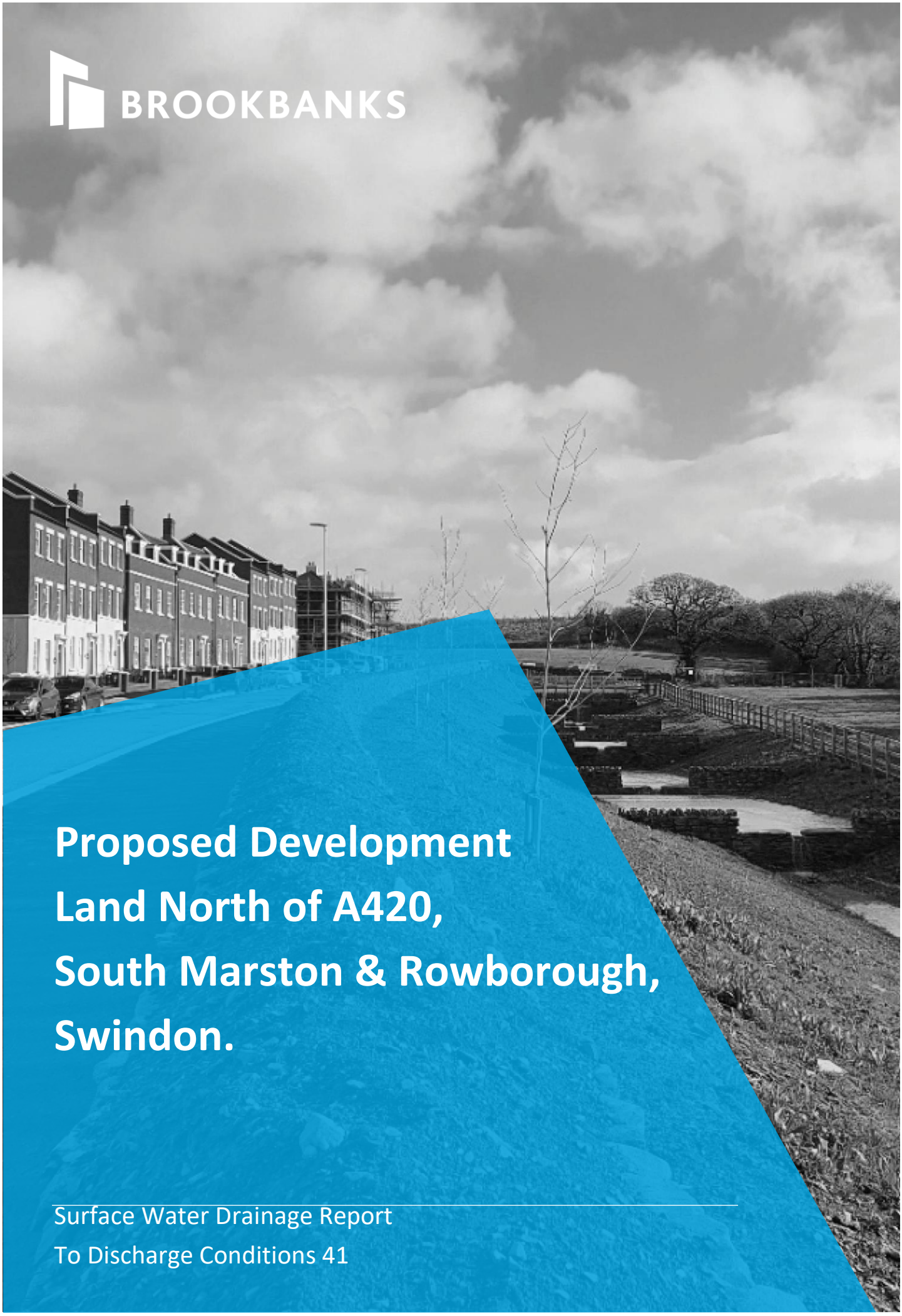

BROOKBANKS

# Proposed Development Land North of A420, South Marston & Rowborough, Swindon.

Surface Water Drainage Report

To Discharge Conditions 41

# Document Control Sheet

| | |
|---|---|
| **Document Title** | Drainage Report |
| **Document Ref** | 1335/SWDR rev00 |
| **Project Name** | Land North of the A420 |
| **Project Number** | 1335 |
| **Client** | Swindon New Eastern Villages Consortium |

## Document Status

| Rev | Issue Status | Prepared / Date | Checked / Date | Approved / Date |
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## Issue Record

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Appendix C – Drawing 1335_SK_114 – Surface Water Drainage Strategy Plan

Appendix D – Drawing 1335_SK_111 – Flood Risk Plan
Drawing 1335_SK_113 – Drainage Exceedance Plan

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Basins A, B, C, D, E & F.

Storage swales 1A, 1B, 2, 3, 4 & 5

Appendix F – Phasing Plan LHL005/186/Rev D (sourced by DLA)

# 1 Introduction

**1.1** Brookbanks Consulting (BCL) is appointed by the Swindon New Eastern Villages Consortium to produce a surface water drainage report for a residential-led scheme development at South Marston and Rowborough to the east of Swindon, together with areas of mixed use comprising: community; employment; education; local retail uses; and formal and informal open space provision on land east of Swindon and north of A420.

**1.2** This Report has been prepared in order to satisfy the following surface water drainage planning condition with respect to the outline planning application (ref. S/OUT/13/1555).

***1.3*** ***Condition 41. Surface Water - Full Site***

*Development shall not begin until a detailed Surface Water Management Strategy for the site, has been submitted to, and approved in writing by the Local Planning Authority. The strategy shall include:*

*a) Evidence that the proposed flows from the site will be restricted to 4.83l/s/ha for all events up to and including events up to and including the 1% AEP + climate change event (40%);*

*b) Details of how the drainage strategy has been designed to incorporate SuDS techniques to manage water quantity and maintain water quality as set out in the FRA and adopted policy and best practice guidance including the latest SuDS Manual C753;*

*c) Details of swales and other overland drainage features to manage the existing surface water flow routes through the site, as highlighted on Plan 1335-DR-05 Rev C (submitted to LPA on 16th July 2020);*

*d) Detailed drainage plan showing the location of the proposed SuDS and drainage network with exceedance flow routes clearly identified as highlighted on Plan 1335-DR-05Rev C (submitted to LPA on 16th July 2020), that acknowledges the role of green infrastructure resource to accommodate additional features to augment the detailed design if required);*

*e) Details of how the strategy shall be maintained and managed after completion;*

*f) Details of how water quality shall be maintained during and after construction;*

*g) Detailed drainage calculations for all rainfall events up to and including the 1 in 100year plus climate change event (40%) to demonstrate that all SuDS features and the drainage network can cater for the critical storm event for its lifetime;*

*h) The submission of evidence relating to accepted outfalls from the site, particularly from any third party network owners; and*

*i) Sequencing for implementation. The scheme shall be implemented in accordance with the approved details and timetable.*

*Reason: To ensure the surface water management strategy (and future phases of development) will comply with the adopted policy and best guidance and that the development will not increase the risk of*

*flooding elsewhere; in accordance with Paragraph 155 of the National Planning Policy Framework (NPPF) and Policy EN6 of the adopted Swindon Local Plan 2026.*

**1.4** This report should be read in in accordance with the engineering drawings and other documents included in the Reserved Matters submission.

# 2 Storm Drainage

## Background

**2.1** The strategic surface water drainage scheme is based on the principles set out in the Flood Risk Assessment (FRA) (ref. 1335/FRA/03) submitted and approved as part of the outline planning application and the Surface Water Management Concept Plan 1335-DR-05 C – which is the agreed starting point for the strategy insofar as dealing with existing overland flows and new drainage swales.

**2.2** Development flows will discharge via detention basins A to F and storage swales 1 to 5 to South Marston Brook and River Cole.

**2.3** Detailed proposals will be supported by a surface water drainage scheme as required by condition 42. Drainage proposals for individual parcel developments will be subject to separate reserved matters applications which will rely on the strategic surface water scheme outlined in this report.

## Baseline Conditions

**2.4** The proposed development lies to the east of Swindon being part of the New Eastern Villages, a key strategic allocation in the adopted Swindon Local Plan.

**2.5** The A420 and the Great Western Rail Line bound the site to the south. To the west of the site, Thornhill Lane forms the site boundary, with the extents of South Marston, Nightingale Lane and the accompanying farmland bounding the site to the north. Agricultural land forms the eastern boundary of the site.

**2.6** The majority of the land is thought to be historically undeveloped, however, small developments including a combination of dwellings, hotels and public houses are spread around the site, with link roads included throughout. The site location and boundary is shown indicatively on Figure 2a, below.

**2.7** Development Criteria

The 165 ha site has outline planning permission for:

- Up to 2,380 residential units
- Up to 1,500m$^2$ Retail Space
- Up to 1,000m$^2$ Employment Space

**2.8** The dominant watercourses in the area are the River Cole and South Marston Brook; the headwaters of the latter originate some 5km north west of the site in the Groundwell Industrial Estate.

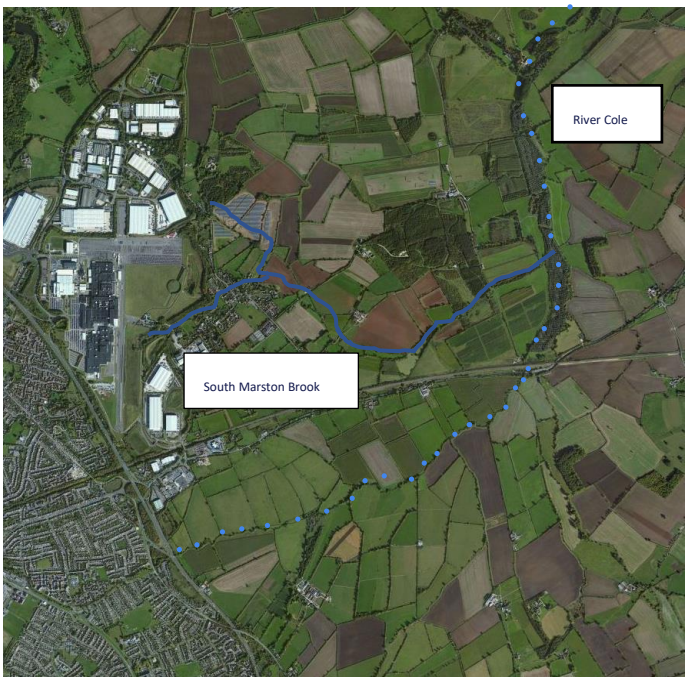


**Figure 2-a: Watercourse Systems River Cole South Marston Brook**

**2.9** The South Marston Brook flows through the centre of the site forming a valley with topography characterised by relatively shallow and consistent falls, towards the brook from each of the site boundaries. Levels fall from a high point of 101m AoD on the north eastern corner of the site, adjacent to Nightingale Lane down to approximately 88m AoD on the eastern boundary adjacent to the South Marston Brook.

**2.10** In accordance with the 'Surface Water Drainage Strategy' included in the (FRA) (ref. 1335/FRA/03) preliminary hydraulic design of the storm water management system was completed for the discharge of flows from the proposed development area to the nearby watercourse network. The calculations show that the SuDS system is able to achieve a peak discharge of 4.83l/s/ha during the 1 in 100 year event. This peak discharge of 4.83l/s/ha represents a reduction in baseline run-off from the site, as shown by IoH124 appraisals, by circa 65.5%.

| Scenario | 1:100year (l/s/ha) |
|---|---|
| Final Site Discharge | 4.83 |
| Baseline Discharge | 14.01 |
| Overall Betterment | 65.5% |
| | |

**Table 2-b: Drainage Criteria and Measures**

**2.10** Reference to the British Geological Society indicates a number of different geological strata across the site. To the south and west the site is reported to be predominantly underlain by Ampthill Clay formation mudstone with an outcrop of Ferruginous limestone on the western corner.

**2.11** To the north and east, the BGS reports the general ground conditions to consist a mix of sandstone to the north east and limestone to the south.

**2.12** With regards to superficial deposits, these are shown to be limited to a thin band of alluvium passing through the site, generally along the line of the South Marston Brook.

## Source Control.

**2.13** At the head of the drainage network, across development parcels, source control measures will be implemented to reduce the amount of run-off being conveyed directly to conveyance systems. As site specific infiltration testing has shown the ground to be practical impervious, source control will be limited to detention type systems, albeit that systems will be unlined and therefore provide for an element of infiltration. The Primary Drainage System will reduce the initial peak discharge at a local level before discharge into the site Secondary Drainage System.

**2.14** Through work on other similar strategically sized projects, it has been shown that peak discharges of circa 15% in residential areas can readily be achieved without unacceptable reductions in net developable land or prohibitive financial implications. It is therefore proposed to set these values as a benchmark for each parcel of the development.

**2.15** The primary aims of the Primary Drainage System will therefore be:

- Reduction in peak discharges by 15% in residential areas.
- Provide one stage of water quality treatment where appropriate

**2.16** The FRA offered a 'toolkit' of source control techniques which could be considered as the design of the surface water system was developed. The following paragraphs now provide details of the preferred source control features to be utilised throughout the development.

**2.17** The FRA refers to a reduction of 15% in peak flows from residential parcels achieved through on plot source control storage. Highway areas (approx. 40% of parcel catchment) can be discounted with highways draining directly to swales and basins. Source control calculations show that for 10 house plots (average of 75$m^2$ impermeable area/plot) there is a storage requirement of 54.3$m^3$ during the 1 in 100-year (+ 40% cc) storm event. Equating this to one plot at 5.43$m^3$ a 15% reduction applied equates to 0.81$m^3$ of storage per plot.

**2.18** Primary treatment of run off from driveways/parking areas will be provided utilising over-edge drainage to filter strips/swales and/ or permeable paving prior to discharge to the main drainage systems.

**2.19** Drainage proposals for individual Parcel developments will be subject to separate reserved matters applications which will rely on the strategic surface water scheme outlined in this report.

## Conveyance.

**2.20** Secondary swales will be designed to provide both storage and conveyance functions. The contributing areas for those of the secondary swales providing a significant storage purpose acting together with the tertiary attenuation features have been appraised for input into the MD cascading analysis. Drawing 1335-SK-100 in Appendix C shows the layout of these features and associated catchments.

**2.21** The secondary SuDS systems include a number of linear storage and conveyance channels, which are designed to attenuate flows to their maximum available capacity while providing conveyance through the site towards the outfall. The following swale characteristics are proposed:

| Storage Swale | Catchment Area | Impermeable Area (ha) | Swale Length (m) | Proposed 100 Year Run-off (l/s) | Detention Volume for 1 in 100 Year (+40%cc) Event (m3) |
|---|---|---|---|---|---|
| 1A | R5 | 0.53 | 134 | 2.57 | 352 |
| 1B | Storage Swale 1A Catchment & Primary Infrastructure | 1.177 | 730 | 8.25 | 785 |
| 2 | R9 | 0.85 | 200 | 4.09 | 560 |
| 3 | Basin A Catchment & Primary Infrastructure | 0.51 | 290 | 46.86 | 333 |
| 4 | Primary Infrastructure | 0.41 | 187 | 2.00 | 275 |
| 5 | Primary Infrastructure | 0.32 | 188 | 1.56 | 216 |
| | | | | | |

**Table 2-c: Details of secondary storage swales**

**2.22** Strategic conveyance swales, will act as an effective means of collecting and conveying highway and development flows as they are routed through the site towards the main detention features. Swale

corridors will also act as overland flow routes in the event of drainage system exceedance or blockage and provide better future proofing in terms of climate change.

**2.23** The significant lengths of swales traversing the site will reduce the need for conventional pipework systems providing additional water quality treatment benefits, as well as flow attenuation and conveyance.

**2.24** Shallow roadside swales, approximately 0.3m deep, will be preferred to collect highway run off along un-developed frontages of the primary highway routes as shown in the figure below. Where conveyance and storage swales flow through open space areas in close proximity to the highway network, direct discharge points for highway run-off will be preferred to a single 'end of run' discharge point. This will increase run-off treatment times and reduce drainage system pipework sizes.

**Table 2-d: Example of shallow roadside swales.**

**2.25** The extensive swale systems will follow the natural topography flowing through visible and managed green infrastructure corridors and open space areas, enhancing the natural landscape.

**2.26** Varied swale profiles will be provided with different side slopes, depths and longitudinal gradients to avoid a channelised appearance. In addition, swales will be widened where possible, to primarily provide additional attenuation volume but also to give the opportunity for planting and varied width low flow channels within the confines of the swale.

**2.27** In relatively steep areas of the site, check dams or berms will be installed across the flow path, will temporarily pond runoff to increase pollutant retention and infiltration and further decrease flow velocity and rates of run off to the main attenuation features.

**2.28** The swales will be seeded with a wetland seed mix that includes species suited to a variety of conditions from relatively dry soils to very wet soils, therefore reflecting the fluctuations in water level that could occur and ensuring a continuity of vegetation cover.

**Figure 2-e: Example of a typical conveyance swale to be implemented.**

**2.29** Additional marginal planting will be established in some of the swale areas and the management regime will allow emergent/marginal planting to establish naturally if the water levels are sufficient to support them. If emergent/marginal species naturally colonise the swales/basins they will be managed in the same way as the grassland, and some of the vegetation in the base of the drainage features will be left uncut each year on a rotational basis.

## Drainage Proposals

**2.30** Preliminary assessment of the requirements for storm drainage have been based on the following criteria:

| Criteria | Measure/Rate/Factor |
|---|---|
| Impermeability factor – Residential | 0.55 |
| Impermeability factor – Commercial | 0.85 |
| Impermeability factor – Education | 0.45 |
| Impermeability factor – Highways | 0.90 |
| Sewer design return period | 1 in 2 year |
| Sewer flood protection | 1 in 30 years |
| Fluvial / Development flood protection | 1 in 100 years |
| M5-60 | 20.0 mm |
| Ratio r | 0.40 |
| Minimum cover to sewers | 1.2 m |
| Minimum velocity | 1.0 m/sec |

| | |
|---|---|
| Pipe ks value | 0.6 mm |
| Climate change | 40% |
| | |

**Table 2-f: Drainage Criteria and Measures**

**2.31** An illustrative strategic surface water sewer layout serving the development has been shown on Drawing 1335-SK-100 included in Appendix C to demonstrate the layout of the drainage system and location of proposed SuDS features.

**2.32** Hydraulic design and analysis of the strategic surface water drainage systems will be completed using the MD Network module for various storm events up to the 1 in 100year (+40%cc) maximum design storm event.

**2.33** Surface water sewers will be designed in accordance with the Sewerage Sector Guidance Appendix C - Design & Construction Guidance (DCG) (formerly Sewers for Adoption) and will be offered to Thames Water (TW) for adoption under a Section 104 agreement. Further detailing of the drainage design will be undertaken as part of the Section 104 submission to TW.

**2.34** Surface water sewers have been designed in accordance with DCG standards for no pipe surcharging during a 1 in 2 year storm event and no surface flooding during a 1 in 30 year storm event.

**2.35** The surface water system will also be checked against storms up to the 1 in 100 year (+40%cc) event, in accordance with DCG requirements. Water escaping from the drainage system will be routed safely through the site and away from dwellings.

**2.36** Gross development areas have been measured from Drawing 32847-RP-M-06 rev.N - Regulating Plan included in the Appendix.

**2.37** Impermeability factors applied to gross areas measured from the development layout plans are set out in the table above with a factor of 55% applied to residential areas.

**2.38** In accordance with the 'Surface Water Drainage Strategy' included in the FRA it was agreed that by implementing source control measures, a reduced run-off circa 15% is readily achievable (equivalent to a reduction in impermeable areas by 15%). For the purposes of the primary Drainage System appraisals and inputs to the secondary system, flows from the MD Source Control model assessment, at the sub-catchment level, have therefore been modelled as equivalent to a reduced contributing catchment of 15%.

**2.39** A Development Schedule with details of impermeable areas and discharge rates of all development parcels is provided in the Appendix. The Schedule also summarises that by providing the primary SuDS features and thus reducing the impermeable areas across a catchment it is possible to reduce discharge rates.

## Attenuation Proposals

**2.40** The primary aims of the Detention Basins are as follows:

- Final flow and water quality conditioning
- Provide landscaping, amenity and ecological benefits.

**2.41** Detention basins will collect partially treated excess water from the conveyance systems at a local level, thereafter, providing both flow attenuation and water quality treatment prior to the main outfalls.

**2.42** The basins will be seeded with a wetland seed mix that includes species suited to a variety of conditions from relatively dry soils to very wet soils, therefore reflecting the fluctuations in water level that could occur and ensuring a continuity of vegetation cover.

**2.43** Basins will be utilised and designed to primarily be dry with permanently wet low flow channels to convey run-off in periods of low rainfall. Wide and shallow wet low flow channels will be formed to add more ecological value.

**2.44** An uneven surface to the basins will provide a variety of shallow wet pools and drier mounds to offer a variety of habitat types and allow a variety of plants to establish. An uneven profile will also be provided on the banks so that as water levels fluctuate, some areas remain wet/damp as others become dry.

**2.45** There is potential for wetland species to establish around the permanent wetted areas and low flow channels. Aquatic vegetation is likely to be minimal as the basins are predominantly dry however the permanent wetted areas and low flow channels may support some aquatic vegetation.

**Figure 2-g: Example of a typical detention basin.**

**2.46** In accordance with FRA objectives, detailed detention basin designs will follow the basic principles below:

- Design based on principles outlined in CIRIA Report 753 - The SuDS Manual.
- Permanently wetted areas.
- Ecological and landscape considerations to be incorporated.
- Shallow and varied side slopes. Maximum 1 in 3 slopes kept to a minimum.
- Provide water treatment and capture of accidental spillages.
- Native emergent and fringing aquatic water purifying planting.
- Biodiversity and amenity opportunities to be maximised where possible.
- Access provided throughout for maintenance purposes.
- Outlet channels to be provided in preference to piped outfalls.

**2.47** Preliminary hydraulic design of the primary detention features within each development catchment area has been completed using the MD Source Control module to estimate surface water storage volumes during storm events up to the 1 in 100year (+40%cc) maximum design storm event. At this stage without the benefit of detailed surface water drainage systems, estimated attenuation volumes have been calculated for the strategic detention basins and swales within each catchment prior to discharge to receiving outfalls.

**2.48** Appropriate best practice methods have been employed by performing detention routing calculations using the MD Source Control module. Where swales and basins are inter-linked for attenuation storage purposes, the cascade function has been utilised. A summary of the calculations included in the Appendix is shown in Table 2g below.

**2.49** In accordance with legislative requirements, the detention proposals have been assessed for the potential effects of climate change. The 1 in 100-year (1% AEP) return events have been modelled for 40% climate change (including peak rainfall intensity). Calculations for the climate change scenarios are contained

within the Appendix and summarised in the table below. Climate change assessments show each detention feature to perform adequately by retaining the additional flows within the system while maintaining a minimum freeboard allowance of 300mm.

| Basin | **Catchment Area** | Impermeable Area (ha) | **Proposed 100 Year Run-off (l/s)** | **Detention Volume for 1 in 100 Year (+40%cc) Event (m3)** |
|---|---|---|---|---|
| A | R1,R2,R3,R4,R5,R6,R7,R8 & Primary Infrastructure | 9.19 | 44.38 | 4,378 |
| B | R10,R11,R12, R13, Primary School, Retained Dev & Mixed Use | 8.66 | 41.85 | 5,969 |
| C | R14,R15,R16, R17(part),R18(part), Mixed Use & Primary Infrastructure | 4.90 | 23.67 | 3,394 |
| D | R17(part),R18(part),R21 & Primary Infrastructure | 5.70 | 27.52 | 4,024 |
| E | R19,R20,R21, Mixed Use & Primary Infrastructure | 6.12 | 29.54 | 4,273 |
| F | R22 | 1.35 | 6.50 | 968 |
| | | | | |

**Table 2-h: Drainage Criteria and Measures**

**2.50** Surface water discharge locations to South Marston Brook and the River Cole have been identified on Drawing 1335-SK-100 included in Appendix C. These all lie within land under the control of the applicant and within the extent of the red line boundary of the application. Rights to discharge to the relevant watercourse are therefore available under riparian owner's rights. Applications will be made for Land Drainage Consent for each outfall.

## Land Drainage

**2.51** The FRA identified that overland surface water flow paths cross within the site and these have been shown on Drawing 1335-SK-111 -Flood Risk Plan included in Appendix D. These flow paths follow the natural topography from the higher ground to the west of the site down to South Marston Brook.

**2.52** In order to safeguard development parcels from overland flows from higher ground, a series of swales will be constructed within green infrastructure areas to intercept and divert flows.

**2.53** The introduction of positive drainage measures at the proposed site, including a number of interceptor and conveyance channels, will result in a reduced risk of surface water flooding from the proposed

development to the existing and proposed properties by collecting and conveying stormwater within managed corridors and away from people and property.

## Exceedance Flows

**2.54** As a result of extreme rainfall it is inevitable that the capacities of sewers and other drainage systems will be exceeded on occasion. Periods of exceedance occur when the rate of surface runoff exceeds the drainage system inlet capacity, when the pipe system becomes overloaded, or when the outfall becomes restricted due to flood levels in the receiving water.

**2.55** Underground conveyance cannot economically or sustainably be built large enough for the most extreme events and, as a result, there will be occasions when surface water runoff will exceed the design capacity of drains. When drainage system capacity is exceeded the excess water (exceedance flow) is conveyed above ground, and will travel along streets and paths, and across open space areas.

**2.56** The topography of the majority of the site falls from the west and east towards South Marston Brook, while the south eastern corner of the site falls towards the River Cole.

**2.57** The proposed levels for the development site will replicate the existing topography, subject to acceptable development gradients, and strategic drainage exceedance flow paths have been designed to follow above ground routes towards South Marston Brook and the River Cole.

**2.58** Drawing 1335-SK-113 included in Appendix D shows exceedance flow directions have been established through the strategic highway network of the development with flows routed to discharge at crossings to South Marston Brook.

**2.59** Basins and swales have also been designed with freeboard allowances above maximum design storm event water levels and spare capacity is available for exceedance run-off during more extreme events.

**2.60** Exceedance flows and flow paths within each parcel development will be considered and designed as part of individual reserved matters applications.

## Water Quality

**2.61** Impermeable surfaces collect pollutants from a wide variety of sources including cleaning activities, wear from car tyres, vehicle oil and exhaust leaks and general atmospheric deposition (source: CIRIA C609). The implementation of SuDS in development drainage provides a significant benefit in removal of pollutant from development run-off.

**2.62** The SuDS Manual C753 describes a 'Simple Index Approach' for assessing the pollution risk of surface run-off to the receiving environment using indices for likely pollution levels for different land uses and SuDS performance capabilities. A 'Simple Index Approach' assessment has been undertaken below.

**2.63** CIRIA document C753 Table 26.2, as shown in Table 2i below, indicates the minimum treatment indices appropriate for contributing pollution hazards for different land use classifications. To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index.

**2.64** For a typically residential type development, run-off from low traffic roads such as cul-de-sacs and individual property driveways pose the worst case pollution hazard.

| Land Use | Pollution Hazard Level | Total suspended solids (TSS) | Metals | Hydro-carbons |
|---|---|---|---|---|
| Residential roofs | Very Low | 0.2 | 0.2 | 0.05 |
| Individual property driveways, residential car parks, low traffic roads (e.g. cul-de-sacs, home zones and general access roads) and non-residential car parking with infrequent change (e.g. schools, offices) i.e. < 300 traffic movements/day | Low | 0.5 | 0.4 | 0.4 |

**Table 2-i:** CIRIA 753 Table 26.2 Pollution Hazard Indices

| Type of SUDS component | Total suspended solids (TSS) | Metals | Hydro-carbons |
|---|---|---|---|
| Detention Basin | 0.5 | 0.5 | 0.6 |
| Swales | 0.5 | 0.6 | 0.6 |

**Table 2-j:** CIRIA 753 Table 26.3 SuDS Mitigation Indices for discharges to surface waters.

**2.65** To provide the correct level of treatment, an assessment needs to be made of the mitigation provided by each SuDS feature. Table 26.3 of The SuDS Manual CIRIA document C753 shown as Table 2j for discharges to surface waters indicate the treatment mitigation indices provided by each SuDS feature.

**2.66** Typically, the strategic surface water system provides treatment of flows by as a minimum a swale prior to a detention basin and an outfall swale where possible. Pollution mitigation indices for this treatment scenario are shown in Table 2j.

**2.67** Strategic source control features as well as 'in plot' source control features are not included in the assessment but will undoubtedly provide additional treatment of flows.

| Pollution Hazard/ Mitigation Indices | Total suspended solids (TSS) | Metals | Hydro-carbons |
|---|---|---|---|
| Pollution Hazard Indices | 0.5 | 0.4 | 0.4 |
| Pollution Mitigation Indices (Swale->Basin->Swale) | 0.92 | >0.95 | >0.95 |
| Water Pollution Management | Sufficient | Sufficient | Sufficient |

**Table 2-k:** Simple Index Approach Assessment

**2.68** The SuDS management train being promoted for the development has been tailored to encourage passive treatment and from the above assessment in accordance with the 'Simple Index Approach' procedure, ref: Table 2k, the combined SuDS pollution mitigation proposed is sufficient to manage the pollution hazards arising from the development.

## Construction Phase Drainage Measures.

**2.69** Two potential construction phase environmental effects have been identified relating to hydrogeology and hydrology. These mechanisms are as follows:

- Direct and indirect contamination of surface water due to mobilisation of soils, existing contamination and spillage of oils and the like from construction plant
- Direct and indirect flooding and changes to baseline drainage hydrology due to disturbance of the ground during construction works

**2.70** The construction stage basin will incorporate a sediment forebay area and permanent water area to aid settlement and filtration of run-off and also provide sediment control using straw bales in the control chamber prior to final discharge. The basin will also incorporate shut-down facilities that could be activated in the event of a pollution incident. Pollutants and sediment accumulations can be held in the detention basin for subsequent pumping out and safe disposal. Reference should be made to the detailed design of the permanent detention feature to consider the incorporation of the temporary measures.

**2.71** The construction stage detention basin used for attenuation, sediment control and pollution prevention will be maintained during the construction period. Reinstatement of the basin will be undertaken towards the end of the construction period in accordance with the detailed landscape and design requirements for the permanent detention basin feature.

**2.72** There is the potential for fuel oil spillage from stored materials supplying site plant, this potential impact will be controlled by storing such materials within bunded tanks located within the site compounds. The works will be completed in a manner that is consistent with the need to protect the surface and ground water quality environment.

**2.73** It will be incumbent on the Principal Contractor to assess working practice related risks and effects before implementation and control such by employing industry good practice techniques. Furthermore, the contractor will be required to develop emergency spillage, flood, fire and contamination control procedures such that any inadvertent incidents are immediately controlled to minimise the potential impact.

**2.74** The contractor will not be permitted to temporarily store materials or introduce 'borrow pits' or the like in areas that may affect drainage flow paths. Furthermore deposition of materials within the floodplain, temporary diversion of watercourses, infilling of land altering flow paths and dewatering of excavations will not be allowed.

**2.75** Any proposed works within the buffer zone to local watercourses must be agreed with the LLFA prior to works commencing.

**2.76** All fuels, oils, chemicals, etc. will be stored in appropriate containers within bunded compounds and in accordance with good site practice and the above-mentioned documents. This will mitigate the potential for spills.

## Implementation.

**2.77** Phasing Plan LHL005/186/Rev D showing the proposed four phases of development is included in Appendix E. Particulars of the main surface water infrastructure delivered within each phase are set out below:

**Phase 1 – South Marston East**

- Provision of surface water drainage features including drainage swales, detention basin A and land drainage channels to be delivered as part of the open space network.
- The drainage infrastructure will be delivered in parallel with the construction of the development parcel that it serves and will be completed prior to last occupation within each parcel.

**Phase 2 – Rowborough West**

- Provision of surface water drainage features including drainage swales, detention basins B,C & D and land drainage channels to be delivered as part of the open space network.
- The drainage infrastructure will be delivered in parallel with the construction of the development parcel that it serves and will be completed prior to last occupation within each parcel.

**Phase 3 – Rowborough East**

- Provision of surface water drainage features including drainage swales and detention basins E & F to be delivered as part of the open space network.
- The drainage infrastructure will be delivered in parallel with the construction of the development parcel that it serves and will be completed prior to last occupation within each parcel.

**Phase 4 – South Marston West**

- Provision of surface water drainage features including drainage swales and land drainage channels to be delivered as part of the open space network.
- Connections to main surface infrastructure draining to detention basin A.
- The drainage infrastructure will be delivered in parallel with the construction of the development parcel that it serves and will be completed prior to last occupation within each parcel.

## Summary

**2.78** A strategy for storm drainage at the site has been developed to meet both national and local policy. The above proposals employ means of drainage to comply with NPPF guidance, together with SFRA and other national and local guidance.

**2.79** The drainage proposals will manage storm water by way of a SUDS management train and ensure peak discharges from the developed land provide betterment from the appraised baseline rates.

**2.80** The proposals will also provide to maintain the quality of water discharged from the development during the construction and operational stages.

**2.81** The storm water management proposals will improve the amenity and biodiversity of the site.

**2.82** The storm water system has been designed so that it is suitable for adoption by TW for future maintenance. Future maintenance of the non- adoptable SuDS elements of the system will be undertaken by a private management company.

**2.83** Implementation of the storm water management system for each development parcel will be undertaken prior to first occupation of dwellings.

# 3.0 Maintenance

## Sewer Systems

**3.1** Once constructed and when the adoption process has been completed, Thames Water (TW) or a New Appointments & Variations (NAV) will be responsible for maintaining the sewer networks and ensuring their continued operation.

**3.2** The highway drainage system will be maintained by the Highways Authority.

## SuDS

**3.3** The strategic surface water drainage system incorporates the following:

- Conveyance/ storage swales
- Detention Basins
- Outfall conveyance swales

**3.4** Future maintenance of SuDS by TW or NAV will be dependent on individual adoption policies. Nonetheless the option of adoption by the local authority or private management company on behalf of the developers can also be considered.

**3.5** Maintenance regimes for primary Source Control measures will be incorporated in separate reserved matters applications for individual development parcels.

**3.6** The swales, basins and associated structures/headwalls are to be maintained in accordance with a Maintenance & Management Plan to be approved by the LPA/LLFA.

**3.7** Detailed plans and design drawings indicating features and areas which are to be maintained will be provided in the formal Maintenance Plan.

**3.8** The development layout provides adequate access and working areas in order to undertake the above maintenance procedures. Formal rights of access will be provided, where necessary.

**3.9** The formal Maintenance & Management Plan will maintain the site in accordance with best practice guidance based on typical maintenance regimes shown in the tables below:

| Maintenance Schedule | Required Action | Typical Frequency |
|---|---|---|
| Regular Maintenance | Remove litter (including leaf litter) and debris | Monthly or as required |
| | Cut grass for spillways and access routes | 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 banksides, structures, pipework etc for evidence of physical damage | Monthly or when required |
| | Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies | Monthly for 12 months, then annually or as required |
| | Inspect inlets and facility surface for silt accumulation, and establish appropriate silt removal frequencies | Six Monthly |
| | Check any penstocks and other mechanical devices | Annually |
| | Tidy all dead growth before start of growing season | Annually |
| | Remove sediment from inlets, outlet and forebay | Annually or as required |
| | Manage wetland plants in outlet pool- where provided | Annually |
| Occasional Maintenance | Reseed areas of poor vegetation growth. | As required |
| | Prune and trim any trees and remove cuttings | Every 2 years or as required |
| | Remove sediment from inlets, outlet and forebay and main basin | Every 5 years or as required |
| Remedial Actions | Repair erosion or other damage by re-turfing or reseeding | As required |
| | Re-alignment of rip-rap | As required |
| | Repair/ rehabilitate inlets, outlets and overflows | As required |
| | Relevel uneven surfaces and reinstate design levels. | As required |

**Table 3a: Recommended maintenance activities for detention basins**

| Maintenance Schedule | Required Action | Typical Frequency |
|---|---|---|
| Regular Maintenance | Remove litter (including leaf litter) and debris | Monthly or as required |
| | Cut grass to retain grass height with 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 > 48 hours | Monthly or when required |
| | Inspect vegetation coverage | Monthly for six months, quarterly for 2 years , then half yearly |
| | Inspect inlets and facility surface for silt accumulation, and establish appropriate silt removal frequencies | Six Monthly |
| 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 reseeding | 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 3b: Recommended maintenance activities for swales**

## Waste management

**3.10** SUDS are designed to intercept silt and allow the natural breakdown of organic pollutants. Undertaking the above maintenance regime of the SUDS features, including occasional removal of silt and vegetation that gathers in SUDS, is required to ensure long term performance.

**3.11** Organic waste should be used around the SUDS components or schemes to form wildlife piles. If this is not practical it should be composted or, as a last resort, removed to a licensed landfill site. The Environment Agency has adopted a risk-based approach in relation to removal of silt from SUDS (Environment Agency 2011).

**3.12** Green waste from SuDS components and schemes is much the same as waste from normal landscape maintenance and can be managed by:

- Shredded for surface spreading like a mulch
- The development of wildlife piles to provide habitat, refuges, shelter etc. When they biodegrade they can compost.
- On or offsite (Council Green Waste) composting which can provide useful mulching
- Disposal to landfill often as a last resort.

# 4.0 Summary

**4.1** The purpose of this Report is to set out details of the proposed foul and surface water drainage schemes to manage foul flows and surface water run-off from the development, as required by Condition 41 and 59 of the outline planning permission.

**4.2** This Report demonstrates that against the requirements of the relevant condition a suitable scheme for the discharge of surface water has been designed in accordance with the approved Surface Water Drainage Strategy contained within the Flood Risk Assessment (FRA) (ref. 1335/FRA/03). The drainage scheme, designed and constructed in accordance with DCG standards with outfalls at agreed points of discharge, will be put in place to minimise the impacts of development during the construction and operational stages and cater for future phases of development.

# 5.0 Limitations

**5.1** The conclusions and recommendations contained herein are limited to those given the general availability of background information and the planned usage of the site.

**5.2** Third party information has been used in the preparation of this report, which Brookbanks Consulting Ltd, by necessity assumes is correct at the time of writing. While all reasonable checks have been made on data sources and the accuracy of data, Brookbanks Consulting Ltd accepts no liability for same.

**5.3** The benefits of this report are provided solely to the members of the Swindon Eastern Villages Consortium for the proposed development only.

**5.4** Brookbanks Consulting Ltd excludes third party rights for the information contained in the report.

# Appendix A

The scaling of this drawing cannot be assured

| Revision | | Date | Drn | Ckd |
|---|---|---|---|---|
| N | Drainage & Swales Updated | 03.11.21 | SM | SG |

- Site Boundary - 164.99Ha / 407.69Ac
- Residential
- Retained Development
- Mixed Use Centre
- Primary School
- Infrastructure
- Railway
- Outdoor Sports
- Play Space
- Allotments
- Green Space
- All Modes Access
- Primary Infrastructure
- Secondary Infrastructure
- Access to Community Hub
- Community Hub
- Existing Roads
- Retained Vehicular Access
- Drainage Swale with Varying Profile to Suit Green Space Location
- Proposed Swales to Direct Existing Surface Water Route
- Drainage Basins
- Existing Ponds and Watercourses
- Existing Footpath
- Existing Bridleway
- Dedicated Pedestrian / Cycleway
- Cycleway Route within Carriageway
- Pedestrian Route
- Pedestrian / Cycle Access
- Existing Underpass
- Other Existing Pedestrian / Cycle Routes (Offsite)
- Network Rail Footpath Diversion
- Key Spaces
- Traffic Calming Intervention along Old Vicarage Lane

| Site Boundary | 164.99 | 407.69 | | |
|---|---|---|---|---|
| **AREA** | **Ha** | **Ac** | **Dph** | **Units** |
| R1 | 3.34 | 8.24 | 28 | 94 |
| R2 | 1.00 | 2.46 | 31 | 31 |
| R3 | 0.34 | 0.85 | 15 | 5 |
| R4 | 2.23 | 5.50 | 31 | 69 |
| R5 | 1.14 | 2.82 | 29 | 33 |
| R6 | 3.33 | 8.22 | 33 | 109 |
| R7 | 1.06 | 2.61 | 24 | 25 |
| R8 | 2.43 | 6.01 | 32 | 79 |
| R9 | 1.81 | 4.46 | 30 | 55 |
| **Sub Total** | **16.66** | **41.18** | **30** | **500** |
| R10 | 7.93 | 19.59 | 40 | 317 |
| R11 | 3.27 | 8.08 | 40 | 131 |
| R12 | 1.65 | 4.08 | 40 | 66 |
| R13 | 2.39 | 5.90 | 40 | 96 |
| R14 | 2.62 | 6.48 | 40 | 105 |
| R15 | 1.28 | 3.16 | 40 | 51 |
| R16 | 1.40 | 3.45 | 40 | 56 |
| R17 | 8.38 | 20.70 | 40 | 335 |
| R18 | 6.15 | 15.20 | 40 | 246 |
| R19 | 0.50 | 1.24 | 40 | 20 |
| R20 | 3.06 | 7.57 | 40 | 123 |
| R21 | 7.41 | 18.32 | 40 | 297 |
| R22 | 2.88 | 7.11 | 40 | 115 |
| **Sub Total** | **48.91** | **120.87** | **40** | **1957** |
| Retained Development | 0.30 | 0.75 | | |
| Mixed Use Centre | 1.62 | 3.99 | | |
| Primary School | 2.25 | 5.56 | | |
| Infrastructure | 7.07 | 17.48 | | |
| Railway | 10.31 | 25.49 | | |
| Outdoor Sports | 10.26 | 25.36 | | |
| Play Space | 2.10 | 5.20 | | |
| Allotments | 1.66 | 4.10 | | |
| Green Space | 63.82 | 157.71 | | |
| **TOTAL** | **164.99** | **407.69** | | **2457** |

Project
LAND NORTH OF A420

Drawing Title
REGULATING PLAN

| Date | Scale | Drawn by | Check by |
|---|---|---|---|
| 22.06.21 | 1:5,000@A1 | S.M. | S.G. |

| Project No | Drawing No | Revision |
|---|---|---|
| 32847 | RG-M-06 | N |

0 100 200 400m

DRAFT

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J:\32000\32847 - Land North Of A420\A4 - Drawings & Registers\Masterplanning\32847 - RG-M-06P - Regulating Plan.dwg - (1-5000@A1)

# Appendix B

## Swindon EV Drainage Calculation

| Impermeability Ratios | |
|---|---|
| Residential | 0.55 |
| Education | 0.45 |
| Mixed Use | 0.85 |
| Retained Development | 0.50 |
| Primary Infrastructure | 0.90 |

| IoH 1ha | |
|---|---|
| 1 Year | 3.73 l/s |
| 100 Year | 14.01 l/s |
| Agreed Discharge | 4.83 l/s |

| Detention Feature | Catchment | Use | Area (ha) | Hard Area (ha) | Ex 1:100 Year discharge rate (l/s) | Hard Area (ha) Reduced by 15% | Prop 1:100 Year (+40%cc) discharge rate (l/s) |
|---|---|---|---|---|---|---|---|
| **Basin A & Storage Swale 1** | R1 | Residential | 3.34 | 1.84 | 25.74 | 1.56 | 7.54 |
| | R2 | Residential | 1.00 | 0.55 | 7.71 | 0.47 | 2.26 |
| | R3 | Residential | 0.34 | 0.19 | 2.62 | 0.16 | 0.77 |
| | R4 | Residential | 2.23 | 1.23 | 17.18 | 1.04 | 5.04 |
| | R5 | Residential | 1.14 | 0.63 | 8.78 | 0.53 | 2.57 |
| | R6 | Residential | 3.33 | 1.83 | 25.66 | 1.56 | 7.52 |
| | R7 | Residential | 1.06 | 0.58 | 8.17 | 0.50 | 2.39 |
| | R8 | Residential | 2.43 | 1.34 | 18.72 | 1.14 | 5.49 |
| | | Primary Infrastructure | 2.49 | 2.24 | 31.40 | 2.24 | 10.82 |
| | **Total** | | **17.36** | **10.42** | **145.98** | **9.19** | **44.40** |
| **Storage Swale 2** | R9 | Residential | 1.81 | 1.00 | 13.95 | 0.85 | 4.09 |
| | **Total** | | **1.81** | **1.00** | **13.95** | **0.85** | **4.09** |
| **Basin B** | R10 | Residential | 7.93 | 4.36 | 61.10 | 3.71 | 17.91 |
| | R11 | Residential | 3.27 | 1.80 | 25.20 | 1.53 | 7.38 |
| | R12 | Residential | 1.65 | 0.91 | 12.71 | 0.77 | 3.73 |
| | R13 | Residential | 2.39 | 1.31 | 18.42 | 1.12 | 5.40 |
| | Primary School | Education | 2.25 | 1.01 | 14.19 | 1.01 | 4.88 |
| | Retained Dev | Commercial | 0.30 | 0.17 | 2.31 | 0.17 | 0.82 |
| | Mixed Use | Mixed Use | 0.42 | 0.36 | 5.00 | 0.36 | 1.74 |
| | **Total** | | **18.21** | **9.92** | **138.93** | **8.66** | **41.85** |
| **Basin C** | R14 | Residential | 2.62 | 1.44 | 20.19 | 1.22 | 5.92 |
| | R15 | Residential | 1.28 | 0.70 | 9.86 | 0.60 | 2.89 |
| | R16 | Residential | 1.40 | 0.77 | 10.79 | 0.65 | 3.16 |
| | Mixed Use | Mixed Use | 0.70 | 0.60 | 8.34 | 0.60 | 2.90 |
| | R17(part) | Residential | 0.61 | 0.34 | 4.70 | 0.29 | 1.38 |
| | R18(part) | Residential | 2.35 | 1.06 | 14.82 | 0.90 | 4.34 |
| | | Primary Infrastructure | 0.71 | 0.64 | 8.95 | 0.64 | 3.09 |
| | **Total** | | **9.67** | **5.54** | **77.64** | **4.90** | **23.67** |
| **Basin D** | R17(part) | Residential | 7.77 | 4.27 | 59.87 | 3.63 | 17.54 |
| | R18(part) | Residential | 3.80 | 1.71 | 23.96 | 1.45 | 7.02 |
| | | Primary Infrastructure | 0.68 | 0.61 | 8.57 | 0.61 | 2.96 |
| | **Total** | | **12.25** | **6.60** | **92.40** | **5.70** | **27.52** |
| **Basin E** | R19 | Residential | 0.50 | 0.28 | 3.85 | 0.23 | 1.13 |
| | R20 | Residential | 3.06 | 1.68 | 23.58 | 1.43 | 6.91 |
| | R21 | Residential | 7.41 | 4.08 | 57.10 | 3.46 | 16.73 |
| | Mixed Use | Mixed Use | 0.50 | 0.43 | 5.95 | 0.43 | 2.08 |
| | | Primary Infrastructure | 0.62 | 0.56 | 7.82 | 0.56 | 2.70 |
| | **Total** | | **12.09** | **7.02** | **98.30** | **6.12** | **29.54** |
| **Basin F** | R22 | Residential | 2.88 | 1.58 | 22.19 | 1.35 | 6.50 |
| | **Total** | | **2.88** | **1.58** | **22.19** | **1.35** | **6.50** |
| **Storage Swale 3** | | Primary Infrastructure | 0.57 | 0.51 | 7.19 | 0.51 | 2.48 |
| | **Total** | | **0.57** | **0.51** | **7.19** | **0.51** | **2.48** |
| **Storage Swale 4** | | Primary Infrastructure | 0.46 | 0.41 | 5.80 | 0.41 | 2.00 |
| | **Total** | | **0.46** | **0.41** | **5.80** | **0.41** | **2.00** |
| **Storage Swale 5** | | Primary Infrastructure | 0.36 | 0.32 | 4.54 | 0.32 | **1.56** |
| | **Total** | | **0.36** | **0.32** | **4.54** | **0.32** | **1.56** |
| | **Grand Total** | | **75.66** | **43.32** | **606.92** | **38.02** | **183.62** |

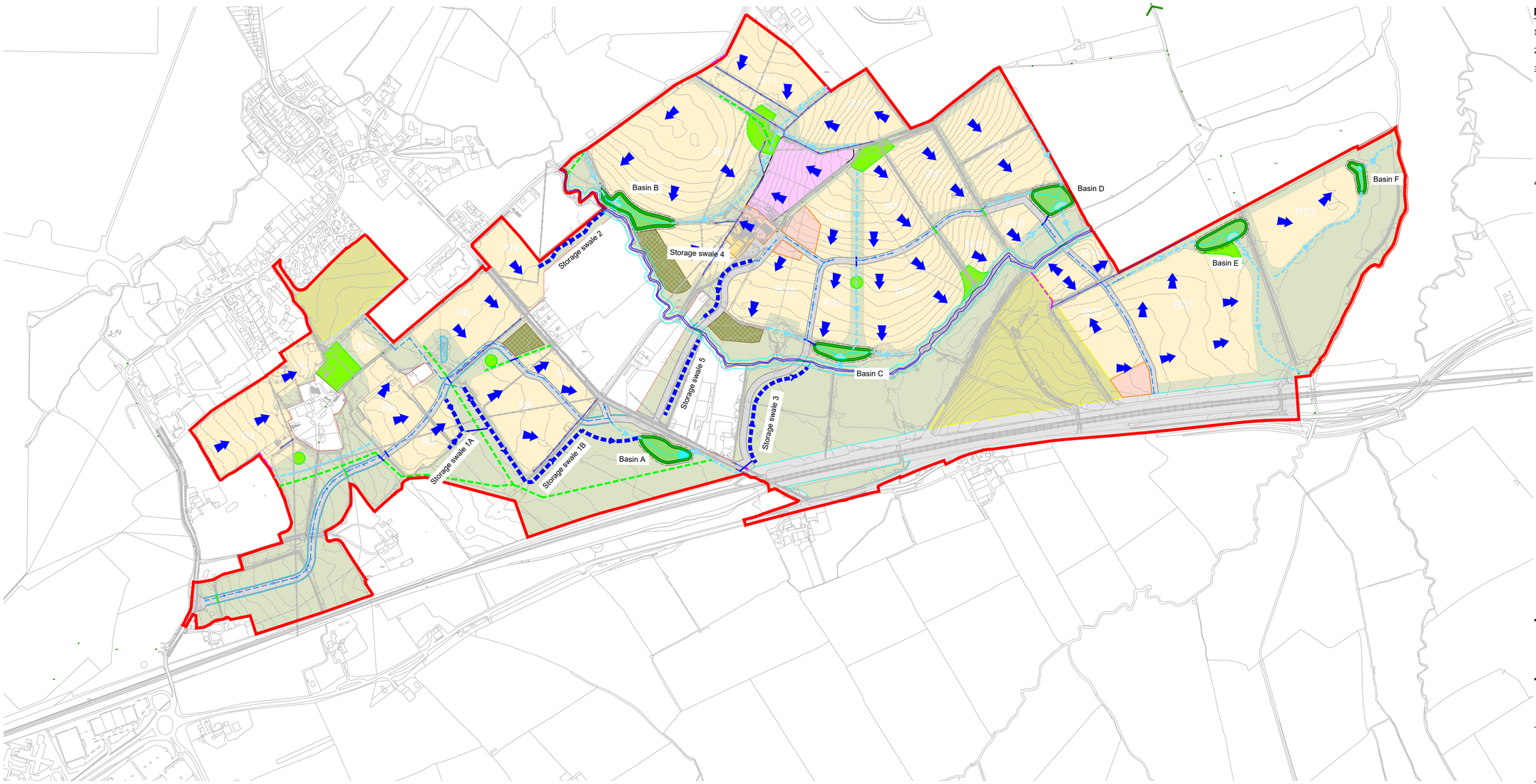
# Appendix C

Original Drawing Size A1

**Construction Design and Management (CDM)**
**Key Residual Risks**

Contractors entering the site should gain permission from the relevant land owners and/or principle contractor working on site at the time of entry. Contractors shall be responsible for carrying out their own risk assessments and for liaising with the relevant services companies and authorities. Listed below are Site Specific key risks associated with the project.

1) Overhead and underground services
2) Street Lighting Cables
3) Working adjacent to water courses and flood plain
4) Soft ground conditions
5) Working adjacent to live highways and railway line
6) Unchartered services
7) Existing buildings with potential asbestos hazards




**NOTES:**

1. Do not scale from this drawing.
2. All dimensions are in metres unless otherwise stated.
3. Brookbanks Consulting Ltd has prepared this drawing for the sole use of the client. The drawing may not be relied upon by any other party without the express agreement of the client and Brookbanks Consulting Ltd. Where any data supplied by the client or from other sources has been used, it has been assumed that the information is correct. No responsibility can be accepted by Brookbanks Consulting Ltd for inaccuracies in the data supplied by any other party. The drawing has been produced based on the assumption that all relevant information has been supplied by those bodies from whom it was requested.
4. No part of this drawing may be copied or duplicated without the express permission of Brookbanks Consulting Ltd.

KEY:

- Planning Boundary
- Surface water sewer and manhole
- Swale Pipe Connection
- Conveyance swale
- Storage swale
- Shallow Roadside Swale (on undeveloped frontages)
- Land drainage exceedance channel
- Detention basin with 3.5m maintenance zone
- Watercourse with 8m buffer zone
- Flow direction
- Flood Extents
- Ditch to be abandoned
- Diverted ditch
- Culvert to existing ditch
- Surface Water flow control

- Residential
- Retained Development
- Mixed Use Centre
- Primary School

| | | |
|---|---|---|
| - | First Issue | CDW NJO SM 20.01.2022 |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Swindon EDA Consortium

Proposed Development
Swindon EV Phase 1

Surface Water
Drainage Layout Plan

| Status | | Status Date |
|---|---|---|
| Draft | | JAN 2022 |
| **Drawn** | **Checked** | **Date** |
| CDW | NJO | 20.01.22 |
| **Scale** | **Number** | **Rev** |
| 1:5000 | 1335-SK-114 | - |

0 100 200 300 400 500
METRES

UNTIL TECHNICAL APPROVAL HAS BEEN OBTAINED FROM THE RELEVANT LOCAL AUTHORITIES, IT SHOULD BE UNDERSTOOD THAT ALL DRAWINGS ARE ISSUED AS PRELIMINARY AND NOT FOR CONSTRUCTION. SHOULD THE CONTRACTOR COMMENCE SITE WORK PRIOR TO APPROVAL BEING GIVEN, IT IS ENTIRELY AT HIS OWN RISK.


P:\1335\CAD\BCL\Current Drawings\1335-SK-114 - SW Drainage Layout Plan.dwg