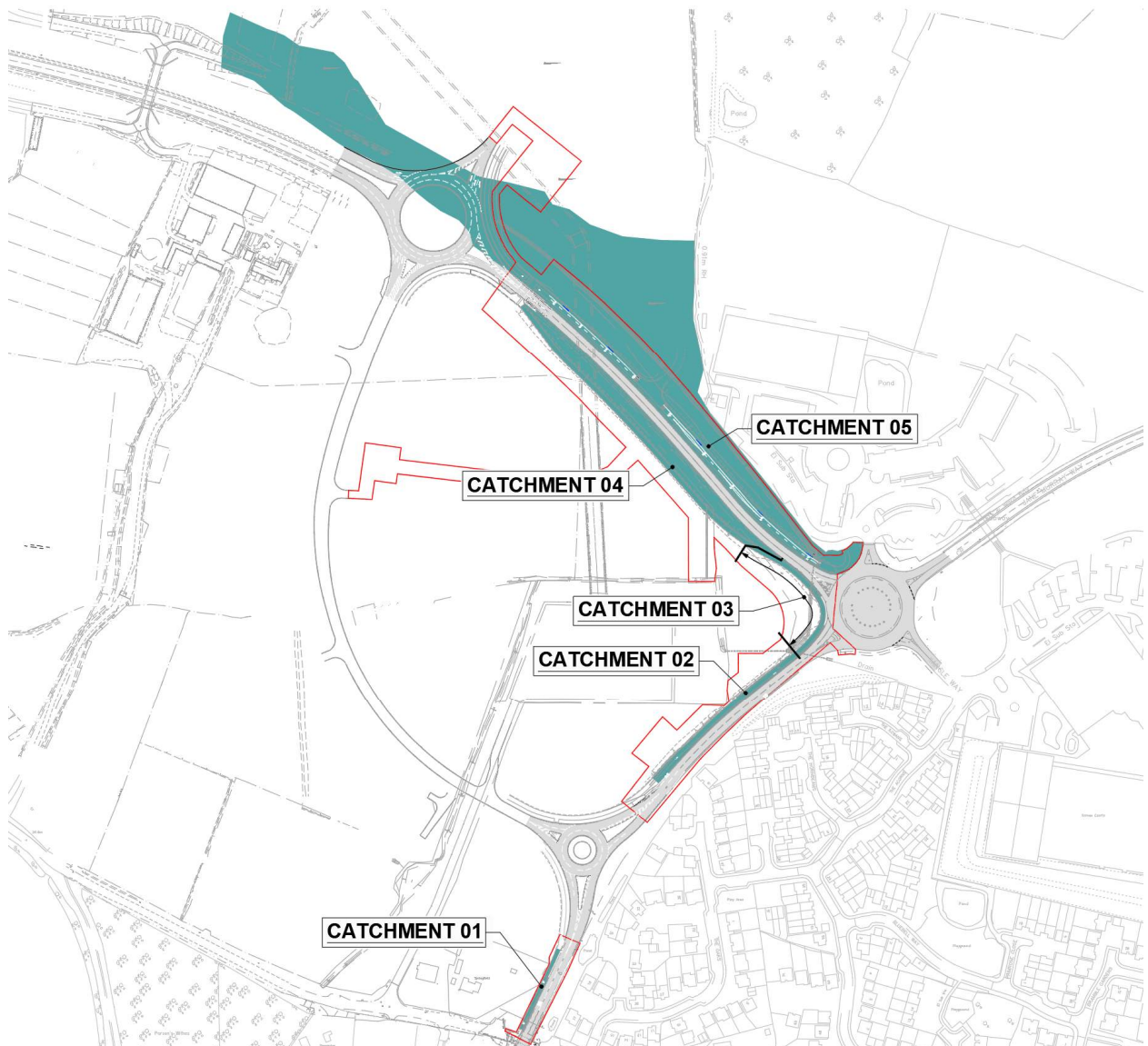


Figure 10: Catchment Areas

| No. | Catchment Description                                                                                                                                                      | Permeable Area (ha) |          | Impermeable Area (ha) |          | Total Contribution Area for Run-off (Proposed Scheme) (ha) |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------|-----------------------|----------|------------------------------------------------------------|
|     |                                                                                                                                                                            | Existing            | Proposed | Existing              | Proposed |                                                            |
| 01  | A273 west side near Gatehouse Lane - proposed shared use footway - draining to existing carriageway.                                                                       | 0.010               | 0.000    | 0.009                 | 0.019    | 0.019                                                      |
| 02  | A273 west side north of new A273 roundabout - proposed shared use footway - draining via filter drain to Phase 1 drainage system in proposed scheme.                       | 0                   | 0.023    | 0                     | 0.039    | 0.063                                                      |
| 03  | A273 west side & A2300 south side, near Triangle Roundabout - proposed shared use footway - draining to existing field & ditches.                                          | 0.031               | 0.005    | 0.000                 | 0.032    | 0.037                                                      |
| 04  | A2300 south side, existing embankment slope and proposed low level shared use footway - draining to swale / new ditch connecting to UKPN sub-station north boundary ditch. | 0.274               | 0.240    | 0.000                 | 0.070    | 0.310                                                      |
| 05  | A2300 north side - proposed footway and cycle track - draining to A2300 culvert via existing drainage ditch.                                                               | 2.432               | 1.410    | 0.000                 | 0.152    | 1.561                                                      |

Table 4: Catchment Area Details

Note that the areas provided in Table 4 are for the specific outfall drainage connections stated in the catchment descriptions. Where, for a particular catchment, the existing total area differs from the proposed total area – this indicates that the proposed scheme is altering the area draining to the stated outfall. For example:

- Catchments 3, 4 & 5: In the proposed scheme these catchments all include a narrow strip of new grass verge which was previously carriageway. When these areas were carriageway they drained to the existing highway drainage network – not the outfall connection stated in the table. Therefore these areas are excluded from the existing catchment area, but included in the proposed catchment area.
- Catchment 2: This catchment reviews the increase in flows discharging to the WBLR phase 1 attenuation basins. In the existing layout, none of this catchment drains to the basin (it runs off into the adjacent woodland which falls toward the tributary of the Pook Bourne), therefore the existing catchment 2 area draining to the WBLR phase 1 basins is stated as zero.

Catchment 1 covers the proposed works within the Full application site boundary. Catchments 2 to 5 cover the proposed works within the RMA site boundary.

Drawings 19442-WIE-ZZ-XX-DR-C-900531 & 900532 'Drainage Catchment Areas Sheet 1 & 2' are included in Appendix F.

#### 4.3.1 Catchment 01: A273 west side near Gatehouse Lane.

Works in this area are to extend and widen the existing footway to provide a 3m shared use footway connecting Gatehouse Lane to Phase 1.

The widening is achieved by the removal of the existing carriageway hard strip allowing it to be replaced by footway. Therefore, the carriageway is being changed to footway and there is no change in impermeable area. However, the extension of the footway north to the WBLR Phase 1 A273 roundabout requires the existing grass verge to be converted to paved footway construction.

The existing section of footway and the grass verge currently slope/drain to the adjacent carriageway where surface water is collected via carriageway gullies discharging into the existing highway drainage pipe network.

The proposed increase in impermeable area (grass becoming paved footway) is just 0.01ha or 100sqm.

The very small catchment area, existing constraints (the rear of the footway is bounded by the fence of the adjacent residential property) and unsuitability of the underlying ground for infiltration make attenuation impracticable. MSDC and WSCC have been consulted (pre-app meeting 20 Oct 2022) regarding this small area and WSCC have advised a general acceptance that this area can continue to drain into the adjacent carriageway / highway drainage network.

It is noted that within catchments 2, 3, 4 & 5 (discussed below) there is generally a reduction in paved area draining to the existing highway drainage network, as sections of the existing paved carriageway hard strips are being reduced / removed and replaced by grass verges which then drain away from the carriageway – thus reducing the catchment of the highway drainage network in those areas.

#### 4.3.2 Catchment 02: A273 west side, north of new WBLR Phase 1 A273 roundabout.

This catchment is currently comprised of the A273 grass verge and embankment (approx. 0.6m to 0.8m above adjacent ground levels) side slope which slope / drain westwards into the adjacent wooded area which then falls westward towards the tributary of the Pook Bourne.

Proposals in this catchment are to widen the existing highway embankment and provide a 3m shared use footway, separated from the carriageway by a 1m wide grass verge, widening towards the tie-in with Phase 1 A273 roundabout to match the wider verge at that location.

The proposed drainage strategy is for the new grass verge and 3m wide shared use footway to drain to a filter drain (gravel filled trench with perforated carrier pipe) located to the rear of the shared use footway, as indicated in [Figure 11](#). A filter drain is a recognised SuDS component with benefits which are discussed further in [Chapter 5](#).

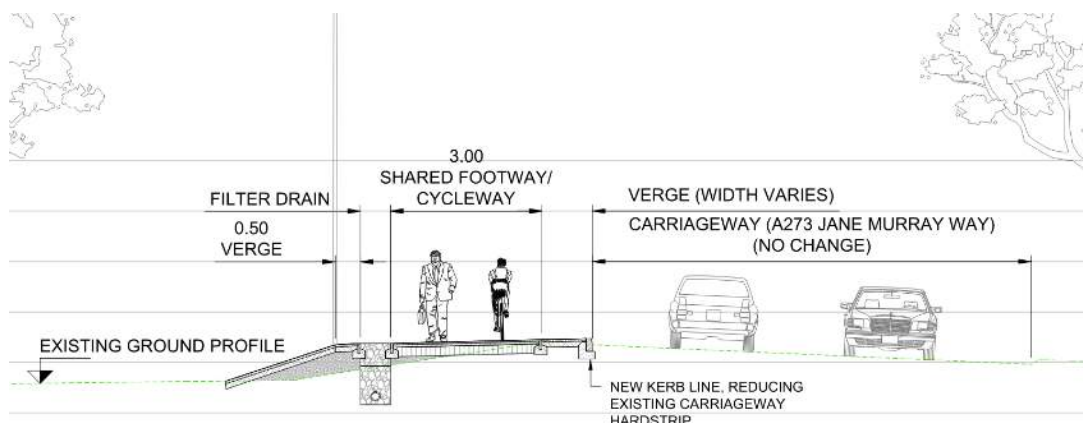


Figure 11: Catchment 02 – Proposed Typical Cross Section showing filter drain

The filter drain slope will follow the proposed ground levels, which fall to the south towards the Phase 1 A273 roundabout, where provision has been made for connection into the Phase 1 drainage system as

shown in the extract from the Phase 1 drainage layout in [Figure 12](#) confirms (note the rotated orientation / direction of north in the Figure).

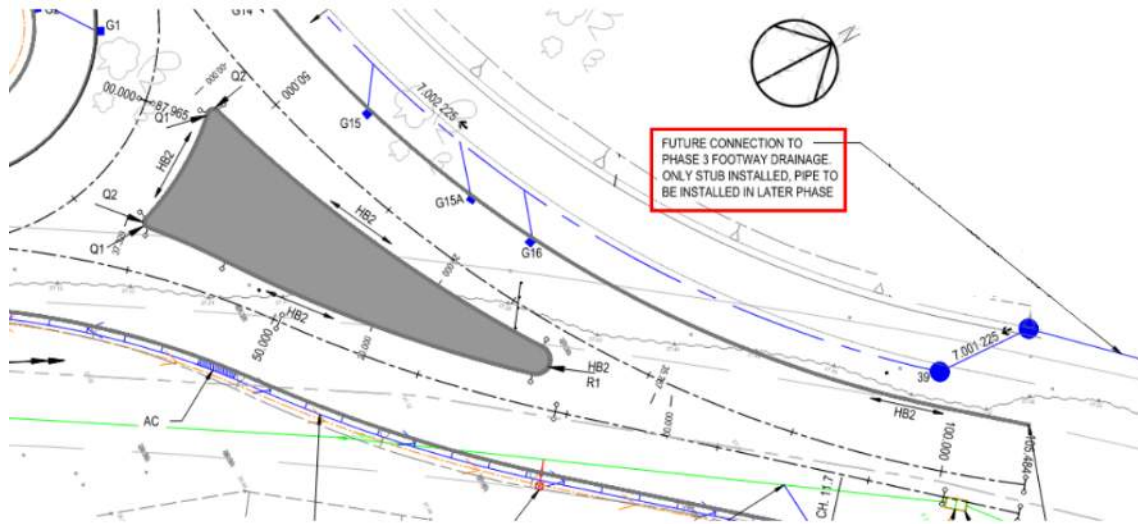


Figure 12: Phase 1b (A273 Roundabout) – extract from drainage layout showing provision for Phase 3 connection

The Phase 1 drainage system is designed to convey the flows from this Phase 3 catchment to the Phase 1 attenuation basins which incorporate a controlled outfall to the tributary of the Pook Bourne, restricting the outfall rate to the agreed discharge rates.

During the development of the Phase 3 scheme, updated Phase 3 catchment details have been provided to the Phase 1 designers allowing them to update the Phase 1 drainage design accordingly. This has included the re-sizing of the Phase 1 attenuation basin outfall vortex control device. A copy of the technical note produced by the Phase 1 designers, confirming the design of the Phase 1 system reflects the Phase 3 flows is included in [Appendix H](#).

The permeable side slope of the widened embankment will continue to drain west into the adjacent wooded area which has a general slope towards the tributary of the Pook Bourne, as the existing permeable ground currently does, therefore maintaining the existing situation.

#### 4.3.3 Catchment 03: A273 west side & A2300 south side, near the Triangle Roundabout.

The existing area comprises a grass verge and side slope of the carriageway embankment (approx. 0.6m to 0.8m above adjacent ground levels). These areas currently slope / drain towards the existing ditch running along the base of the embankment, or into the adjacent field area which then slopes west / towards the electricity substation perimeter ditch.

The catchment includes an area of existing footway at the Triangle roundabout connecting the uncontrolled pedestrian crossings of the A2300 and A273 arms of the roundabout. This small area of footway currently slopes/drains toward the carriageway.

Proposals in this catchment are to widen the existing highway embankment and provide a 3m shared use footway, separated from the carriageway by a 1m wide grass verge.

The widening of the embankment requires a minor re-alignment of the existing ditch, a minor extension of the A2300 culvert to a new headwall, and reconstruction of the A273 culvert headwall to incorporate wingwalls to suit the proposed earthworks.

Consideration was given to continuing the proposed filter drain in catchment area 2, to include this area of new footway, however the presence of the two existing / extended culverts, and the proposed levels of the footway which start to fall west at the start of the A2300 make this unfeasible.

The proposed drainage strategy for this area is for the impermeable footway area to slope/drain away from the carriageway, down the embankment side slope into the adjacent field / landscaped areas. It will then join with the realigned ditch close to the base of the embankment or draining across the field to the ditch along the east boundary of the electricity substation.

The increased impermeable area created in this catchment is 0.032ha or 320sqm. If this area were to be attenuated and discharged at the Qbar greenfield rate, the control device would need to restrict the flow to  $0.032\text{ha} \times 5.77\text{l/s/ha} = 0.19\text{l/s}$ . It is generally accepted that where proximity of trees and vegetation increase the risk of blockages, the minimum practical attenuation rate is 5 l/s, therefore attenuation of this small catchment in isolation is considered impracticable.

MSDC have been consulted regarding the drainage strategy for the south side of the A2300 and it is understood that the proposed strategy described above for catchment 3, and below for catchment 4, is considered acceptable due to the small area of the catchments involved and the impracticality of attenuating / controlling such small target discharge flows via a controlled outfall. A copy of correspondence discussing the proposed strategy is included in [Appendix G](#). It is understood that MSDC are satisfied that the uncontrolled flows from these areas is, or can be, suitably compensated for in other areas of the Brookleigh development where attenuation is more easily achieved.

#### 4.3.4 Catchment 04: A2300 south side.

This catchment area comprises the existing grass verge and carriageway embankment side slope of the A2300, and an area of the existing adjacent field which will contain the proposed shared use footway. The existing permeable catchment area slopes/drains to the south across the field towards the existing ditch along the north boundary of the electricity substation.

Proposals in this catchment are to leave the existing embankment side slope largely untouched, to allow the retention of most of the existing vegetation. The low-level footway has been located close to (approx. 2m offset) the base of the embankment to minimise loss of development area in the adjacent plot.

The proposed levels of the new footway are designed to be above the existing field level (by approx. 0.25m) to reduce excavation close to the retained vegetation, and to prevent surface water run-off from the A2300 verge and embankment side slope draining across the footway. This proposed slightly raised footway turns the existing strip of field, between the footway and A2300 embankment toe, into a shallow swale feature where run-off from the existing embankment side slope and the new footway will flow. A swale is a recognised SuDS component with benefits which are discussed further in [Chapter 5](#).

The existing ground levels along the base of the embankment which form the swale have a shallow long fall (approx. 0.5%) to a low point, where it is proposed to create a shallow culvert beneath the new footway. Any flows emerging from the swale will be conveyed south in a new section of ditch connecting to the existing electricity substation perimeter ditch.

The increase in impermeable area within this catchment is 0.0695 ha or 695sqm which would have a Qbar flow rate of  $0.0695\text{ ha} \times 5.77\text{ l/s/ha} = 0.4\text{ l/s}$ .

MSDC have been consulted regarding the drainage strategy for the south side of the A2300 and it is understood that the proposed strategy described for catchments 3 & 4 is considered acceptable due to the small area of the catchments involved and the impracticality of attenuating / controlling such small target discharge flows. A copy of correspondence discussing the proposed strategy is included in [Appendix G](#). It is understood that MSDC are satisfied that the uncontrolled flows from these areas is, or

can be suitably compensated for in other areas of the Brookleigh development where attenuation is more easily achieved.

#### 4.3.5 Catchment 05: A2300 north side - proposed 2m footway and 3m cycle track - draining to A2300 culvert via existing drainage ditch.

This catchment covers the area draining to the culvert beneath the A2300 near the Triangle roundabout.

The original catchment area (pre-WBLR) drained 2.43 ha of permeable area comprising the A2300 north verge (approx. 20m with a northward slope toward the ditch parallel to the A2300 carriageway) and parts of the adjacent agricultural land to the north of the ditch.

This catchment area has now been reduced following the construction of the WBLR Phase 1 A2300 roundabout, which removed an upstream section of the ditch and its associated catchment area of just under 0.9ha (8,975sqm).

There is a very small addition to the catchment area, created by the narrowing of the A2300 carriageway (removal of the existing circa. 1m hard strip along the north edge). This 0.0271ha strip of additional grass verge then draining away from the carriageway toward the existing ditch.

The overall impact of the WBLR Phase 1 and 3 schemes to the catchment area draining to the A2300 culvert is a reduction in area from 2.43ha to 1.56ha, a 36% reduction in area.

The Phase 3 proposals in this catchment area are to create a 5m wide segregated footway and two-way cycle track (referred to hereafter as 'the paved area'), resulting in 0.150 ha of existing grass area becoming impermeable footway construction.

An initial drainage concept was indicated on concept design drawings (prepared by others), to capture run-off from this paved area in a filter drain and convey it via gravity pipework approx. some 280m northward to the WBLR Phase 2 proposed attenuation tanks for controlled discharge to the River Adur. On further review, it was demonstrated to MSDC that this proposal is unfeasible due to the levels of the proposed paved area (constrained by the levels of the existing A2300 carriageway) relative to the existing ditch and the adjacent land through which the filter drain would pass. In discussions with MSDC it was agreed that an alternative strategy should be found, preferably dealing with the run-off more locally to avoid unnecessary pipework and the associated maintenance and blockage issues that result.

An alternative concept was then investigated, to capture the run-off from the paved area into an attenuation system (potentially buried crates or oversized pipework) and discharge it to the adjacent ditch at a controlled rate. Due to the small size of this impermeable surface created (0.15ha) the resulting Qbar greenfield rate ( $5.77\text{l/s/ha} \times 0.15\text{ha} = 0.87\text{ l/s}$ ) is deemed too small to achieve with a control device. It is generally accepted that the minimum control rate practicably achievable is 5 l/s (possibly reducing to 3 l/s if away from vegetation or upstream filtration can be incorporated), without the control device becoming prone to unacceptably frequent blockages.

In the absence of a practical solution to control the flow from the new paved area, and in discussion with MDSC during the pre-application consultation process it was agreed that the most appropriate strategy for this paved area is to allow it to drain naturally along its length onto and through the adjacent grass and area of dense vegetation which has a shallow fall toward the parallel ditch. Although this solution does not create an engineered or quantifiable flow control, there will be benefits as the run-off will in part infiltrate into the upper soil layer, be absorbed by vegetation. This area will therefore act as a filter strip, a SuDS component with benefits which are discussed further in [Chapter 5](#).

A copy of correspondence confirming agreement to this approach is included in [Appendix G](#).

As identified in section 3.4 of this report, the EA's flood risk mapping ([Figure 7](#)) shows a high risk of flooding from surface water along the route of the existing ditch as it approaches the A2300 culvert. The three colours of blue shown on the mapping indicate:

- High risk = greater than a 3.3% chance of occurring in a year. A 3.3% chance would result from a 1 in 30 year storm event (AEP 3.3%)
- Medium risk = between 1% and 3.3% chance of occurring in a year. This would result from a 1 in 30 year to 1 in 100 year storm event (AEP 3.3% to 1%)
- Low risk = between 0.1% and 1% chance of occurring in a year. This would result from a 1 in 100 year to 1 in 1,000 year storm event (AEP 1% to 0.1%)

Whilst there is a risk of flooding identified in this area, the mapping indicates that even for the low risk (greatest) flood event shown by the lightest blue – the flood extent does not appear to directly affect buildings.

The cause of flooding in this area will be from water not making it through the existing culvert beneath the A2300 at the required rate of flow, and therefore backing up along the ditch.

The flood mapping shows that the area on the downstream side of the culvert (to the south of the A2300) is not at risk of flooding, which indicates that the exit from the culvert *should* be free flowing. Therefore, the initial assumption was that the existing culvert capacity is insufficient. The existing culvert was therefore assessed to determine its capacity.

The existing culvert:

- has internal diameter of 380mm,
- is 22.38m long,
- upstream invert level = 27.577mAOD,
- downstream invert level = 27.394mAOD,
- has a gradient of 1 in 122.

With reference to the HR Wallingford Tables for the hydraulic design of pipes, sewers and channels (eighth edition), table A18 (roughness coefficient  $K_s = 0.6\text{mm}$ , water at 15 degrees Celsius, full-bore conditions):

- a 375mm diameter pipe (slightly smaller than the 380mm culvert)
- at 1 in 125 (slightly shallower than the culvert)

has the capacity to discharge **178.68 l/s**.

The existing and proposed catchments draining to this culvert, and resulting flow rates are shown in the [Table 5](#) below, for the various storm events:

|             | Runoff Rates (l/s/ha) |                         |                        |                        |
|-------------|-----------------------|-------------------------|------------------------|------------------------|
|             | Qbar**                | 1:30 year<br>(3.3% AEP) | 1:100 year<br>(1% AEP) | 1:100 Year +<br>40% CC |
| Permeable   | 5.77                  | 13.27                   | 18.40                  | 25.76                  |
| Impermeable | 44.49                 | 114.74                  | 146.26                 | 204.76                 |

\*\* Uses 1 in 2 year event for impermeable as approximation (closest available data in FEH)

| Catchment |                   |           | Area<br>(ha) | Catchment Discharge Flow (l/s) |                         |                        |                        |        |
|-----------|-------------------|-----------|--------------|--------------------------------|-------------------------|------------------------|------------------------|--------|
|           |                   |           |              | Qbar                           | 1:30 year<br>(3.3% AEP) | 1:100 year<br>(1% AEP) | 1:100 Year +<br>40% CC |        |
| 5         | A2300 north side. | Existing  | Permeable    | 2.432                          | 14.031                  | 32.269                 | 44.743                 | 62.641 |
|           |                   | Layout    | Impermeable  | 0.000                          | 0.000                   | 0.000                  | 0.000                  | 0.000  |
|           |                   |           | Total        | 2.432                          | 14.031                  | 32.269                 | 44.743                 | 62.641 |
|           | Proposed          | Permeable | 1.410        | 8.135                          | 18.708                  | 25.940                 | 36.316                 |        |
|           |                   | Layout    | Impermeable  | 0.152                          | 6.740                   | 17.384                 | 22.158                 | 31.021 |
|           |                   |           | Total        | 1.561                          | 14.875                  | 36.092                 | 48.098                 | 67.338 |
|           | Increase          |           |              | 0.844                          | 3.823                   | 3.355                  | 4.697                  |        |

Table 5: A2300 Culvert Catchment Area and Discharge Flow Rates

Table 5 shows that even for the **1:100 year + 40%** climate change allowance storm event, the increase in flow rate for the proposed catchment is just 4.7 l/s, with a proposed flow rate of **67.34 l/s**.

This shows that the existing culvert would be flowing at just (67.34 / 178.68) **37.69%** of its capacity during the 1:100 year + 40% climate change allowance storm event.

This assessment demonstrates that as long as the existing culvert is free from defects and obstructions, it should not be causing a bottleneck to the drainage ditch it serves.

From a review of the existing ditches on both sides of the culvert, it is clear that the ditch is not well maintained.

The two photos in **Figure 13** below show the upstream section of ditch and culvert entrance. The area is overgrown with vegetation and obstructed by a timber and wire mesh fence, the lower section of which has three closely spaced rails across the lower section of the ditch. Ground levels around the base of the fence then form a high point in the ditch base, with the photo on the right showing the ditch sat part full of water in the background.

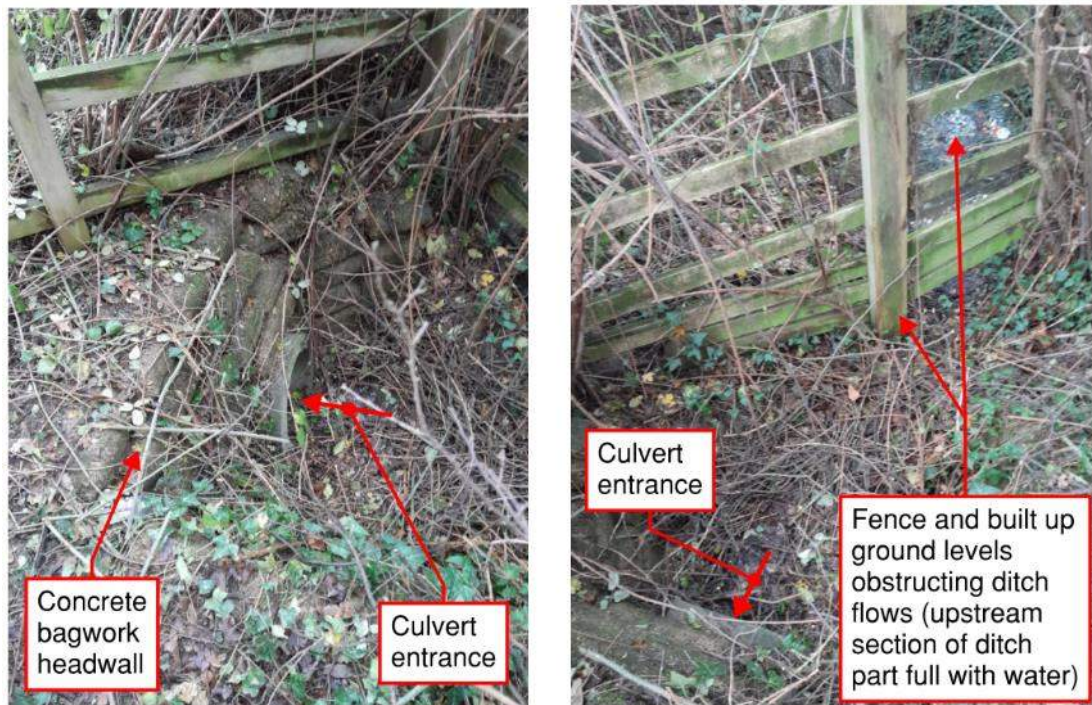


Figure 13: Photos showing the upstream end of the A2300 culvert

Figure 14 below shows that a similar situation exists on the south (exit) side of the culvert, where vegetation has been allowed to encroach into the ditch including a tree growing at the culvert exit. Debris has not been cleared, and ground levels in the ditch just downstream have built up (likely due to vegetation growth) which is resulting in the culvert exit area sitting in standing water which will impact the capacity of the culvert.



Figure 14: Photo showing the downstream end (exit) of the A2300 culvert

It is therefore proposed to undertake maintenance and improvement works to the existing ditch on both the upstream and downstream side of the culvert, to remove obstructing vegetation, re-form the ditch profile and base slope (long-fall), and to remove or replace the existing fence to prevent obstruction. There may also be scope, subject to further discussion with the WSCC, to install a grill (sometimes referred to as a trash screen) to prevent obstructions entering / blocking the entrance of the culvert and allowing clearance of captured debris. These are often sloped so that floating debris is pushed up the front of the grill and out of the way by the flowing water, as example below:



It is also proposed to undertake a CCTV survey of the existing culvert to inspect for any defects or blockages which may be restricting flows and to then discuss repair works with the culvert owner, WSCC.

These much-needed maintenance works to the existing ditch and culvert entrance / exit are anticipated to restore the capacity of the ditch and culvert and reduce or possibly eliminate the current localised flooding in this area.

#### 4.3.6 Change in flows discharging to the existing drainage ditch.

As discussed above, it is proposed that catchment 1 continues to drain to the existing highway drainage network, and catchment 2 drains to the WBLR Phase 1 drainage basins where it is attenuated and discharged at the target  $Q_{bar}$  greenfield rate.

It is proposed that catchments 3, 4 & 5 discharge into the adjacent permeable grass and vegetation areas which slope toward the existing ditch system. **Table 6** below provides the increase flow draining to the ditch from these three catchment areas, for the various design storm events being assessed.

| Runoff Rates (l/s/ha) |        |                         |                        |                        |
|-----------------------|--------|-------------------------|------------------------|------------------------|
|                       | Qbar** | 1:30 year<br>(3.3% AEP) | 1:100 year<br>(1% AEP) | 1:100 Year +<br>40% CC |
| Permeable             | 5.77   | 13.27                   | 18.40                  | 25.76                  |
| Impermeable           | 44.49  | 114.74                  | 146.26                 | 204.76                 |

\*\* Uses 1 in 2 year event for impermeable as approximation (closest available data in FEH)

| Catchment                            |                                                                    |                    |                    | Area<br>(ha) | Catchment Discharge Flow (l/s) |                        |                        |        |       |
|--------------------------------------|--------------------------------------------------------------------|--------------------|--------------------|--------------|--------------------------------|------------------------|------------------------|--------|-------|
|                                      |                                                                    |                    | Qbar               |              | 1:30 year<br>(3.3% AEP)        | 1:100 year<br>(1% AEP) | 1:100 Year +<br>40% CC |        |       |
| 3                                    | A273 west side &<br>A2300 south side, near<br>Triangle Roundabout. | Existing<br>Layout | Permeable          | 0.031        | 0.180                          | 0.414                  | 0.574                  | 0.804  |       |
|                                      |                                                                    |                    | Impermeable        | 0.000        | 0.000                          | 0.000                  | 0.000                  |        |       |
|                                      |                                                                    | Total              | 0.031              | 0.180        | 0.414                          | 0.574                  | 0.804                  |        |       |
|                                      |                                                                    | Proposed<br>Layout | Permeable          | 0.005        | 0.027                          | 0.062                  | 0.086                  | 0.121  |       |
|                                      |                                                                    |                    | Impermeable        | 0.032        | 1.433                          | 3.695                  | 4.710                  | 6.593  |       |
|                                      |                                                                    | Total              | 0.037              | 1.460        | 3.757                          | 4.796                  | 6.714                  |        |       |
|                                      | Increase                                                           |                    |                    |              | 1.280                          | 3.343                  | 4.222                  | 5.911  |       |
|                                      | 4                                                                  | A2300 south side.  | Existing<br>Layout | Permeable    | 0.274                          | 1.583                  | 3.640                  | 5.047  | 7.066 |
|                                      |                                                                    |                    |                    | Impermeable  | 0.000                          | 0.000                  | 0.000                  | 0.000  |       |
| Total                                |                                                                    |                    | 0.274              | 1.583        | 3.640                          | 5.047                  | 7.066                  |        |       |
|                                      |                                                                    | Proposed<br>Layout | Permeable          | 0.240        | 1.386                          | 3.187                  | 4.420                  | 6.188  |       |
|                                      |                                                                    |                    | Impermeable        | 0.070        | 3.092                          | 7.975                  | 10.165                 | 14.231 |       |
|                                      |                                                                    | Total              | 0.310              | 4.478        | 11.162                         | 14.585                 | 20.419                 |        |       |
| Increase                             |                                                                    |                    |                    | 2.895        | 7.522                          | 9.538                  | 13.353                 |        |       |
| 5                                    | A2300 north side.                                                  | Existing<br>Layout | Permeable          | 2.432        | 14.031                         | 32.269                 | 44.743                 | 62.641 |       |
|                                      |                                                                    |                    | Impermeable        | 0.000        | 0.000                          | 0.000                  | 0.000                  |        |       |
|                                      |                                                                    | Total              | 2.432              | 14.031       | 32.269                         | 44.743                 | 62.641                 |        |       |
|                                      |                                                                    | Proposed<br>Layout | Permeable          | 1.410        | 8.135                          | 18.708                 | 25.940                 | 36.316 |       |
|                                      |                                                                    |                    | Impermeable        | 0.152        | 6.740                          | 17.384                 | 22.158                 | 31.021 |       |
|                                      |                                                                    | Total              | 1.561              | 14.875       | 36.092                         | 48.098                 | 67.338                 |        |       |
|                                      | Increase                                                           |                    |                    |              | 0.844                          | 3.823                  | 3.355                  | 4.697  |       |
| Total Increase (Catchments 3, 4 & 5) |                                                                    |                    |                    | 5.019        | 14.689                         | 17.115                 | 23.961                 |        |       |

Table 6: Change in flows discharging to the existing drainage ditch

#### 4.3.7 Scheme wide notes

Drainage of the existing WSCC carriageway of the A2300 and A273 is being adjusted slightly due to the proposed narrowing of the existing paved area (the existing 1m wide hard strips either side of the traffic lanes are being removed and replaced with kerb lines at the edge of the traffic lanes). This requires the removal of an existing concrete dished drainage channel on the south side of the A2300 which currently discharges via gullies along its length. New gullies will be installed along the new kerb line at a suitable spacing (to be agreed with the highway authority). Where the long fall of the carriageway becomes shallow and would require an unusually close spacing of gullies (often where gully spacing reduces below 10m) a combined kerb-drainage system will be utilised (similar to the Phase 1 design) subject to approval by the highway authority. It is proposed that the retained existing areas of carriageway within Phase 3 continue to drain to the existing WSCC highway drainage system (pipe network).

No allowance has been made for urban creep as the application area consists mainly of new footway / cycle infrastructure.

## 5. SuDS Strategy

The proposed drainage strategy layout presented in [Appendix F](#), illustrates the drainage features proposed to manage the surface water runoff from the new areas of impermeable footway and cycle track construction within the site. The drainage strategy has been discussed and agreed in principle during pre-application consultation with MSDC (correspondence included in [Appendix G](#)).

Due to the underlying ground conditions, infiltration drainage solutions are not possible on site. This principle has been previously established and approved under the Extant Outline Planning Permission (Ref DM/21/3279). Therefore, following the SuDS hierarchy, the proposed discharge is to the local watercourses, with the existing land drainage ditches out-falling to the Pook Bourne the most appropriate discharge destination. Site specific infiltration testing has been carried out in the adjacent WBLR Phase 1 and 2 sites which confirmed that infiltration is not viable.

The following SuDS features have however been incorporated into the scheme proposals:

### 5.1.1 Filter Drain

Capturing run-off from the proposed shared use footway on the west side of the A273 Jane Murray Way. Due to the long fall gradient of the existing carriageway and therefore the proposed shared use footway, the filter drain in this location is not suitable for use as attenuation, however it still provides benefits. As stated in the CIRIA report C753 The SuDS Manual (chapter 16), filter drains ‘help reduce pollutant levels in runoff by filtering out fine sediments, metals, hydrocarbons and other pollutants. They can also encourage adsorption and biodegradation processes.’.

### 5.1.2 Filter Strips

A filter strip is formed where the flow from an impermeable area is discharged evenly (as a sheet flow, not concentrated) to an adjacent area of uniformly graded and gently sloping grass or other dense vegetation, before then entering a downstream drainage component. The Phase 3 scheme incorporates this SuDS component:

- Along the north side of the A2300, where the new segregated footway and cycle track will run-off along its entire length to the adjacent grass and vegetation before reaching the existing land drainage ditch.
- To the west of the Triangle Roundabout where part of the shared use footway will run-off to the adjacent grass field area (which is intended to be planted with trees and other vegetation).

These filter strips provide valuable treatment benefits by promoting sedimentation, filtration and infiltration, although due to the underlying ground conditions within the site infiltration will be limited.

### 5.1.3 Swale:

A swale will be formed along the southern side of the A2300 embankment to collect run-off from the proposed shared use footway. Swales (shallow flat bottomed vegetated open channels) are able to collect distributed inflows along the length of the adjacent impermeable surface and convey it to the next component in the drainage system. The vegetation within the swale helps to slow the progress of water, especially compared to conventional pipework which allows rapid conveyance. The vegetation and slow conveyance facilitate sedimentation, evapotranspiration and infiltration, although due to the underlying ground conditions within the site infiltration will be limited. There may be scope during the detailed design to incorporate small check dams at intervals across the path of the flow to temporarily pond run-off to increase pollutant retention and infiltration and further decrease flow velocity, although their benefit may be limited in this particular location.

#### 5.1.4 Trees:

Catchment 03, located to the west of the Triangle Roundabout will, in part, run-off across the adjacent land area before eventually reaching the existing ditch around the substation. This land area is currently grass but is likely to be planted with both trees and shrubs by UK Power Networks as mitigation for tree removal during their overhead electricity cable undergrounding works. The presence of trees and vegetation in this area provides additional benefits over and above those provided by a grass filter strip, as extract from CIRIA report C753 The SuDS Manual below:

Trees and their planting structures provide benefits to surface water management in the following ways:

- **Transpiration** – This is the process by which water, taken in from the soil by tree roots, is evaporated through the pores or stomata on the surface of leaves (Nisbet, 2005). Trees draw large quantities of water from the soil, which can contribute to reducing runoff volumes (**Box 19.1**).
- **Interception** – Leaves, branches and trunk surfaces intercept (store and allow the water to evaporate) and absorb rainfall, reducing the amount of water that reaches the ground, delaying the onset and reducing the volume of runoff (**Box 19.1**).
- **Increased infiltration** – Root growth and decomposition increase soil infiltration capacity and rate, reducing runoff volumes.
- **Phytoremediation** – In the process of drawing water from the soil, trees also take up trace amounts of harmful chemicals, including metals, organic compounds, fuels and solvents that are present in the soil. Inside the tree, these chemicals can be transformed into less harmful substances, used as nutrients and/or stored in roots, stems and leaves.

## 5.2 Surface Water Quality

As the new footway and cycle areas are for non-motorised users only, water quality is not anticipated to be an issue, however the use of SuDS as described in section 5 above will help treat the run-off before it enters downstream watercourses.

For the replacement highway drainage, road gullies, or combined kerb drainage units with outfall units providing the same benefits as road gullies (trapped with sediment collection sumps, and to the highway authority's approval) will be utilised.

The use of road gullies is recognised within the SuDS Manual and whilst it is acknowledged that no treatment occurs within the road gullies, they do however capture and retain the initial silt and suspended solids from the surface water runoff before it enters the drainage system. If the gullies are regularly maintained these pollutants can be removed and disposed of correctly.

## 6. Schedule of Maintenance

### 6.1 Introduction

The maintenance of SuDS components is vital to ensuring that they work as efficiently as they set out to do. Maintenance activities can be broadly defined as:

- Regular maintenance - basic tasks carried out regularly
- Occasional maintenance – tasks that are required periodically but on a much less frequent basis
- Remedial maintenance – tasks required when a fault needs rectifying and often includes unforeseen events

The Phase 3 proposals are primarily to:

- adjust existing highway drainage features such as the existing culverts beneath the A2300 and A273, the adjustment of carriageway drainage on the A2300, and the ditch along the north side of the A2300, which all lie within the existing highway boundary, or
- provide new drainage for the new pedestrian and cycle facilities, either within the existing highway boundary or to be adopted as highway, subject to formal agreement with the Highway Authority, under Section 38 agreement.

The inspection and maintenance of most of the drainage assets will therefore be the responsibility of the Highway Authority.

The existing land drainage ditches to the south of the A2300, and the proposed new section of ditch to the south of the A2300 will remain the responsibility of the landowner, whose land they pass through, to maintain.

During construction, it is the responsibility of the Principal Contractor to ensure the relevant management and maintenance requirements outlined below are implemented. The principal contractor will retain responsibility during construction up to the handover of the completed scheme to the client.

### 6.2 Filter Strips

#### 6.2.1 Construction

6.2.1. A newly constructed filter strip should be protected from surface water flows until vegetation has been established. This may be achieved by:

- diverting runoff around the filter strip until vegetation is established
- using pre-established turf or seeded mattresses
- covering the filter strip with clear plastic until the vegetation is well rooted
- placing an erosion control blanket over the freshly applied seed mix.

#### 6.2.2 Maintenance Schedule

**Table 7** shows the maintenance requirements for filter strips, taken from the CIRIA report C753 The SuDS Manual.

| Maintenance schedule   | Required action                                                                                                                                      | Typical frequency                                                           |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| Regular maintenance    | Remove litter and debris                                                                                                                             | Monthly (or as required)                                                    |
|                        | Cut the grass – to retain grass height within specified design range                                                                                 | Monthly (during growing season), or as required                             |
|                        | Manage other vegetation and remove nuisance plants                                                                                                   | Monthly (at start, then as required)                                        |
|                        | Inspect filter strip surface to identify evidence of erosion, poor vegetation growth, compaction, ponding, sedimentation and contamination (eg oils) | Monthly (at start, then half yearly)                                        |
|                        | Check flow spreader and filter strip surface for even gradients                                                                                      | Monthly (at start, then half yearly)                                        |
|                        | Inspect gravel flow spreader upstream of filter strip for clogging                                                                                   | Monthly (at start, then half yearly)                                        |
|                        | Inspect silt accumulation rates and establish appropriate removal frequencies                                                                        | Monthly (at start, then half yearly)                                        |
| Occasional maintenance | Reseed areas of poor vegetation growth; alter plant types to better suit conditions, if required                                                     | As required or if bare soil is exposed over > 10% of the filter strip area. |
| Remedial actions       | Repair erosion or other damage by re-turfing or reseeded                                                                                             | As required                                                                 |
|                        | Relevel uneven surfaces and reinstate design levels                                                                                                  | As required                                                                 |
|                        | Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface               | As required                                                                 |
|                        | Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip                                                       | As required                                                                 |
|                        | Remove and dispose of oils or petrol residues using safe standard practices                                                                          | As required                                                                 |

Table 7: Maintenance requirements for filter strips (CIRIA C753, 2015)

## 6.3 Filter Drains

### 6.3.1 Construction

During construction it is important to prevent muddy water from flowing into the system. Where possible, construction should be undertaken during dry periods. The filter drains should be constructed with adequate fall to ensure the area drains efficiently. During construction the contractor must ensure the designed width and depth are achieved, and the geotextile used has the specified porosity.

### 6.3.2 Maintenance Schedule

Table 8 shows the maintenance requirements for filter drains, taken from the CIRIA C753 SuDS Manual.

| Maintenance schedule   | Required action                                                                                                                                  | Typical frequency           |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Regular maintenance    | Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices                            | Monthly (or as required)    |
|                        | Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage            | Monthly                     |
|                        | Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies          | Six monthly                 |
|                        | Remove sediment from pre-treatment devices                                                                                                       | Six monthly, or as required |
| Occasional maintenance | Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (eg NJUG, 2007 or BS 3998:2010) | As required                 |
|                        | At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium                       | Five yearly, or as required |
|                        | Clear perforated pipework of blockages                                                                                                           | As required                 |

Table 8: Maintenance requirements for filter drains (CIRIA C753, 2015)

## 6.4 Swales

### 6.4.1 Construction

Swales should ideally not receive any runoff until the vegetation is fully established and construction at the site has reached a state where sediment loads will not cause rapid siltation of the swale. If flows into the swale prior to vegetation establishment is not practicable, freshly seeded areas should be stabilised with appropriate temporary or permanent soil stabilisation methods, such as erosion control matting or blankets. If more than 30% of the planted area is bare after four weeks, reseeding or replanting should be considered to achieve 90% coverage.

### 6.4.2 Maintenance Schedule

Table 9 shows the maintenance requirements for swales, taken from the CIRIA C753 SuDS Manual.

| Maintenance schedule   | Required action                                                                                                                        | Typical frequency                                                                   |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Regular maintenance    | Remove litter and debris                                                                                                               | Monthly, or as required                                                             |
|                        | Cut grass – to retain grass height within specified design range                                                                       | Monthly (during growing season), or as required                                     |
|                        | Manage other vegetation and remove nuisance plants                                                                                     | Monthly at start, then as required                                                  |
|                        | Inspect inlets, outlets and overflows for blockages, and clear if required                                                             | Monthly                                                                             |
|                        | Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours           | Monthly, or when required                                                           |
|                        | Inspect vegetation coverage                                                                                                            | Monthly for 6 months, quarterly for 2 years, then half yearly                       |
|                        | Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies                              | Half yearly                                                                         |
| Occasional maintenance | Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required                                       | As required or if bare soil is exposed over 10% or more of the swale treatment area |
| Remedial actions       | Repair erosion or other damage by re-turfing or reseeded                                                                               | As required                                                                         |
|                        | Relevel uneven surfaces and reinstate design levels                                                                                    | As required                                                                         |
|                        | Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface | As required                                                                         |
|                        | Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip                                         | As required                                                                         |
|                        | Remove and dispose of oils or petrol residues using safe standard practices                                                            | As required                                                                         |

Table 9: Maintenance requirements for swales, taken from the CIRIA C753 SuDS Manual.

## 6.5 Proprietary Treatment Systems

### 6.5.1 Construction

The proprietary treatment systems include conventional pipework, gullies, combined drainage kerb and headwalls.

## 6.5.2 Maintenance Schedule

**Table 10** below shows the operation and maintenance requirements, taken from the CIRIA C753 SuDS Manual

| <b>Maintenance Schedule</b>   | <b>Required Action</b>                 | <b>Typical Frequency</b>        |
|-------------------------------|----------------------------------------|---------------------------------|
| <b>Regular maintenance</b>    | <i>Remove litter and debris</i>        | <i>Monthly (or as required)</i> |
|                               | <i>Monitoring</i>                      | <i>Inspect monthly</i>          |
| <b>Occasional maintenance</b> | <i>Sediment management</i>             | <i>Annually or as required</i>  |
| <b>Remedial maintenance</b>   | <i>Structure rehabilitation/repair</i> | <i>As required</i>              |

Table 10: Operation and maintenance requirements for proprietary treatment systems

## 7. Conclusions

Waterman Infrastructure & Environment Ltd has prepared this drainage strategy and maintenance statement to support a full planning application and a reserved matters application for the area of the Brookleigh development (formerly the Northern Arc development) known as Western Bridge and Link Road (WBLR) - Phase 3. The extant Planning Permission covering most of the site refers to the OPA Development under DM/21/3279. This statement has been based on the approved Flood Risk Assessment and addendum reports produced by AECOM.

The BGS online geology viewer notes that the site is predominantly underlain by Wealdstone Clay Formation which is unlikely to be suitable for infiltration drainage. This was confirmed by intrusive ground investigation including infiltration testing carried out for the adjacent WBLR Phase 2 site between January to March 2020 and again in September 2022.

The topography of the site generally falls to the south and west towards existing land drainage ditches which become a tributary of the Pook Bourne.

The surface water drainage strategy has been designed, where practicable, in accordance with the NPPF and accompanying guidance and technical standards for SuDS. Where this has not been achievable the proposed drainage strategy has been discussed with MSDC during the pre-application consultation process and agreed in principle.

The Proposed surface water strategy seeks to retain and mimic the existing flow paths for the site. A filter drain connecting into the WBLR Phase 1 attenuation tanks will attenuate the flow from part of the Phase 3 site area, before a controlled discharge at QBar into the Tributary of the Pook Bourne. The rest of the site has incorporated SuDS features where practicable to do so, providing benefits including slowing of flows (compared to conventional pipework), some infiltration into the upper soil layers, and added treatment value.

The maintenance of SuDS features is vital to ensuring that they work as efficiently as they are designed to do.

Subject to agreement with the Highway Authority, most of the proposed drainage, which is not already highway drainage, is to be offered for adoption.

## **Appendices**

### **A. Site Location and Existing Site Layout**

## **B. Proposed Layout**

### **Appendices**

WBLR Phase 3 (Brookleigh, Burgess Hill)

Document Reference: WIE19442

**WIE19442-100-R-5-1-5**

## **C. Topographical Information**

### **Appendices**

WBLR Phase 3 (Brookleigh, Burgess Hill)

Document Reference: WIE19442

**WIE19442-100-R-5-1-5**

## **D. Site Photographs**

### **Appendices**

WBLR Phase 3 (Brookleigh, Burgess Hill)

Document Reference: WIE19442

**WIE19442-100-R-5-1-5**

## **E. Sewage Undertaker Asset Information**

### **Appendices**

WBLR Phase 3 (Brookleigh, Burgess Hill)

Document Reference: WIE19442

**WIE19442-100-R-5-1-5**

## **F. Proposed Drainage and Utilities Layout**

### **Appendices**

WBLR Phase 3 (Brookleigh, Burgess Hill)

Document Reference: WIE19442

**WIE19442-100-R-5-1-5**

## **G. Pre-Planning Application Consultation Correspondence**

### **Appendices**

WBLR Phase 3 (Brookleigh, Burgess Hill)

Document Reference: WIE19442

**WIE19442-100-R-5-1-5**

## **H. Supporting Calculations**

### **Appendices**

WBLR Phase 3 (Brookleigh, Burgess Hill)

Document Reference: WIE19442

**WIE19442-100-R-5-1-5**

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