

Infinity Garden Village (Wragley Way)

ENVIRONMENTAL STATEMENT

Volume 3

Appendices and Figures to the Main Technical Studies

June 2019



**Hallam Land
Management**



BETTER SOLUTIONS, INTELLIGENTLY ENGINEERED

ENVIRONMENT

Hallam Land Management Ltd
Infinity Garden Village
(Wragley Way)
Flood Risk Assessment

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Infinity Garden Village
(Wragley Way)
Flood Risk Assessment

Birmingham
Livery Place, 35 Livery Street, Colmore Business District, Birmingham, B3 2PB
T: 0121 233 3322

Cambridge
14-16 High Street, Histon, Cambridge
CB24 9JD
T: 01223 235 173

Leeds
Whitehall Waterfront, 2 Riverside Way, Leeds
LS1 4EH
T: 0113 233 8000

London
11 Borough High Street
London, SE1 9SE
T: 0207 407 3879

Manchester
4th Floor Carvers Warehouse, 77 Dale Street
Manchester, M1 2HG
T: 0161 233 4260

Market Harborough
12a Woodcock House, Compass Point Market Harborough, Leicestershire, LE16 9HW
T: 01858 455020

Nottingham
Waterfront House, Station Street, Nottingham NG2 3DQ
T: 0115 924 1100

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P02	04/06/19	S2	Josephine Green BA(Hons)/BEng(Hons)	Lauren Towle BSc (Hons)	Rooney BSc (Hons) MSc

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EXECUTIVE SUMMARY

This Flood Risk Assessment (FRA) has been prepared in accordance with the requirements set out in the National Planning Policy Framework (NPPF) and the associated Planning Practice Guidance. It has been produced on behalf of Hallam Land Management Ltd in respect of a planning application for the proposed Infinity Garden Village development off Wragley Way, Derby.

This report demonstrates that the proposed development is at an acceptable level of flood risk, subject to the recommended flood mitigation strategies being implemented.

There are numerous ordinary watercourses located within the vicinity of the site. These are included within a hydraulic model previously prepared by BWB Consulting. The hydraulic modelling exercise shows that the majority of the site is shown to be removed from flood risk however the culverts located under Stenson Road and Arleston Lane are shown to be restrictive, resulting in water pooling behind these structures during a flood event. Blockage scenarios on these culverts show the culverts and resulting flood extents are sensitive to blockage.

Environment Agency mapping indicates that majority of the site is at very low risk from pluvial flooding. Some areas are shown to be at 'Low Risk', with the main areas of risk indicated to occur within the 1 in 30yr 'High Risk' event being constrained to the route of the existing watercourses and minor topographical depressions. The hydrological assessment of the Cuttle Brook and Barrow Drain catchments which have informed the hydraulic modelling within the immediate and wider site area undertaken include for contributing runoff from Sinfin Moor and Stenson Fields area. Therefore, this potential source of flooding is included as part of the assessment of fluvial flood risk.

Land to the north comprising of Sinfin/Stenson Fields urban area is understood to be served by an existing surface water drainage network. Two surface water sewers have outfalls into the unnamed watercourses adjacent to the site boundary at the upstream face of the Arleston Lane culvert. The contributing flows from the Combined Sewer Outfalls east of Farmhouse Lane were included within the hydraulic model of the Cuttle Brook as part of a combined hydraulic model. Therefore, the assessment of this potential source of flooding has been incorporated as part of the assessment of fluvial flood risk.

It is recommended that finished floor levels should be set a minimum of 600mm above the adjacent 1 in 100-year + 30% flood level. This freeboard is sufficient to offer resilience against the 1 in 100-year + 50% events, and also against the increased flood levels resulting from potential blockages of the Stenson Road and Arleston Lane culverts. It is also recommended that finished floor levels are set a minimum of 150mm above adjacent ground levels, and that ground levels are profiled to encourage pluvial runoff and overland flows away from the built development and towards the nearest drainage point.

Although the culverts located under Stenson Road and Arleston Lane are shown to be restrictive, modelled scenarios in which these culverts are upsized to increase capacity has shown to result in detriment to third party land. Preliminary tests indicate it may be possible, however, to rearrange the floodplain within the development without impacting water levels downstream.

In compliance with the requirements of National Planning Policy Framework, and subject to the mitigation measures proposed, the development could proceed without being subject to significant flood risk. Moreover, the development will not increase flood risk to the wider catchment area as a result of suitable management of surface water runoff discharging from the site.

CONTENTS

EXECUTIVE SUMMARY	III
1. INTRODUCTION	1
Sources of Data	1
Existing Site	2
Proposed Development	3
2. FLOOD RISK PLANNING POLICY	6
National Planning Policy Framework	6
Flood Map for Planning	6
The Design Flood.....	7
Climate Change	8
Strategic Flood Risk Assessment	9
Preliminary Flood Risk Assessment	9
Local Flood Risk Management Strategy	10
The River Trent Catchment Flood Management Plan	10
Local Plan.....	10
3. POTENTIAL SOURCES OF FLOOD RISK	12
Fluvial Flood Risk	12
Historic Flooding	21
Flood Risk from Canals	22
Groundwater Flood Risk	22
Flood Risk from Reservoirs & Large Waterbodies	24
Pluvial Flood Risk	25
Flood Risk from Sewers	26
Effect of Development on Wider Catchment	27
4. FLOOD RISK MITIGATION	29
Layout Considerations	29
Development Levels	29
Blue-Green Infrastructure	30
Gas Main Easement	32
Surface Water Drainage	33
Foul Water Drainage	33
5. CONCLUSIONS AND RECOMMENDATIONS	34

FIGURES

Figure 1.1: Site Location
Figure 1.2: Local Authority Boundaries
Figure 1.3: Masterplan Areas
Figure 2.1: Flood Map for Planning
Figure 3.1: Watercourse Locations
Figure 3.2: Baseline Floodplain Extents
Figure 3.3: Comparison of Modelled Water Levels (m) for 66% Blockage of Stenson Road Culvert
Figure 3.4: Comparison of Modelled Water Levels (m) for 90% Blockage of Stenson Road Culvert
Figure 3.5: Comparison of Modelled Water Levels (m) for 66% Blockage of Arleston Lane Culvert
Figure 3.6: Comparison of Modelled Water Levels (m) for 90% Blockage of Arleston Lane Culvert
Figure 3.7: Fluvial Flooding Ditch Downstream of Deep Dale Lane - Circa March 2018
Figure 3.8: BGS Bedrock Geology
Figure 3.9: Reservoir Failure Flood Risk Map
Figure 3.10: Risk of Flooding from Surface Water Mapping
Figure 3.11: Sewer Inflow Locations
Figure 4.1: Flood Corridor Locations
Figure 4.2: Change in Peak Modelled Water Level (m)

TABLES

Table 1.1: Site Summary
Table 2.1: Peak River Flow Allowance for the Humber River Basin District
Table 2.2: Application of the Appropriate Climate Change Allowance
Table 3.1: Pre-Mitigation Sources of Flood Risk
Table 3.2: Peak Modelled Water Levels (mAOD)
Table 5.1: Summary of Flood Risk Assessment

APPENDICES

APPENDIX 1: Topographical Survey
APPENDIX 2: Development Proposals
APPENDIX 3: Severn Trent Water DSE & Sewer Mapping

1. INTRODUCTION

- 1.1 This Flood Risk Assessment (FRA) has been prepared in accordance with the requirements set out in the National Planning Policy Framework (NPPF) and the associated Planning Practice Guidance. The FRA has been produced on behalf of Hallam Land Management Ltd in respect of a planning application for the Infinity Garden Village development off Wragley Way, Derby.
- 1.2 This FRA is intended to support an outline planning application and as such the level of detail included is commensurate and subject to the nature of the proposals. Summary information is included as **Table 1.1**.

Table 1.1: Site Summary

Site Name	Infinity Garden Village (Wragley Way)
Location	Land off Wragley Way, South Derby
NGR (approx.)	434340, 330410
Application Site Area (ha)	150ha
Development Type	Residential-led Mixed Use Development
Flood Zone Classification	Flood Zone 1, minimal extent of Flood Zone 2
NPPF Vulnerability	More Vulnerable
Environment Agency Office	Midlands Region, East Area
Lead Local Flood Authority	Derby City Council/Derbyshire County Council
Local Planning Authority	South Derbyshire District Council

Sources of Data

- i. Topographical Survey by BWB Consulting Ltd
- ii. Illustrative Masterplan by Planning & Design Group
- iii. OS Explorer Series mapping
- iv. Environment Agency consultation and model information
- v. Derbyshire County Council, Derby City Council and South Derbyshire District Council Consultation
- vi. Derby City Council Level 1 Strategic Flood Risk Assessment
- vii. Derbyshire County Council Preliminary Flood Risk Assessment
- viii. Derbyshire County Council Local Flood Risk Management Strategy
- ix. Derby City Council Local Flood Risk Management Strategy
- x. The River Trent Catchment Flood Management Plan

- xi. Derby City Council Local Plan Core Strategy & South Derbyshire Local Plan
- xii. Site visits undertaken by BWB Consulting Ltd
- xiii. Hydraulic modelling of the Cuttle Brook, Main Drain, Barrow Drain and associated tributaries undertaken by BWB Consulting
- xiv. Web Based Soil Mapping & British Geological Survey Drift & Geology Maps
- xv. BWB Consulting Ltd Ground Investigation - Land to the West of Deep Dale Lane reference: NTH2136/02/V1/WEST and Land to the East of Deep Dale Lane reference: NTH2136E/02/V1/EAST undertaken in February 2014.
- xvi. Anecdotal Evidence and images of flooding

Existing Site

- 1.3 The site is located on land to the south of Sinfin and Stenson Fields, a suburb to the southwest of Derby. Wragley Way lies to the north, Sinfin Moor to the east and the A50 Bypass to the south. The site's location and extent are illustrated within **Figure 1.1**.

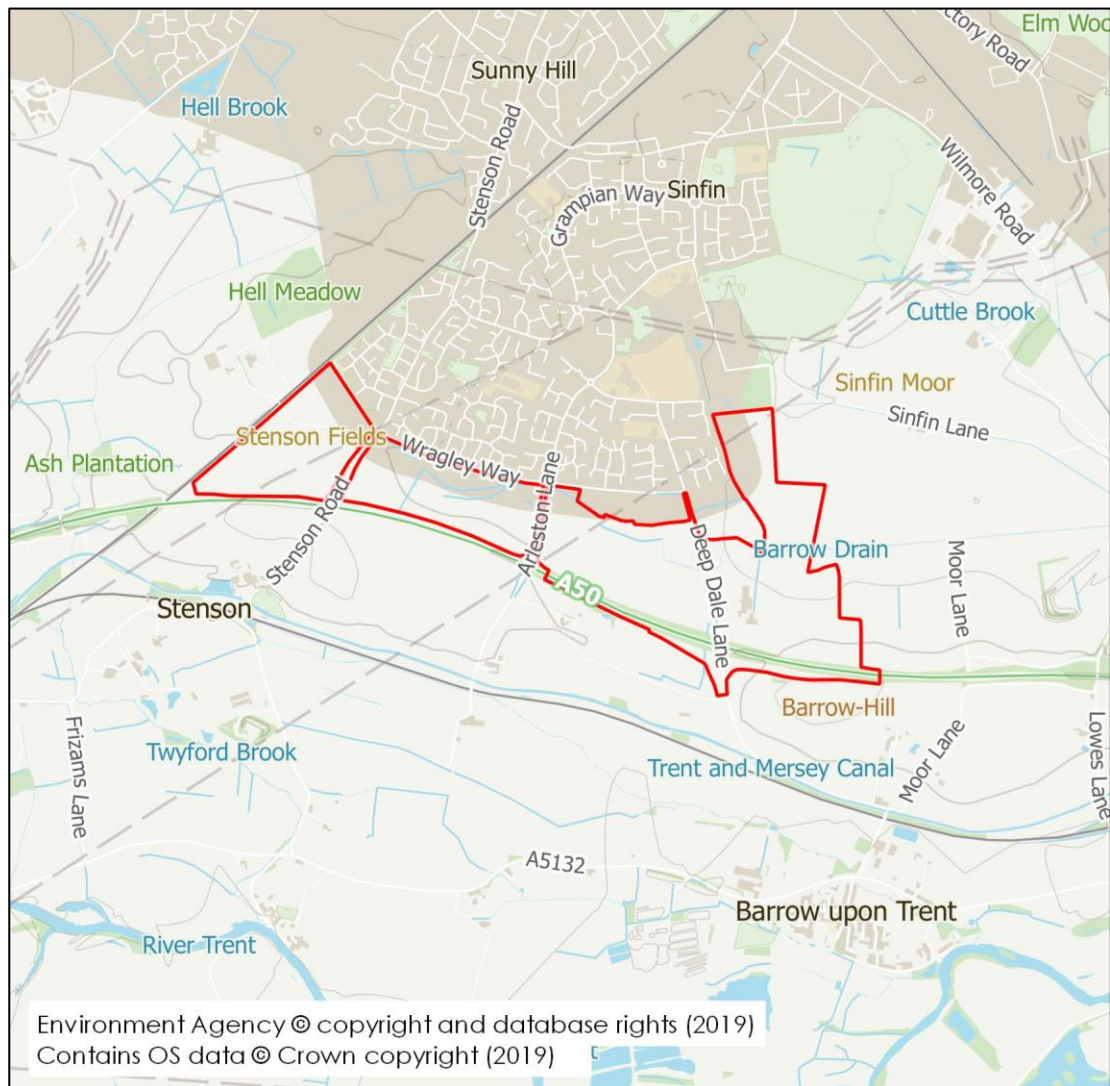


Figure 1.1: Site Location

- 1.4 A topographical survey included for reference as **Appendix 1**, indicates that there is a general fall in elevations across the site from 50.74m AOD in the west to 39.23m AOD in the east. The site is presently wholly greenfield in nature currently occupied by arable fields used for agricultural/farming purposes.

Proposed Development

- 1.5 The Proposed Development forms part of an allocated site within the South Derbyshire Local Plan¹ known as the Infinity Garden Village. This particular element is to comprise of 1,850 dwellings, a 2 form entry primary school, a local community centre (including community hall, retail and other local services and facilities), public house, drive through restaurant, petrol filling station, employment uses, strategic road links, public open space including children's play provision, surface water drainage infrastructure, landscaping, earthworks and ancillary supporting infrastructure. An Illustrative Masterplan is included for reference as **Appendix 2**.
- 1.6 Infinity Garden Village is known as a 'cross boundary' site between South Derbyshire District Council (SDDC) and Derby City Council (DCC), as shown in **Figure 1.2**.
- 1.7 The planning status of 'Infinity Garden Village' is varied though all is allocated within the Local Plans of South Derbyshire District Council (adopted - June 2016) and Derby City Council (adopted - January 2017). The Garden Village helps address South Derbyshire and also Derby City's housing need alongside further development, regeneration and employment growth to the south of Derby City.

¹ The South Derbyshire Local Plan (SDDC, June 2017)

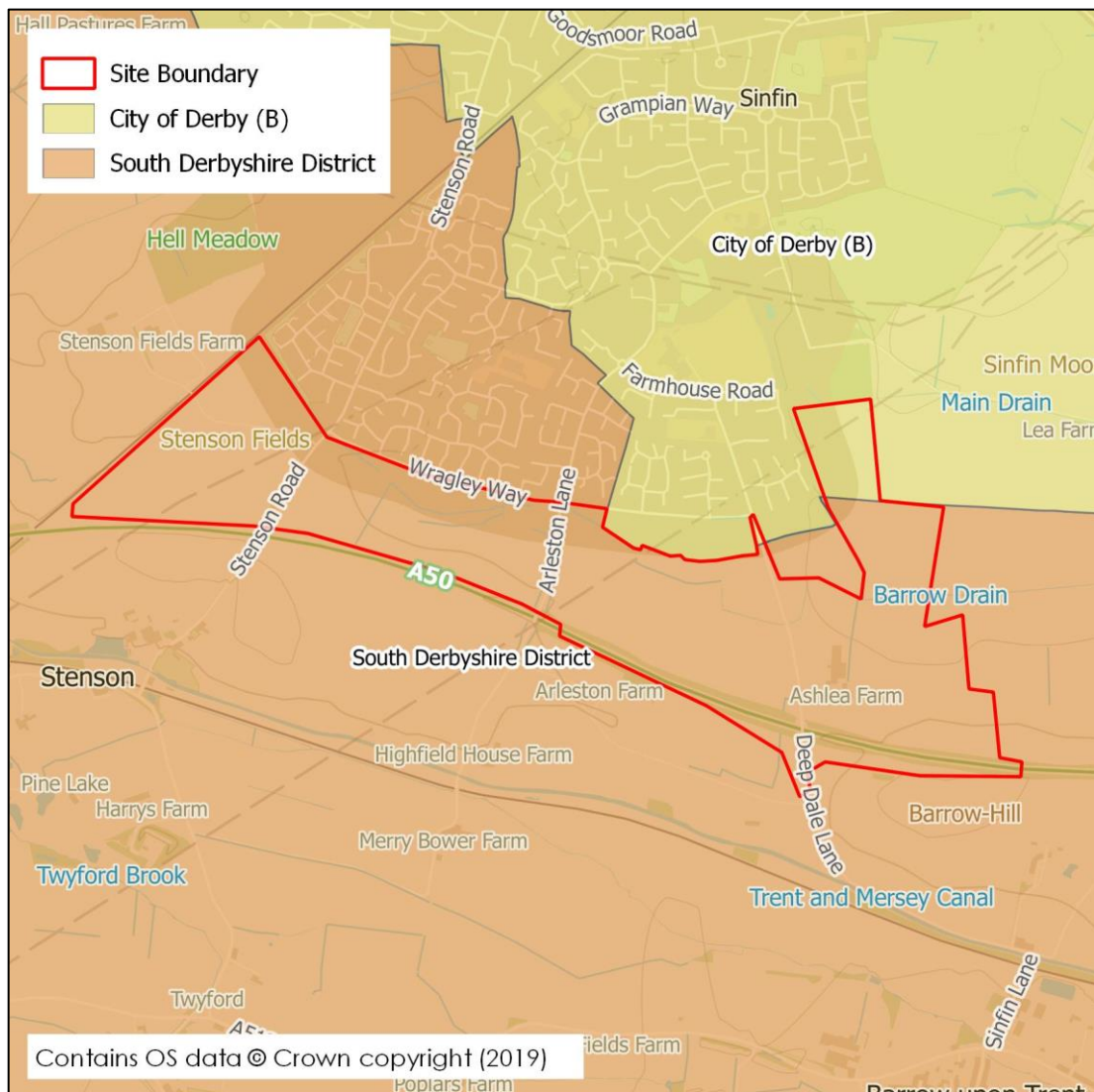


Figure 1.2: Local Authority Boundaries

- 1.8 Within the assessed red line boundary, the development includes the primary development parcels 1, 2, 3 and 4, consisting of residential uses with associated ancillary facilities, retail space and landscaping. The red line also includes parcel J, which comprises a proposed new A50 junction and link road which has been submitted under a separate planning application. These areas are depicted within **Figure 1.3**.

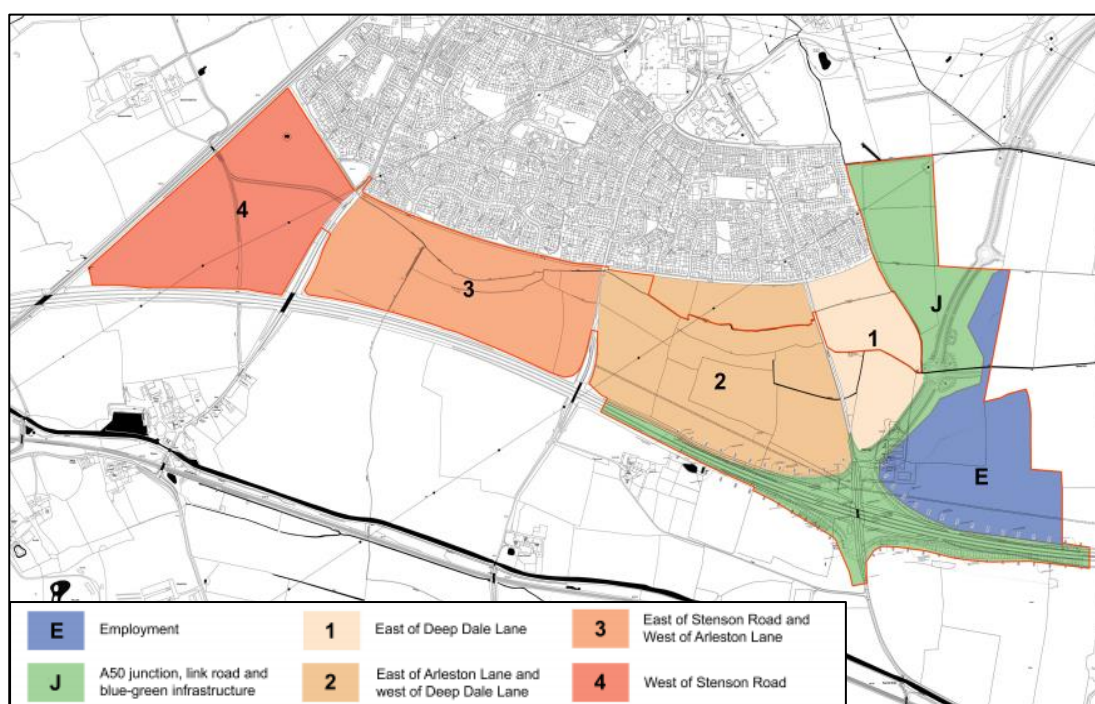


Figure 1.3: Masterplan Areas

- 1.9 These schemes are integral to one another and will be delivered as part of the strategic plan of future development as set out within the South Derbyshire and Derby City Council Local Plans. Details of phasing of the scheme are to be confirmed prior to detailed design.

2. FLOOD RISK PLANNING POLICY

National Planning Policy Framework

- 2.1 The NPPF² sets out the Government's national policies on different aspects of land use planning in England in relation to flood risk. Planning Practice Guidance is also available online³.
- 2.2 The Planning Practice Guidance sets out the vulnerability to flooding of different land uses. It encourages development to be in areas of lower flood risk where possible and stresses the importance of preventing increases in flood risk off site to the wider catchment area.
- 2.3 The Planning Practice Guidance also states that alternative sources of flooding, other than fluvial (river flooding), should also be considered when preparing a Flood Risk Assessment.
- 2.4 The Planning Practice Guidance includes a series of tables that define Flood Zones (Table 1), the flood risk vulnerability classification of development land uses (Table 2) and 'compatibility' of development within the defined Flood Zones (Table 3).
- 2.5 This Flood Risk Assessment is written in accordance with the NPPF and the Planning Practice Guidance.

Flood Map for Planning

- 2.6 With reference to planning and development, the Flood Map for Planning produced by the Environment Agency identifies Flood Zones in accordance with Table 1 of the Planning Practice Guidance.
- 2.7 Flood Zone 1 (Low Probability) is defined as land having less than a 1 in 1000 annual probability of river or sea flooding (<0.1% Annual Exceedance Probability).
- 2.8 Flood Zone 2 (Medium Probability) is defined as land having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1% AEP); or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1% AEP).
- 2.9 Flood Zone 3a (High Probability) is defined as land having a 1 in 100 or greater annual probability of river flooding (>1% AEP); or land having a 1 in 200 or greater annual probability of flooding from the sea (>0.5% AEP). This is represented by "Flood Zone 3" on the Flood Map for Planning.
- 2.10 Flood Zone 3b (The Functional Floodplain) is defined as land where water has to flow or be stored in times of flood. This is not identified or separately distinguished from Zone 3a on the Flood Map for Planning.

² Revised National Planning Policy Framework, Ministry of Housing, Communities & Local Government, February 2019.

³ Planning Practice Guidance: <https://www.gov.uk/government/collections/planning-practice-guidance>

- 2.11 The residential development is shown to be located within Flood Zones 1 and 2 as shown in **Figure 2.1**. The wider site boundary, incorporating areas attributed to the A50 junction and link road application, includes a small extent of Flood Zone 3.

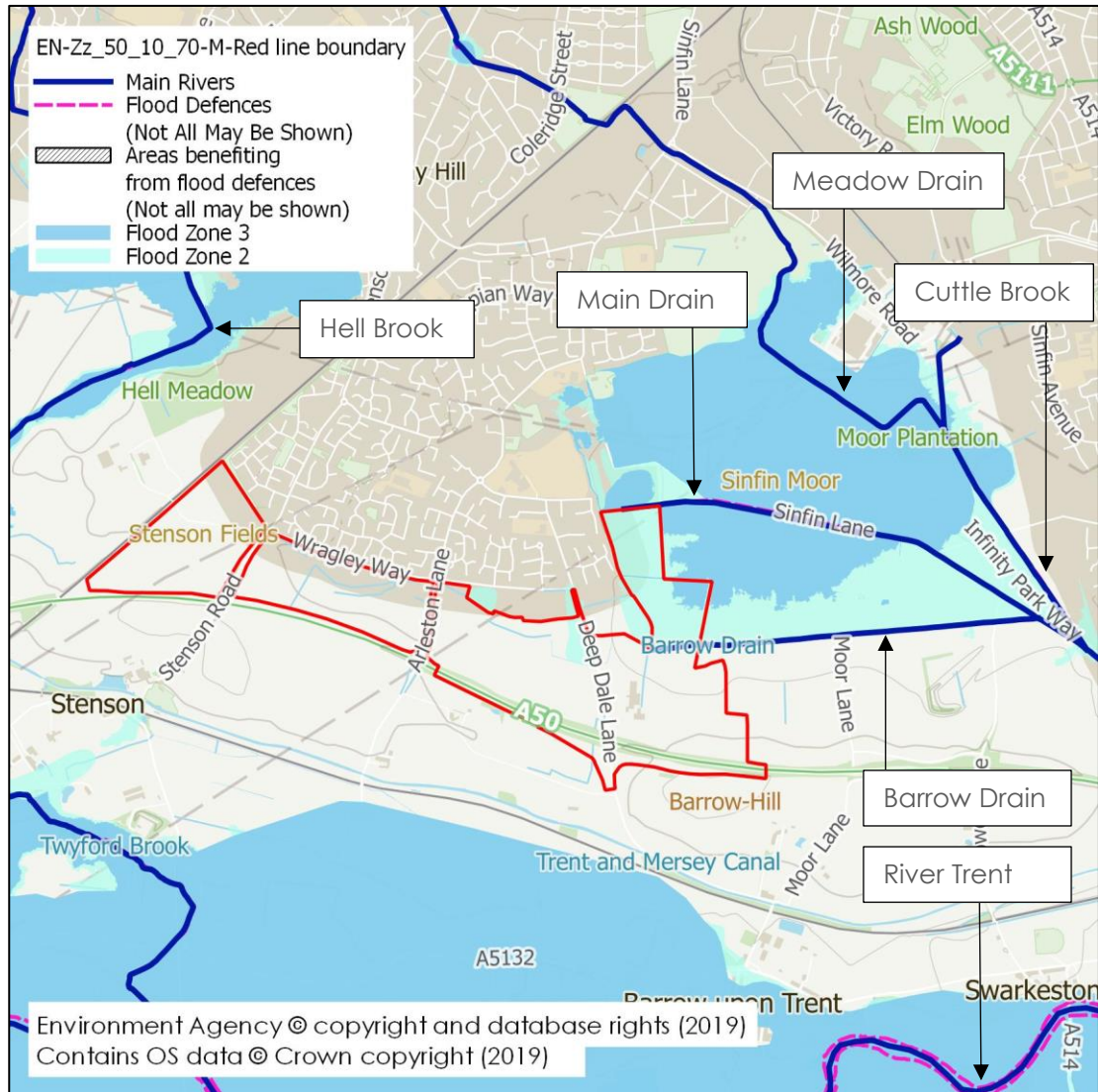


Figure 2.1: Flood Map for Planning

The Design Flood

- 2.12 The Planning Practice Guidance identifies that new developments should be designed to provide adequate flood risk management, mitigation, and resilience against the 'design flood' for their lifetime.
- 2.13 This is a flood event of a given annual flood probability, which is generally taken as fluvial (river) flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year), or tidal flooding with a 0.5% annual probability (1 in 200 chance each year), against which the suitability of a proposed development is assessed and mitigation measures, if any, are designed.

Climate Change

- 2.14 Predicted future change in peak river flows caused by climate change are provided by the Environment Agency⁴, with a range of projections applied to regionalised 'river basin districts'. The site falls within the Humber river basin district. **Table 2.1** identifies the relevant peak river flow allowances from this river basin district.

Table 2.1: Peak River Flow Allowance for the Humber River Basin District

Allowance Category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper End	20%	30%	50%
Higher Central	15%	20%	30%
Central	10%	15%	20%

- 2.15 When determining the appropriate allowance for use in a Flood Risk Assessment the Flood Zone classification, flood risk vulnerability and the anticipated lifespan of the development should be considered. **Table 2.2** provides a matrix summarising the Environment Agency's guidance on determining the appropriate allowances.

Table 2.2: Application of the Appropriate Climate Change Allowance

Flood Zone	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
1	Use the central allowance				Use none of the allowances
2	Use the higher central and upper end to assess a range of allowances	Use the higher central and upper end to assess a range of allowances	Use the central and higher central to assess a range of allowances	Use the central allowance	Use none of the allowances
3a	Use the upper end allowance	Development should not be permitted	Use the higher central and upper end to assess a range of allowances	Use the central and higher central to assess a range of allowances	Use the central allowance
3b	Use the upper end allowance	Development should not be permitted	Development should not be permitted	Development should not be permitted	Use the central allowance
*If development is considered appropriate when not in accordance with Flood Zone vulnerability categories, then it would be appropriate to use the upper end allowance.					

⁴ Environment Agency, Flood risk assessments: climate change allowances: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#table-1>

- 2.16 The site is located mostly in Flood Zone 1, however given its significant extent and strategic importance to redevelopment of the area, the Higher Central and Upper End allowances for the 2080s epoch will be considered in this case to add future resilience.
- 2.17 Therefore, to ensure the development is designed adequately for its lifetime an allowance of 30% and 50% will be applied to the design flood to be considered within the developments recommended flood management and resilience strategy.

Strategic Flood Risk Assessment

- 2.18 A Strategic Flood Risk Assessment (SFRA) is a study carried out by one or more local planning authorities to assess the risk to an area from flooding from all sources, now and in the future.

Derby City Council Level 1 (SFRA)

- 2.19 The Derby City Level 1 SFRA⁵ has been reviewed in the production of this FRA. The SFRA provides information specific to the site location in the form of fluvial, surface water and groundwater flood risk mapping, as well as records of historic flooding.
- 2.20 The SFRA indicates that there is also risk from waterlogging and sewer flooding within the area stating that the drainage system may not perform satisfactorily during periods of high rainfall when the main watercourses are already at capacity.
- 2.21 The area of Sinfin Moor near to the A50 is influenced by the water levels in the River Trent to the south of the City Boundary and during high water events on the River Trent water has been observed flowing upstream into the Sinfin Moor area. The SFRA highlights that any further development around this area needs to be considered very carefully and the overall strategy for managing flows in the Cuttle Brook System should be a requirement of the development proposals.

Preliminary Flood Risk Assessment

- 2.22 A Preliminary Flood Risk Assessment (PFRA) is an assessment of floods that have taken place in the past and floods that could take place in the future. It generally considers flooding from surface water runoff, groundwater and ordinary watercourses, and is prepared by the Lead Local Flood Authorities.
- 2.23 The Derby City Council PFRA⁶ considers flooding from surface water runoff, groundwater, ordinary watercourses and canals.
- 2.24 A summary of historic flooding is provided and this identifies past flooding within the Derby City area in particular within three areas - the Littleover Brook Catchment, the upper catchment of the Cuttle Brook and highway drainage within the Stenson Fields area. No specific reports of historic flooding are reported to have occurred at the site within the PFRA.

⁵Derby City Council Level 1 Strategic Flood Risk Assessment (DCC, July 2010)

⁶Derby City Council Preliminary Flood Risk Assessment (DCC, June 2011)

- 2.25 Since these recorded flood events, improvement works have been undertaken in partnership with Severn Trent to improve the highway drainage and sewer systems at the head of the Cuttle Brook to reduce flood risk in the Hollow area of Littleover. This was indicated to have been completed in 2006.

Local Flood Risk Management Strategy

- 2.26 A Local Flood Risk Management Strategy (LFRMS) is prepared by a Lead Local Flood Authority to help understand and manage flood risk at a local level.
- 2.27 The LFRMS aims to ensure that the knowledge of local flood risk issues is communicated effectively so that they can be better managed. The LFRMS also aims to promote sustainable development and environmental protection.
- 2.28 The Derbyshire County Council LFRMS⁷ & Derby City Council LFRMS⁸ have been reviewed and will be referenced within this report where applicable.

The River Trent Catchment Flood Management Plan

- 2.29 The River Trent Catchment Flood Management Plan (CFMP)⁹, is one of 77 CFMPs for England and Wales. The CFMP considers all types of inland flooding, from rivers, ground water, surface water and tidal flooding but not flooding directly from the sea (coastal flooding), which is covered by Shoreline Management Plans (SMPs). The role of the CFMP is to establish flood risk management policies which will deliver sustainable flood risk management for the long term.
- 2.30 The River Trent CFMP covers the entire River Trent catchment from its source above Stoke-on-Trent down to Keadby Bridge. It sets out the Environment Agency's preferred plan for sustainable flood risk management over the next 50 to 100 years.
- 2.31 The River Trent Catchment Flood Management Plan (CFMP) has been reviewed and will be referenced within this report where applicable.

Local Plan

Derby City Council Local Plan Core Strategy

- 2.32 Land South of Wragley Way is discussed within the Derby City local plan¹⁰ reference: AC18 - Wragley Way and will form part of the new sustainable urban extension to Derby, the majority of which will be within South Derbyshire. The whole strategy location south of the urban extent of the City will provide circa 2,000 new homes and supporting infrastructure when complete.

⁷ Derbyshire County Council Local Flood Risk Management Strategy (AECOM, June 2015)

⁸ Derby City Council Local Flood Risk Management Strategy (DCC, February)

⁹ The River Trent Catchment Flood Management Plan (Environment Agency, December 2010)

¹⁰ Derby City Council Local Plan (DCC, January 2017)

- 2.33 The plan states that the City Council will work with South Derbyshire District Council to ensure that the new neighbourhood is comprehensively masterplanned to deliver a sustainable addition to the city.
- 2.34 With reference to flood risk and drainage the Council will work with South Derbyshire District Council to ensure that appropriate flood mitigation and drainage measures are implemented.

South Derbyshire Local Plan

- 2.35 South Derbyshire Local Plan¹¹ refers to the delivery of the Infinity Garden scheme and development of circa 1,950 dwellings within South Derbyshire, to include the new highways infrastructure to mitigate the transport impact on the local and strategic networks around the site. Land at Wragley Way is referred to within The South Derbyshire Local Plan¹² under Policy H15. The plan indicates that the referenced cross boundary site will provide a sustainable urban extension to Derby City.
- 2.36 General flood risk guidance within the local plan states that development in areas identified as being at risk of flooding will be expected to:
- i. Be resilient to flooding through design and layout;
 - ii. Incorporate appropriate mitigation measures, such as on-site flood defence works and/or combination towards a commitment to undertake and/or maintain off-site measures;
 - iii. Not increase flood risk to other properties or surrounding areas; and
 - iv. Not affect the integrity or continuity of existing flood defences
- 2.37 Suitable measures to deal with surface water will be required on all sites to minimise the likelihood of new development increasing flood risk locally. Any developments that could lead to changes in surface water flows or increase flood risk should be managed through the incorporation of Sustainable Drainage Systems (SUDS), which mimic the natural drainage patterns, unless this is not technically feasible, or where it can be demonstrated that ground conditions are unsuitable for such measures.
- 2.38 The council require developments to contribute to the enhancement of watercourses in accordance with the objectives of the Water Framework Directive.

¹¹ The South Derbyshire Local Plan (SDDC, June 2017)

¹² South Derbyshire Adopted Local Plan , (SDDC, June 2016)

3. POTENTIAL SOURCES OF FLOOD RISK

- 3.1 Flooding can occur from a variety of sources, or combination of sources, which may be natural or artificial. **Table 3.1** below identifies the potential sources of flood risk to the site in its current condition, and the impacts which the development could have in the wider catchment, prior to mitigation. These are discussed in greater detail in the forthcoming section. The mitigation measures proposed to address flood risk issues and ensure the development is appropriate for its location are discussed within **Section 4.0**.

Table 3.1: Pre-Mitigation Sources of Flood Risk

Flood Source	Potential Risk				Description
	High	Medium	Low	None	
Fluvial		X			Site is predominantly in Flood Zone 1 so at low risk. Localised flooding close to watercourses and existing structures.
Coastal				X	No risk associated with this flood source.
Canals			X		The Trent and Mersey Canal lies approximately 215m south of the proposed A50 junction.
Groundwater			X		There are no recorded instances of flooding. Overall risk is low.
Reservoirs and waterbodies				X	The site is shown to fall outside of the area at risk of reservoir failure.
Pluvial runoff		X			Pluvial mapping indicates that the land to the northwest and northeast of the site has the potential to shed pluvial runoff towards the development.
Sewers			X		The sewer network around the site may have limited capacity, which could be exceeded in an extreme storm event.
Effect of Development on Wider Catchment	X				The Development may encroach towards limited floodplain extents.
		X			The development will increase the area of impermeable surfaces leading to a potential increase in runoff.

Fluvial Flood Risk

- 3.2 Flooding from watercourses occurs when flows exceed the capacity of the channel, or where a restrictive structure is encountered, which leads to water overtopping the banks

into the floodplain. This process can be exacerbated when debris is mobilised by high flows and accumulates at structures.

Ordinary Watercourses

- 3.3 An unnamed ordinary watercourse running from the northwest of the site, flows east through the entire site, crossing in culvert beneath Stenson Road, Arleston Lane and Deep Dale Lane and continuing to flow eastwards away from the site.
- 3.4 The watercourse has a number of small tributaries and their main function is primarily land drainage of the surrounding agricultural fields. Nevertheless these have been surveyed and included within a hydraulic model to quantify the potential risk presented. For reference, **Figure 3.1** shows the location of these ordinary watercourses.



Figure 3.1: Watercourse Locations

- 3.5 Other smaller ditches are known to traverse the site in various locations, including running on both sides of Arleston Lane and along field boundaries. However, on numerous site visits they were observed to run dry and so not specifically included in the hydraulic model. The model topography does pick up several depressions along the lines of the ditches to represent critical flow routes and floodplain connectivity.
- 3.6 A hydraulic model of the key watercourses, including the Main Drain, Barrow Drain, Meadow Drain and Cuttle Brook located downstream, has been previously prepared by BWB Consulting to assess the fluvial flood risk to the area. This takes the form of a dynamically linked 1D-2D Flood Modeller-ESTRY-TUFLOW model which is currently being reviewed by the Environment Agency as part of the adjacent A50 junction application. However, the baseline model, representing current conditions has been previously reviewed and considered fit for purpose.

- 3.7 The culvert beneath Deep Dale Lane is being upgraded as part of the application for 130 residential dwellings under application reference: 03/16/00338 and flood alleviation further downstream afforded as part of Outline application for the residential application, reference: 9/2017/0922. This upgrade is represented within the hydraulic model as part of the 'baseline' condition now it is in place.
- 3.8 The baseline floodplain extents are illustrated in **Figure 3.2** and peak flood levels summarised in **Table 3.2**.

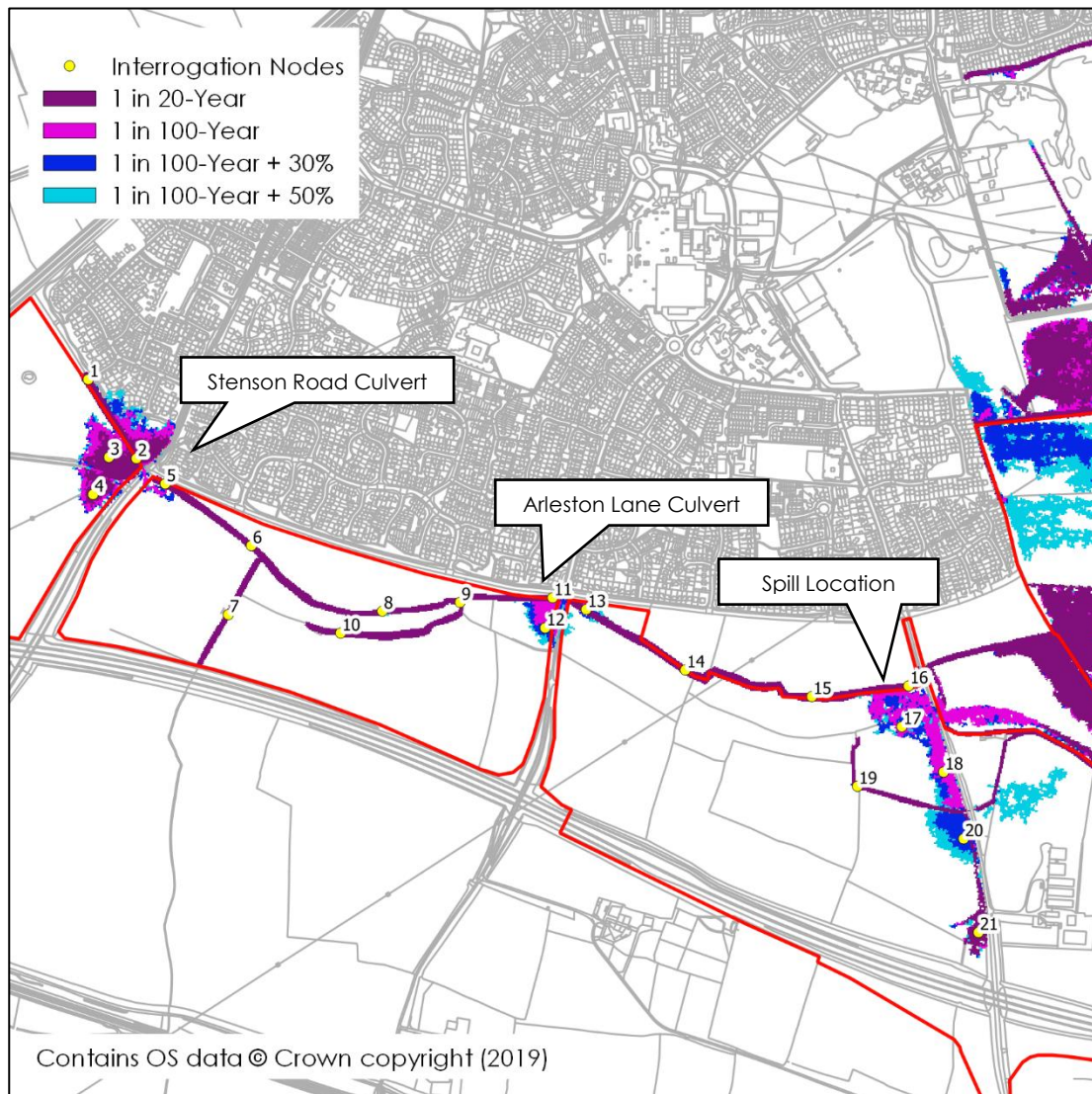


Figure 3.2: Baseline Floodplain Extents

Table 3.2: Peak Modelled Water Levels (mAOD)

Interrogation Node	1 in 20-year	1 in 100-year	1 in 100-year + 30%	1 in 100-year + 50%
1	49.53	49.72	49.80	49.85
2	49.51	49.70	49.75	49.79
3	49.51	49.70	49.75	49.77
4	49.50	49.70	49.75	49.77
5	48.25	48.28	48.40	48.46
6	47.63	47.65	47.77	47.81
7	47.73	47.74	47.79	47.81
8	45.86	45.89	46.03	46.08
9	44.68	44.70	44.81	44.87
10	46.18	46.18	46.18	46.18
11	44.10	44.33	44.46	44.51
12	-	-	44.46	44.52
13	43.88	44.07	44.18	44.25
14	42.68	42.83	42.90	42.96
15	40.85	40.99	41.06	41.12
16	40.09	40.26	40.29	40.30
17	-	40.11	40.12	40.13
18	-	39.71	39.73	39.73
19	-	-	39.54	39.66
20	39.73	39.79	39.83	39.86
21	40.51	40.52	40.53	40.53

- 3.9 Most of the site is shown to be removed from flood risk however the culverts located under Stenson Road and Arleston Lane are shown to be restrictive, resulting in water pooling behind these structures during a flood event. Water is also shown to spill from Watercourse 5, approximately 100m upstream from Deep Dale Lane, due to low bank elevations in this location.
- 3.10 To assess the impact of blockages on the culverts located under Stenson Road and Arleston Lane, 66% and 90% blockages were applied for the 1 in 100-year event.

- 3.11 A 66% blockage of the Stenson Road culvert is shown to increase water levels within the site by up to 34mm within the floodplain and up to 58mm within the channel, as shown in **Figure 3.3**. There is also a small increase in floodplain extent within the vicinity of the culvert.

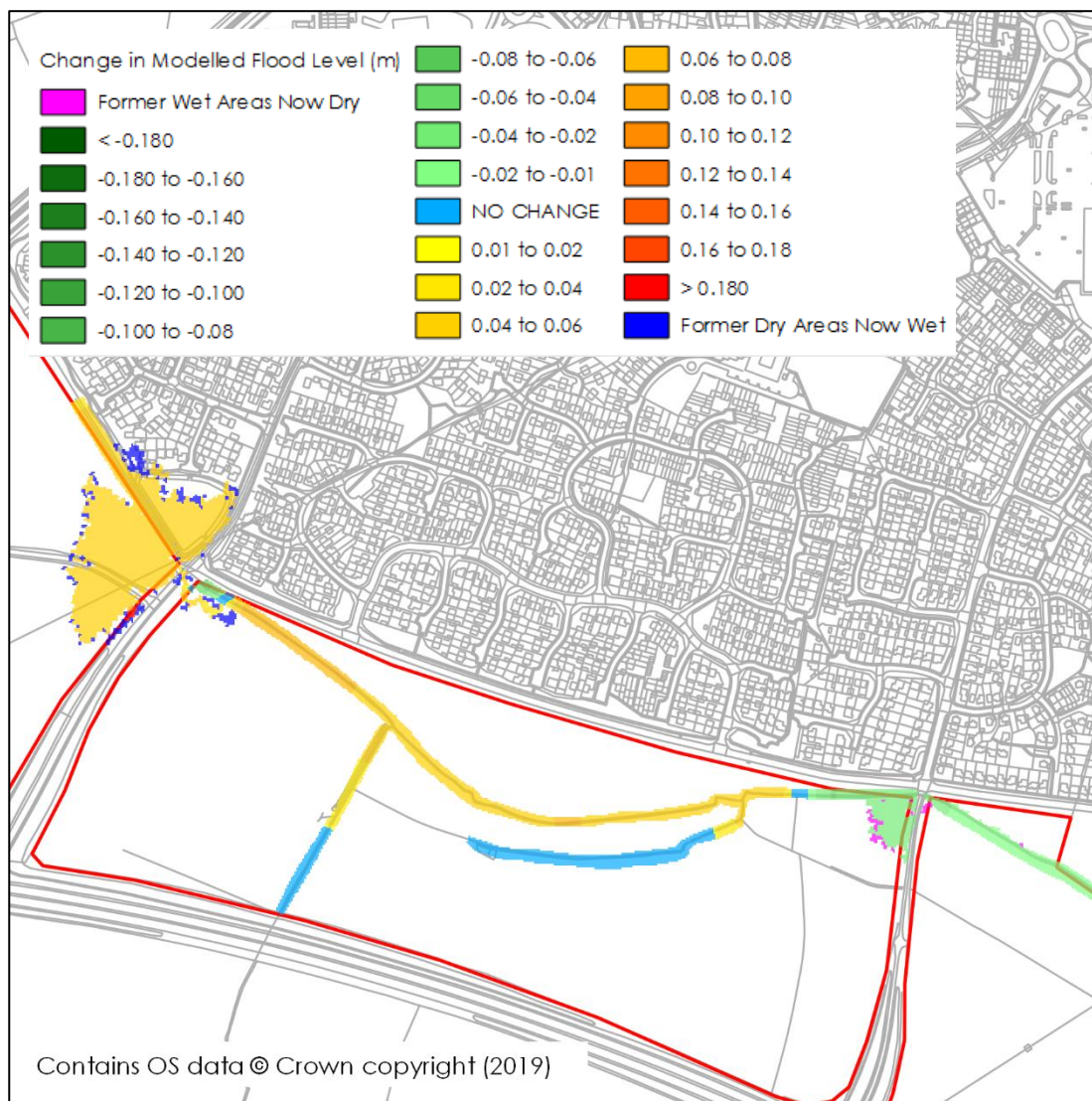


Figure 3.3: Comparison of Modelled Water Levels (m) for 66% Blockage of Stenson Road Culvert

- 3.12 A 90% blockage of the Stenson Road culvert is shown to increase water levels within the site by up to 43mm within the floodplain and up to 81mm within the channel, as shown in **Figure 3.4**. There is also a small increase in floodplain extent within the vicinity of the culvert.

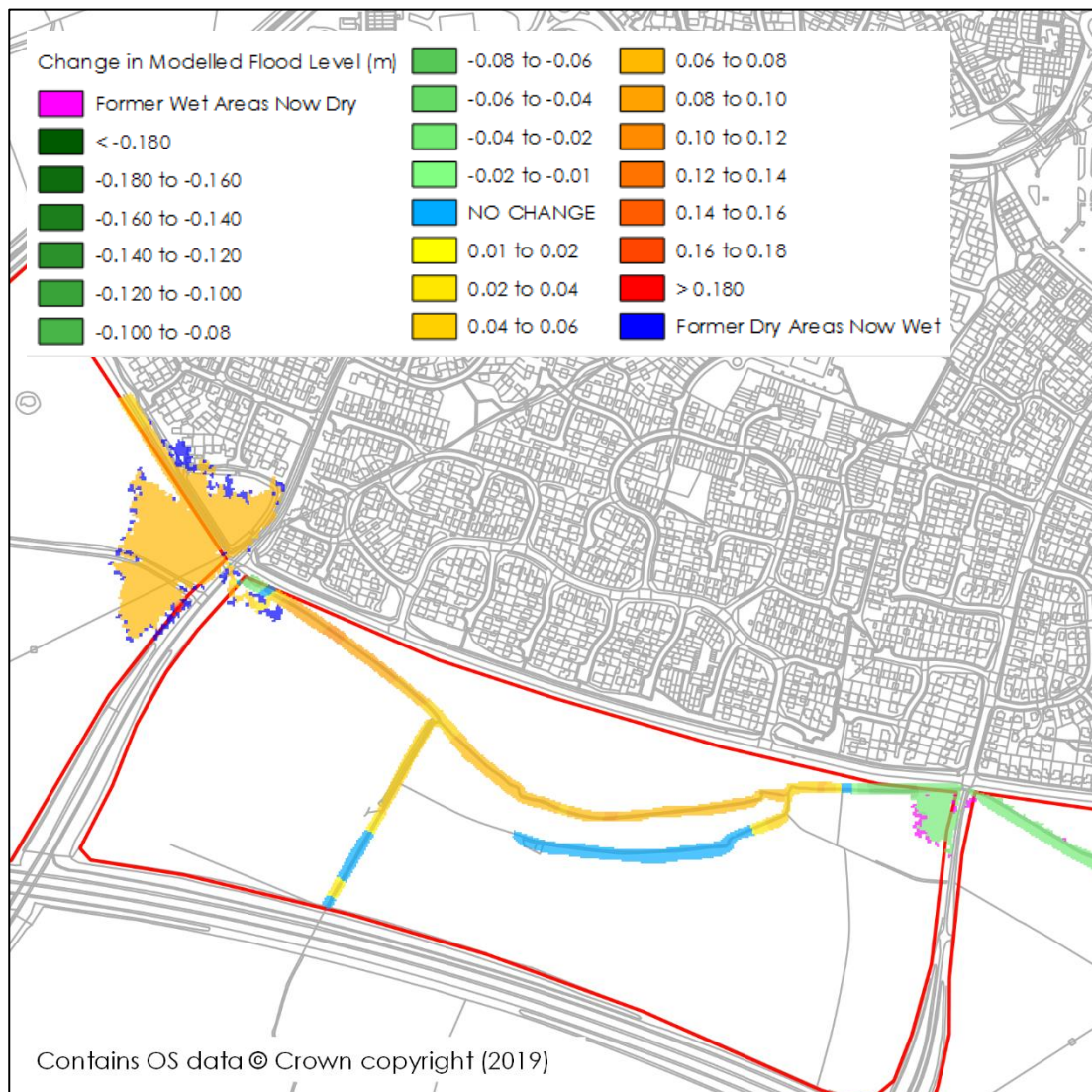


Figure 3.4: Comparison of Modelled Water Levels (m) for 90% Blockage of Stenson Road Culvert

- 3.13 A 66% blockage of the Arleston Lane culvert is shown to increase water levels within the site by up to 200mm within the floodplain and within the channel, as shown in **Figure 3.5**. There is also a moderate increase in floodplain extent within the vicinity of the culvert, which also leads to water spilling over Arleston Lane into land to the east.

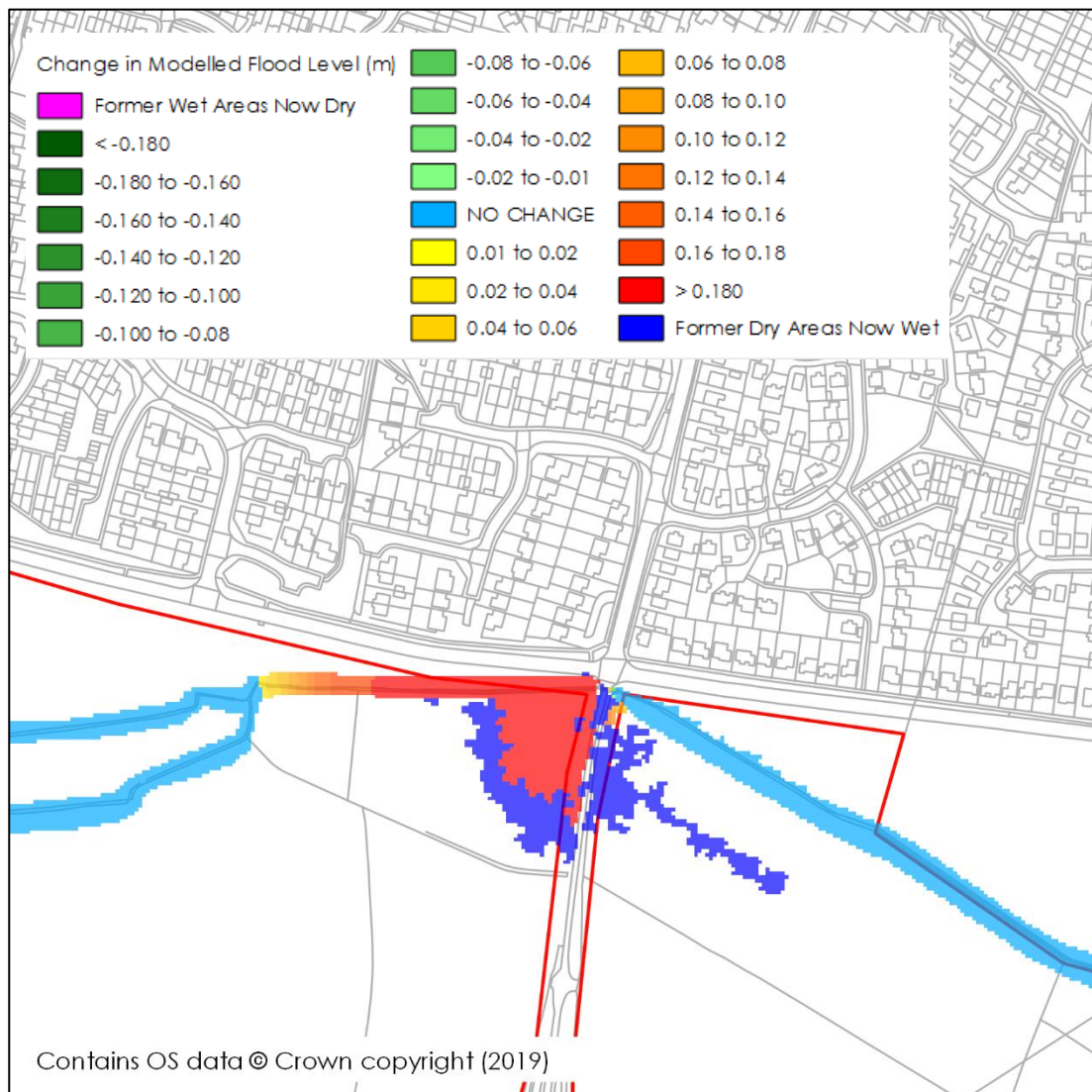


Figure 3.5: Comparison of Modelled Water Levels (m) for 66% Blockage of Arleston Lane Culvert

- 3.14 A 90% blockage of the Arleston Lane culvert is shown to increase water levels within the site by up to 224mm within the floodplain and within the channel, as shown in **Figure 3.6**. There is also a moderate increase in floodplain extent within the vicinity of the culvert, along with the creation of an additional flow route downstream that runs parallel to the main channel.

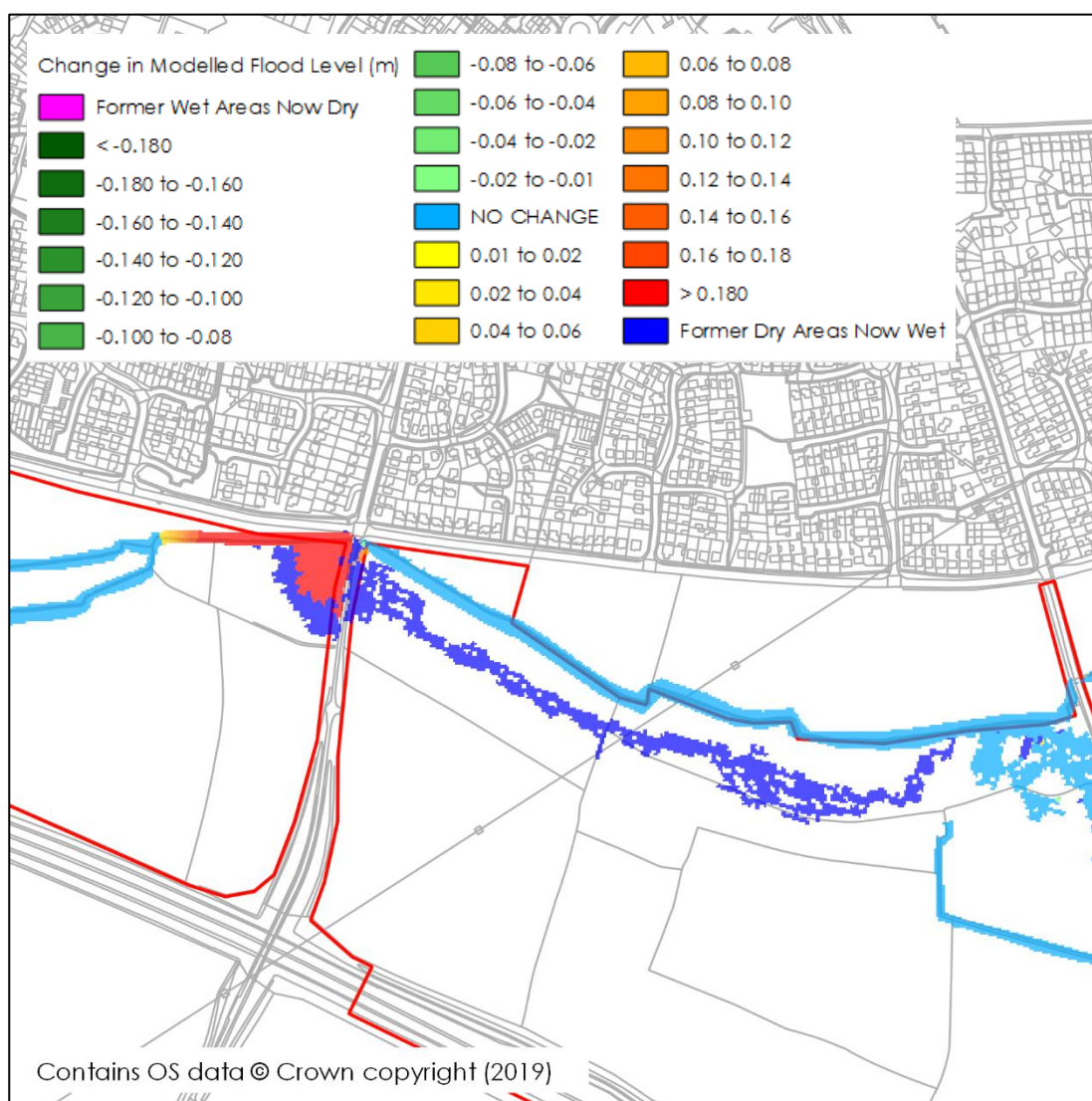


Figure 3.6: Comparison of Modelled Water Levels (m) for 90% Blockage of Arleston Lane Culvert

3.15 Modelled peak water levels for the blockage scenarios are summarised in **Table 3.3**.

Table 3.3: Peak Modelled Water Levels (mAOD)

Interrogation Node	Stenson Road 66% Blockage	Stenson Road 90% Blockage	Arleston Lane 66% Blockage	Arleston Lane 90% Blockage
1	49.74	49.75	49.71	49.72
2	49.74	49.75	49.70	49.70
3	49.73	49.74	49.70	49.70
4	49.73	49.74	49.70	49.70
5	48.27	48.28	48.28	48.28
6	47.69	47.70	47.65	47.65

Interrogation Node	Stenson Road 66% Blockage	Stenson Road 90% Blockage	Arleston Lane 66% Blockage	Arleston Lane 90% Blockage
7	47.75	47.75	47.74	47.74
8	45.93	45.94	45.89	45.89
9	44.73	44.75	44.70	44.70
10	46.18	46.18	46.18	46.18
11	44.30	44.29	44.53	44.55
12	-	-	44.53	44.55
13	44.05	44.04	44.07	44.07
14	42.82	42.81	42.83	42.84
15	40.97	40.97	40.99	40.99
16	40.26	40.26	40.26	40.27
17	-	-	40.10	40.11
18	39.70	39.70	39.71	39.71
19	-	-	-	-
20	39.79	39.79	39.79	39.79
21	40.52	40.52	40.52	40.52

- 3.16 Overall, the risk to much of the site area remains low. There are some localised flood risk issues around the watercourse corridor and near the Arleston Lane and Stenson Road culverts. Measures to mitigate the fluvial risk are discussed in **Section 4.0**.

Main Rivers

- 3.17 The site is located within the vicinity of two Environment Agency Main Rivers: the Main Drain and the Barrow Drain which flow into the Cuttle Brook. The Cuttle Brook then flows in a south-easterly direction to cross the Trent and Mersey Canal approximately 1.3km downstream then to the confluence with the River Trent an additional 1.2km further downstream.
- 3.18 As the site is located upstream of these watercourses, they are therefore considered to pose a low risk to the site.
- 3.19 A sensitivity test has been carried out utilising the 100 year plus climate change flood level on the River Trent as a downstream boundary. The results indicate that peak flood levels and flood extents within the site remain unchanged when the system downstream is affected by the Trent.

Historic Flooding

- 3.20 Derby City Council provided evidence of potential flooding which occurred circa March 2018 along the ditches adjacent to Deep Dale Lane caused by a localised rainfall event. One example shown in **Figure 3.7** shows the ditch running downstream from Deep Dale Lane (eastwards) at near channel full capacity.



Figure 3.7: Fluvial Flooding Ditch Downstream of Deep Dale Lane - Circa March 2018

- 3.21 There are various mitigation proposals related to adjacent applications that seek to provide solutions to manage flood risk. As part of planning application reference: 03/16/00338 for the 130-dwelling scheme known as Land south of Wragley Way, Derby, some ditch widening, and realignment is proposed upstream of Deep Dale Lane.
- 3.22 Further mitigation is also specified by way of provision of a flood alleviation area as part of the proposals for residential development of up to 100 dwellings including infrastructure and associated works with planning reference: 9/2017/0922, Land at Deep Dale Lane.
- 3.23 The application for the A50 junction and link road also includes a strategic flood alleviation scheme to the east of Deep Dale Lane that provides a holistic solution to flood risk in the wider area, although provides limited benefits to the site at Wragley Way as it is located downstream of the key constrictions of Stenson Road and Arleston Lane.
- 3.24 A network of blue-green infrastructure following the route of the primary watercourses within the site is proposed that will seek to manage residual flood risk within the development site, complemented by measures discussed within **Section 4**.

Flood Risk from Canals

- 3.25 The Canal and River Trust (CRT) generally maintains canal levels using reservoirs, feeders and boreholes and manages water levels by transferring it within the canal system.
- 3.26 Water in a canal is typically maintained at predetermined levels by control weirs. When rainfall or other water enters the canal, the water level rises and flows out over the weir. If the level continues rising it will reach the level of the storm weirs. The control weirs and storm weirs are normally designed to take the water that legally enters the canal under normal conditions. However, it is possible for unexpected water to enter the canal or for the weirs to become obstructed. In such instances the increased water levels could result in water overtopping the towpath and flowing onto the surrounding land.
- 3.27 Flooding can also occur where a canal is impounded above surrounding ground levels and the retaining structure fails.
- 3.28 The nearest canal to the site is the Trent and Mersey Canal lies approximately 500m south of the site. The site is elevated significantly above the canal by circa 5m.
- 3.29 Flood risk posed from this flood source can therefore be considered to be low.

Groundwater Flood Risk

- 3.30 Groundwater flooding occurs when the water table rises above ground elevations. It is most likely to happen in low lying areas underlain by permeable geology. This may be regional scale chalk or sandstone aquifers, or localised deposits of sands and gravels underlain by less permeable strata such as that in a river valley.
- 3.31 British Geological Survey (BGS) 1:50,000 scale geological mapping, shown in **Figure 3.8**, indicates that majority of the site is underlain by Gunthorpe Member Mudstone. With the easternmost extent underlain by Branscombe Mudstone Formation - Mudstone and the southeast of the site underlain by a combination of Cotgrave Sandstone Member and Edwalton Member Mudstone.

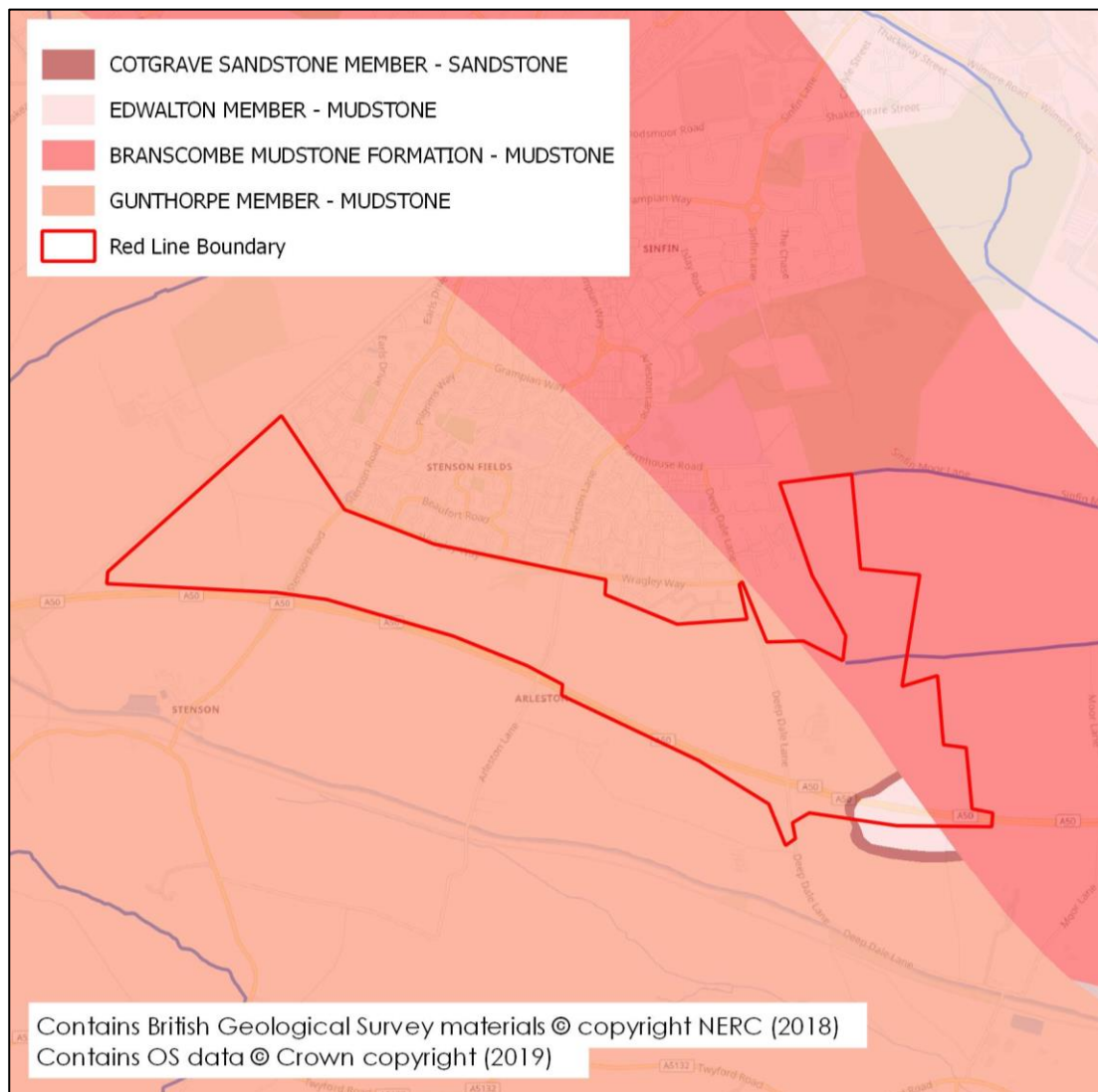


Figure 3.8: BGS Bedrock Geology

- 3.32 BWB Consulting Ltd have undertaken ground investigation on the land adjacent to Deep Dale Lane as part of Phase II Geo Environmental Assessment report. Ground investigation was undertaken for Land West of Deep Dale Lane, report reference: NTH2136/02/V1/WEST, February 2014 and for Land East of Deep Dale Lane, report reference: NTH2136E/02/V1/EAST, February 2014.
- 3.33 These reports indicate that groundwater was indicated to be between depths of approximately 1.7m bgl and 3.0m bgl with a relatively high groundwater table. It is understood that the superficial lacustrine deposits beneath the site are relatively poorly draining and therefore hold a volume of water within them. Groundwater levels can fluctuate dependant on weather conditions as the water does not percolate away quickly enough. Over time, elevated water table levels are reduced through conveyance of water away via the network of surface drains and ditches.
- 3.34 It is therefore considered that there is a potential risk posed from groundwater to the site. Suitable mitigation will address any limited risk that may be present from this source.

Flood Risk from Reservoirs & Large Waterbodies

- 3.35 Flooding can occur from large waterbodies or reservoirs if they are impounded above the surrounding ground levels or are used to retain water in times of flood. Although unlikely, reservoirs and large waterbodies could overtop or breach leading to rapid inundation of the downstream floodplain.
- 3.36 To help identify this risk, reservoir failure flood risk mapping has been prepared, this shows the largest area that might be flooded if a reservoir were to fail and release the water it holds. The map displays a worst-case scenario and is only intended as a guide. An extract from the mapping is included for reference as **Figure 3.9**.



Figure 3.9: Reservoir Failure Flood Risk Map

- 3.37 The nearest reservoir breach flood outline lies approximately 490m south of the site. This is associated with a breaching of the Foremark Reservoir. Further reservoir breach flood outlines to the south are attributed to a breaching of Carsington and Blithfield Reservoirs.
- 3.38 Overall risk posed from this flood source is low.

Pluvial Flood Risk

- 3.39 Pluvial flooding can occur during prolonged or intense storm events when the infiltration potential of soils, or the capacity of drainage infrastructure is overwhelmed leading to the accumulation of surface water and the generation of overland flow routes.
- 3.40 Risk of flooding from surface water mapping has been prepared, this shows the potential flooding which could occur when rainwater does not drain away through the normal drainage systems or soak into the ground but lies on or flows over the ground instead. An extract from the mapping is included as **Figure 3.10**.

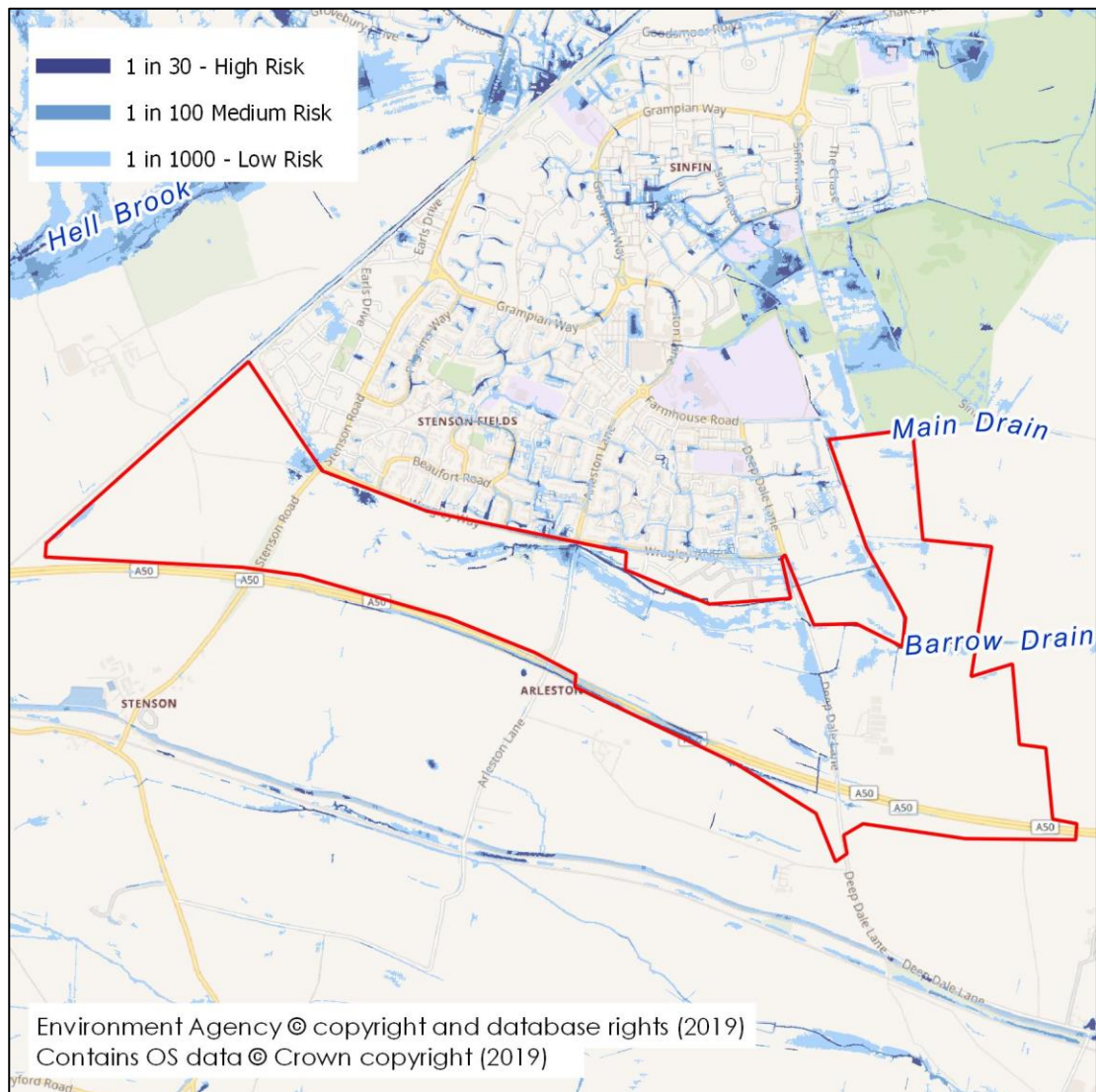


Figure 3.10: Risk of Flooding from Surface Water Mapping

- 3.41 Environment Agency mapping indicates that majority of the site is at very low risk from pluvial flooding. Some areas are shown to be at 'Low Risk', occurring within a 1 in 1000yr event with depths of between 150mm and 600mm limited to localised topographical depressions. This aligns with the secondary flow route that engages during the Arleston Lane blockage scenario.

- 3.42 The pluvial flow routes indicated to occur within the 1 in 30yr 'High Risk' event are constrained to the route of the existing watercourses and minor topographical depressions.
- 3.43 Depths in majority are indicated to be circa 0 - 0.3m, with majority of pluvial flooding occurring within the field adjacent to Deep Dale Lane and the surrounding watercourses at depths of between 0 - 0.6m. This is commensurate with the anecdotal evidence of flooding provided by Derby City Council and with other observations during site visits after prolonged or intense rainfall.
- 3.44 The hydrological assessment of the Cuttle Brook and Barrow Drain catchments which have informed the hydraulic modelling within the immediate and wider site area undertaken include for contributing runoff from Sinfin Moor and Stenson Fields area. Any surface water catchments that are limited to the site extents will be incorporated into the proposed surface water drainage strategy, thereby capturing and managing surface water runoff generated by the site itself.
- 3.45 Therefore, this potential source of flooding is included as part of the assessment of fluvial flood risk and will be mitigated in the same manner. This is discussed further within **Section 4.0**.

Flood Risk from Sewers

- 3.46 Sewer flooding can occur when the capacity of the infrastructure is exceeded by excessive flows, or as a result of a reduction in capacity due to collapse or blockage, or if the downstream system becomes surcharged. This can lead to the sewers flooding onto the surrounding ground via manholes and gullies, which can generate overland flows.
- 3.47 Land to the north comprising of Sinfin/Stenson Fields urban area is understood to be served by an existing surface water drainage network. Severn Trent Sewer records are included for reference as **Appendix 3**.
- 3.48 These indicate the presence of both surface and foul water sewers within Wragley Way of varying sizes. Two surface water sewers have outfalls into the unnamed watercourses adjacent to the site boundary at the upstream face of the Arleston Lane culvert.
- 3.49 There is a potential for these sewers to surcharge when the watercourse is in spate, or as a result of a blockage to the system. As the area to the north is generally at a higher elevation to the site, overland flows associated with sewer flooding may be conveyed towards the site.
- 3.50 However, the rate and volume of overland flows is likely to be minimal given the shallow gradient towards the site. Simple mitigation measures can be put in place to ensure any potential risk from this source is adequately addressed.
- 3.51 There are known combined sewer overflows (CSO) outfalling directly to the fluvial system which could potentially pose a flood risk to the site. Consultation with Severn Trent Water

during the hydraulic modelling exercise has identified the outfall locations of the CSO's - these are illustrated within **Figure 3.11**.

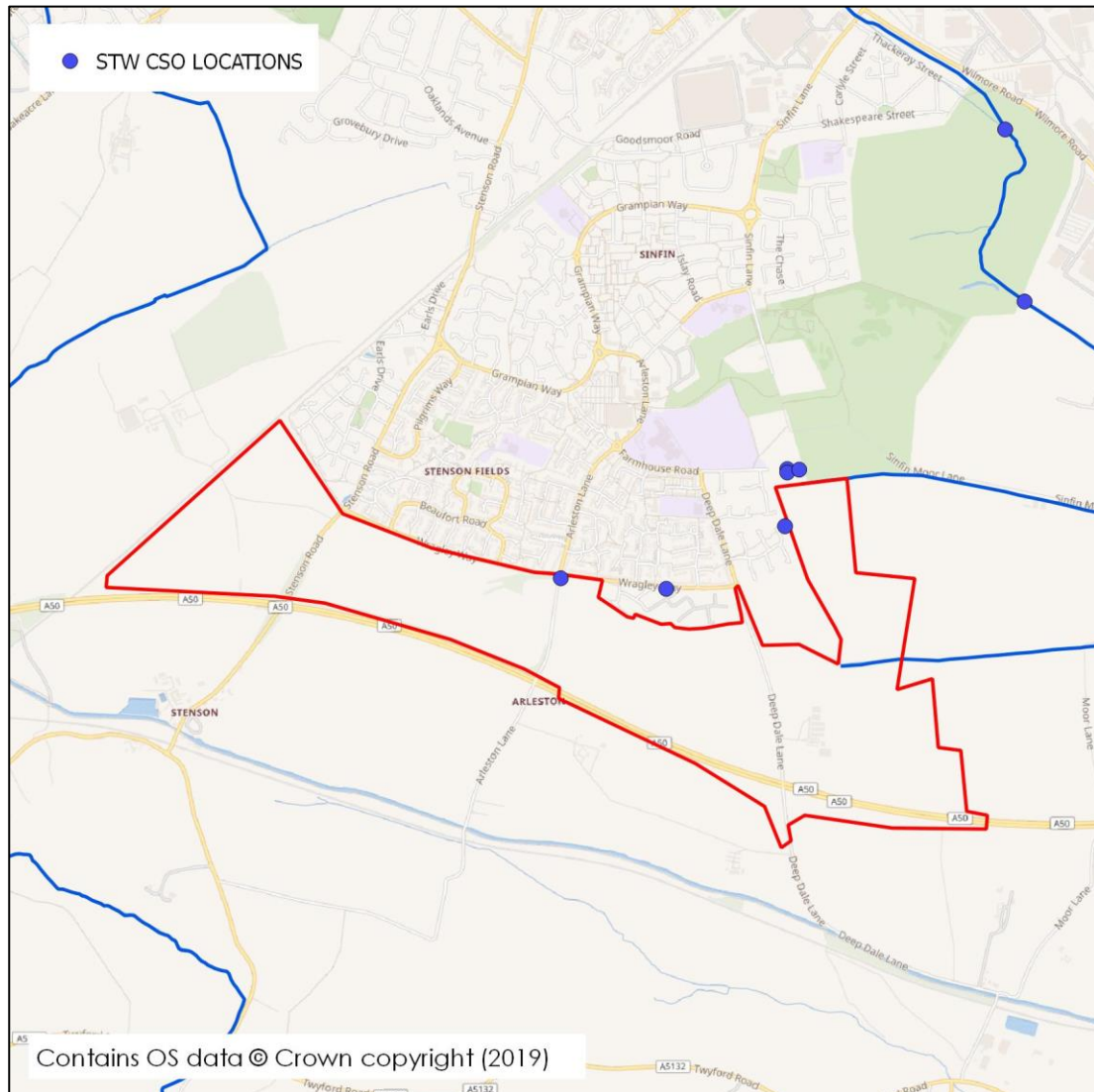


Figure 3.11: Sewer Inflow Locations

- 3.52 The contributing flows from the CSO's were included within the hydraulic model of the Cuttle Brook as part of a combined hydraulic model. Therefore the assessment of this potential source of flooding has been incorporated as part of the assessment of fluvial flood risk and will be mitigated in the same manner. Please see **Section 4.0** for further details.

Effect of Development on Wider Catchment

Displacement of Floodplain

- 3.53 The development proposals will not result in displacement of fluvial floodplain.

Development Land Use/Drainage Considerations

- 3.54 Development proposals will result in an increase in impermeable area and subsequently an increase in associated runoff.
- 3.55 Further information on the drainage approach is provided within the accompanying Sustainable Drainage Statement, reference WRA-BWB-ZZ-XX-RP-CD-0001_SDS.
- 3.56 The drainage strategy is based on sustainable drainage principles to manage surface water runoff from the development in such a way to ensure that flood risk is not increased elsewhere. Therefore, it can be considered that there will be no detriment in terms of surface water flood risk on the wider catchment posed from the site.

4. FLOOD RISK MITIGATION

- 4.1 **Section 3.0** has identified the sources of flooding which could potentially pose a risk to the site and the proposed development. This section of the FRA sets out the mitigation measures which are to be incorporated within the proposed development to address and reduce the risk of flooding to within acceptable levels.

Layout Considerations

- 4.2 A large proportion of the area proposed for residential development is in areas outside of the extent of the 100-year (plus climate change) flood outline, and areas shown on the Environment Agency Flood Map for Planning as within Flood Zone 1.
- 4.3 Where possible, areas shown to be at risk during the 1 in 100 year (plus climate change event) should be avoided. In the event that this cannot be achieved, they should be given over to less vulnerable uses such as open space, recreational uses or similar. This would follow a sequential approach to the layout consistent with planning policy.
- 4.4 The layout must also consider appropriate standoffs from the main watercourses to comply with local byelaws. Typically, a standoff of 8m should be allowed from the top of bank in which no built development should take place.
- 4.5 Derbyshire County Council (as Lead Local Flood Authority for the application site) specify that the 8m standoff zone for development to an ordinary watercourse is potentially difficult to deal with on a practical level and recommended an easement of 3 metres for watercourses less than 2 metres wide and a 4.5m easement (i.e. vehicle width) for becks/streams over 2m width.
- 4.6 This will be adopted where practicable alongside the philosophy of retaining the ditches or converting them to swales wherever possible. As part of the illustrative masterplan, the watercourses typically flow through open areas and/or landscaping with development parcels allowing a suitable corridor.
- 4.7 Detailed design proposals should maintain this philosophy, but there may be scope to reduce this standoff in key locations, or whether other constraints may dictate building closer to the watercourse. Any deviations should be agreed with the Lead Local Flood Authority at the earliest opportunity.
- 4.8 The development layout may also necessitate new crossings to be placed over the watercourse for vehicular and/or pedestrian access. It is recommended that these are designed as clear spanning structures where possible, with a suitable soffit level above the appropriate flood level to prevent surcharging and reduce potential blockages.

Development Levels

- 4.9 For development parcels in close proximity to the watercourses, road crossings or within the areas shown to be at risk of flooding, it is recommended that finished floor levels are elevated 600mm above the nearest relevant 100-year plus 30% climate change flood level.

- 4.10 Peak flood levels are detailed within **Section 3.0**. This shows that the recommended 600mm freeboard is sufficient to offer resilience against the 1 in 100-year + 50% events, and also against the increased flood levels resulting from potential blockages of the Stenson Road and Arleston Lane culverts.
- 4.11 For any areas beyond the watercourse corridor, it is also recommended that finished floor levels are set a minimum of 150mm above adjacent ground levels, and that ground levels are profiled to encourage pluvial runoff and overland flows away from the built development and towards the nearest drainage point.

Blue-Green Infrastructure

- 4.12 Although the culverts located under Stenson Road and Arleston Lane are shown to be restrictive, modelled scenarios in which these culverts are upsized to increase capacity has shown to result in detriment to third party land.
- 4.13 Nevertheless, upgrading the crossing under Stenson Road may be required due to the potential highway changes required to serve the development. Therefore, options may need to be considered at detailed design to upgrade this culvert and manage any offset in flood risk associated with the works.
- 4.14 Preliminary tests indicate it may be possible, however, to rearrange the floodplain within the development to reduce water levels without impacting water levels downstream. **Figure 4.1** illustrates where flood corridors of 0.5m depth were applied to allow for additional channel capacity in a flood event.

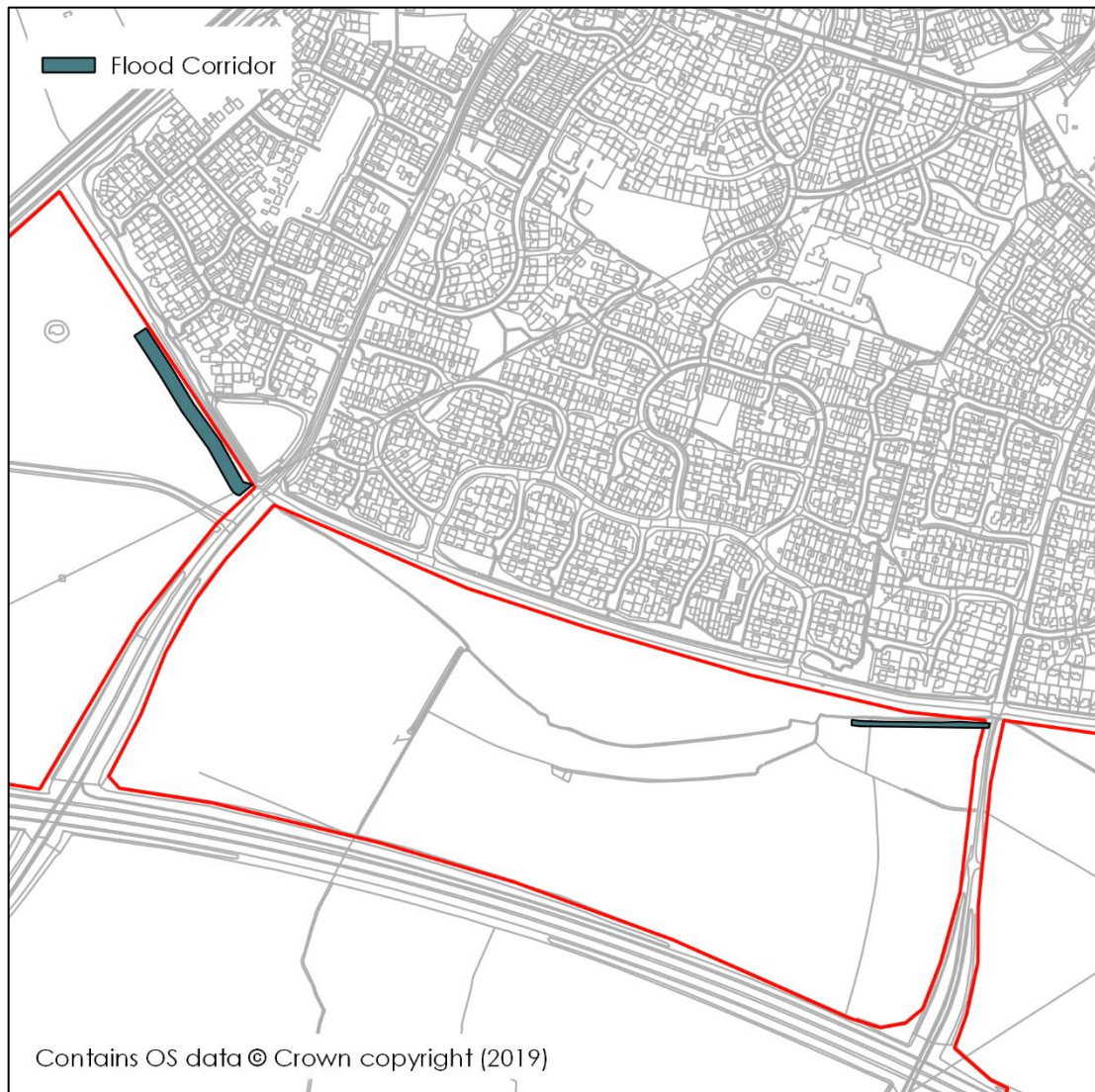


Figure 4.1: Flood Corridor Locations

- 4.15 This option complements the proposals for blue-green infrastructure along the length of the watercourse through the site. Providing a two-stage channel would provide biodiversity improvements, increased habitat variation and better floodplain or marginal wetted areas directly connected to the watercourse.
- 4.16 As shown in **Figure 4.2**, these flood corridors resulted in decreased flood levels and extents within the site without impacts on third party land for the baseline scenario.

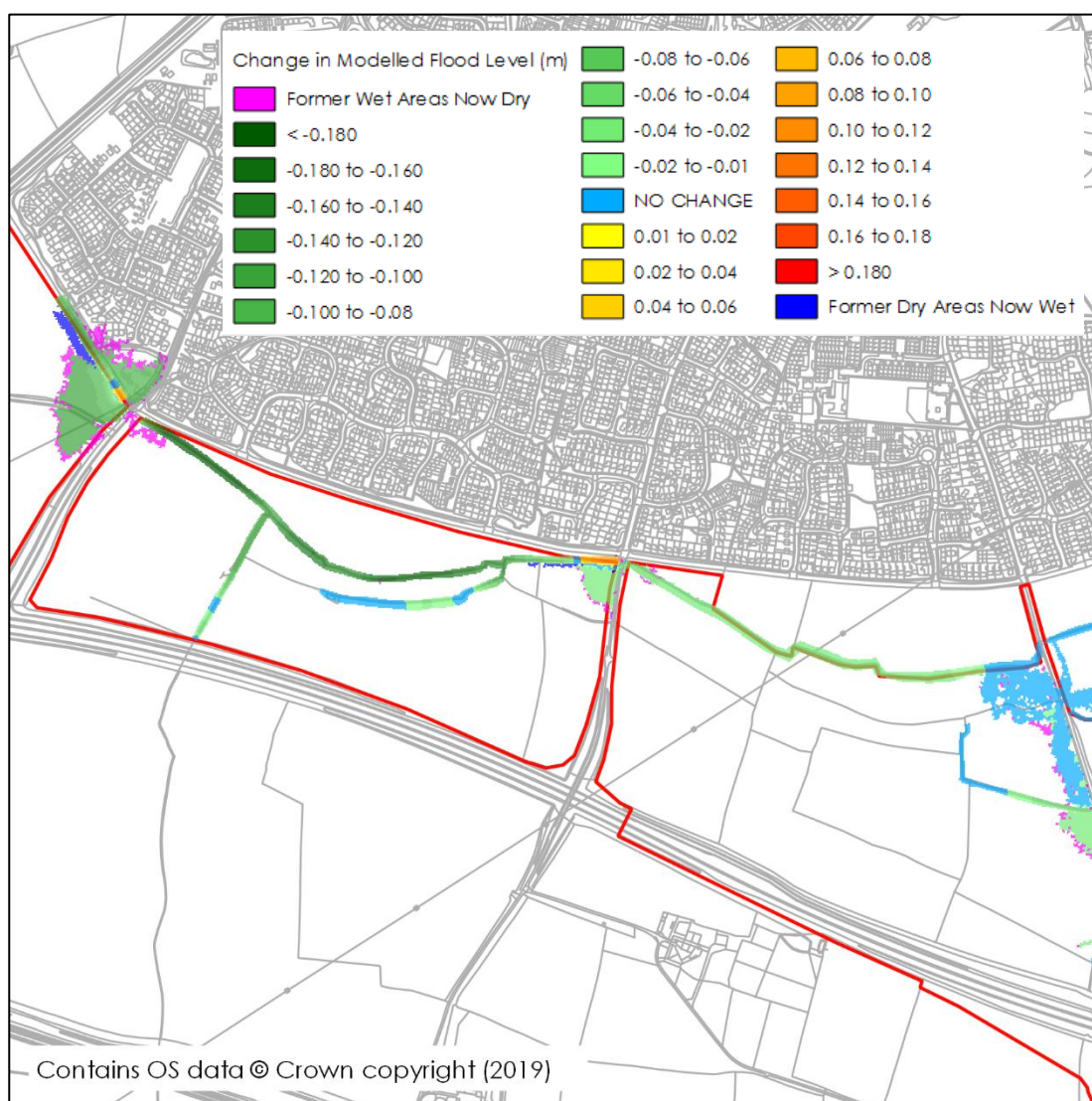


Figure 4.2: Change in Peak Modelled Water Level (m)

- 4.17 It should be noted that in areas where the flood corridors are present the modelled water levels are shown to decrease, however this is due to ground levels in these areas having decreased.
- 4.18 There is potential for these corridors to be extended further, increasing the wide ranging benefits offered by such a solution. However, given the outline nature of the associated planning application the principle of the areas reducing flood risk associated with a blockage have been proven, and would be subject to detailed design as various phases are brought forward for development.

Gas Main Easement

- 4.19 Although not directly relevant to flood risk and associated mitigation, the gas main running through the site may provide an additional constraint to flood risk mitigation proposals where smaller drains or ditches cross the gas main. Further details are provided in the associated Foul Water & Utilities Statement submitted as part of the planning application.

Surface Water Drainage

- 4.20 To mitigate the development's impact on the current runoff regime it is proposed to incorporate surface water attenuation and storage as part of the development proposals.
- 4.21 Further information on the drainage approach is provided within the accompanying Sustainable Drainage Statement, reference WRA-BWB-ZZ-XX-RP-CD-0001_SDS.
- 4.22 In brief, the development will continue to discharge surface water to the local watercourse at the equivalent greenfield QBAR rate. Attenuated surface water storage will be provided in the form of above ground SuDS with capacity for the 1 in 100-year storm with an allowance for climate change.
- 4.23 The development should be designed with exceedance in mind, road network used to convey excess overland flows towards the attenuation points. Overflow should be provided from the SuDs features to the watercourse should the design standard of the drainage be exceeded.

Foul Water Drainage

- 4.24 Severn Trent Water has been consulted with regard to connections to the public foul sewer system.
- 4.25 At present, due to "the size of the development and the complexity of the receiving sewerage system sewer modelling" is required by Severn Trent Water to understand the impact of the development and what works will be required to accommodate it. For further information in regards the foul drainage for the proposed site, please refer to BWB Consulting Utilities Report reference: WRA-BWB-VUT-ZZ-RP-G-0001_FWU.
- 4.26 Nevertheless, there are a number of public foul sewers located in close proximity to the northern site boundary. As such, a connection to the network is considered feasible, although additional measures such as on-site pumping contributions to network pumping station upgrades may be required.
- 4.27 It is recommended that Severn Trent Water are commissioned at the appropriate juncture to undertake the necessary sewer modelling to confirm what works will be needed to support the proposed development.
- 4.28 Regardless of this it is considered that a solution on the site would be feasible and therefore would not prevent development occurring. An appropriate solution will ensure that flood risk to the wider catchment is not exacerbated as a result of the proposed development.
- 4.29 Further information on the drainage approach is provided within the accompanying Sustainable Drainage Statement, reference WRA-BWB-ZZ-XX-RP-CD-0001_SDS.

5. CONCLUSIONS AND RECOMMENDATIONS

- 5.1 This Flood Risk Assessment (FRA) has been prepared in accordance with requirements set out in the National Planning Policy Framework (NPPF) and the associated Planning Practice Guidance. The FRA has been produced on behalf of Hallam Land Management Ltd in respect of a planning application for the proposed residential development.
- 5.2 This FRA is intended to support an outline planning application and as such the level of detail included is commensurate and subject to the nature of the proposals.
- 5.3 This report demonstrates that the proposed development is at an acceptable level of flood risk, subject to the recommended flood mitigation strategies being implemented. The identified risks and mitigation measures are summarised within **Table 5.1**:

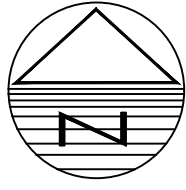
Table 5.1: Summary of Flood Risk Assessment

Flood Source	Risk & Proposed Mitigation Measures
Fluvial/Pluvial /Sewer	There are numerous ordinary watercourses located within the vicinity of the site. The hydraulic modelling exercise shows that majority of the site is shown to be removed from flood risk however the culverts located under Stenson Road and Arleston Lane are shown to be restrictive, resulting in water pooling behind these structures during a flood event. Blockage scenarios on these culverts show the culverts are sensitive to blockage. It is recommended that finished floor levels should be set a minimum of 600mm above the adjacent 1 in 100-year + 30% flood level. This freeboard is sufficient to offer resilience against the 1 in 100-year + 50% events, and also against the increased flood levels resulting from potential blockages of the Stenson Road and Arleston Lane culverts. Further mitigation includes lowering levels adjacent to the channel to complement the blue-green infrastructure proposals throughout the site. These help to mitigate flood risk whilst also providing ecological improvements. The modelling has proven a principle, which can then be adopted and expanded at detailed design stage. Appropriate standoffs from the top of bank of the watercourses are recommended in line with Derbyshire County Council guidance. Finished floor levels should be set a minimum of 150mm above adjacent ground levels, and that ground levels are profiled to encourage pluvial runoff and overland flows away from the built development and towards the nearest drainage point.
Impact of the Development	Surface water runoff from the development will be controlled appropriately. A strategy has been prepared separately under BWB reference: WRA-BWB-ZZ-XX-RP-CD-0001_SDS.
This summary should be read in conjunction with BWB's full report. It reflects an assessment of the Site based on information received by BWB at the time of production.	

- 5.4 In compliance with the requirements of National Planning Policy Framework, and subject to the mitigation measures proposed, the development could proceed without being subject to significant flood risk. Moreover, the development will not increase flood risk to the wider catchment area as a result of suitable management of surface water runoff discharging from the site.

APPENDICES

APPENDIX 1: Topographical Survey



- NOTES
- DO NOT SCALE THIS DRAWING. ALL DIMENSIONS MUST BE CHECKED/ VERIFIED ON SITE. IF IN DOUBT ASK.
 - THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.
 - ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE. ALL LEVELS IN METRES UNLESS NOTED OTHERWISE.
 - ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.
 - ALL HEIGHT INFORMATION HAS BEEN TAKEN FROM LIDAR DATA AND BACKGROUND MAPPING FROM OSMM DATA. NO FIELDWORK HAS BEEN CARRIED OUT, DRAWING HAS BEEN COMPILED FROM OFFICE BASED WORK.

STATION COORDINATES			
STN NAME	EASTINGS (m)	NORTHINGS (m)	HEIGHT (m)
TC1	383428.382	408989.467	104.487
TC2	383393.143	409009.608	104.904
TC3	383381.262	409024.458	105.951
TC4	383300.171	409087.668	113.189

LEGEND

	OS Buildings		Electric		Electric
	Surveyed Buildings		BT		British Telecom
	Buildings / walls		Fh		Fire Hydrant
	Kerb line		St		Stop tap
	Edge of surface		Sv		Stop valve
	Canopy / Overhang		Wo		Wash Out
	Line Marking		Wm		Wash Master
	Centre Line		Mar		Service Marker
	Barrier		Re		Rodding eye
	Security Fence		Av		Air Valve
	Panel Fence		Crmp		Cable Marker
	Open Fence		Lp		Lamp Post
	Hedge		Sp		Sign Post
	Chamber		Ep		Electricity Post
	Overhead Powerline		Tp		Telegraph Post
	Woodland		TL		Traffic light
	Station and Name		Bs		Bus Stop
	Station Level		F1		Floodlight
	Benchmark		Fp		Flagpole
	Borehole		Pb		Post box
	Trial Hole		Lb		Liter Bin
	Tree / Bush / Sapling		Bo		Boiler
	Area of Undergrowth		TCB		Telephone call box
	Gate		Fs		Flagstaff
	IC		WL		Water level
	CL		Ht		Height
	IL		IFL		Internal floor level
	P_invert		THL		Threshold level
	Gy		Re		Rodding Eye
	Bg		Dk		Drop kerb
	MH		Gos		Gos
			Er		Earth rod

Rev	Date	Details of issue / revision	Drw	Rev
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Client

**HALLAM LAND
MANAGEMENT LTD**

Project Title

WRAGLEY WAY, DERBY

Drawing Title

**EXISTING SITE PLAN
SITE WIDE**

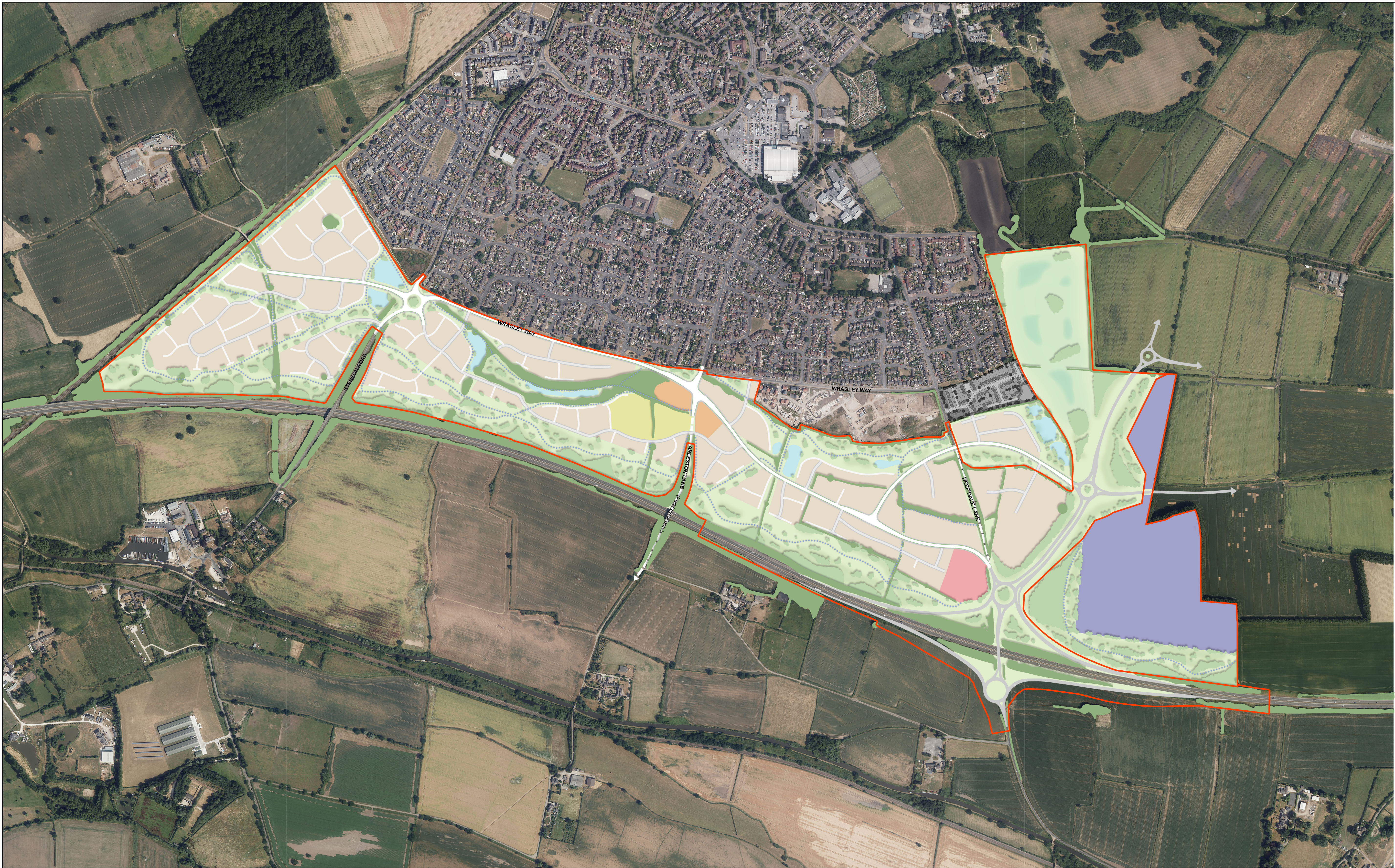
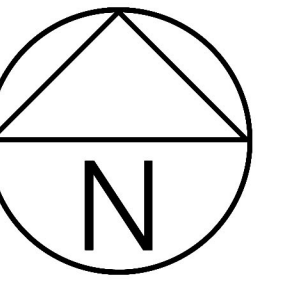
Scale	1:5000 @ A1	Drawn	SDS
Size	A1	Reviewed	TDP

Drawing Status

PRELIMINARY

Drawing No.	Revision
NTH/2136/SVY/001	

APPENDIX 2: Development Proposals



KEY

- | | | | | | |
|--|-----------------------------|--|---------------------------------|--|-------------------------------------|
| | Application site boundaries | | Proposed employment area | | Proposed link road |
| | Proposed residential | | Proposed attenuation pond | | Proposed secondary road |
| | Proposed primary school | | Existing vegetation | | Proposed minor road |
| | Proposed local centre | | Proposed vegetation | | Proposed A50 junction and link road |
| | Proposed mixed use | | Proposed pedestrian/cycle route | | |

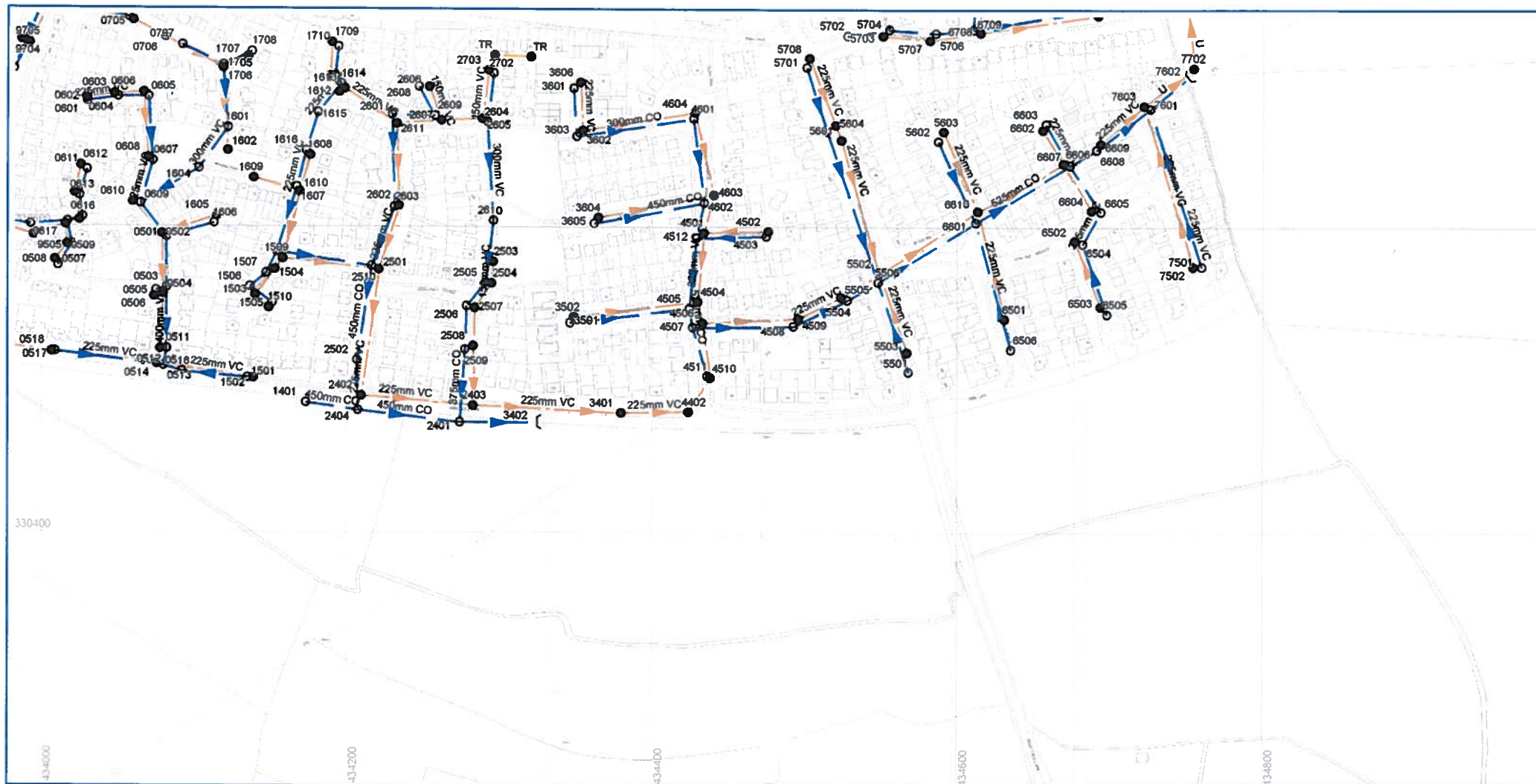
0m 100m 200m 300m 400m 500m

FOR ILLUSTRATIVE PURPOSES ONLY

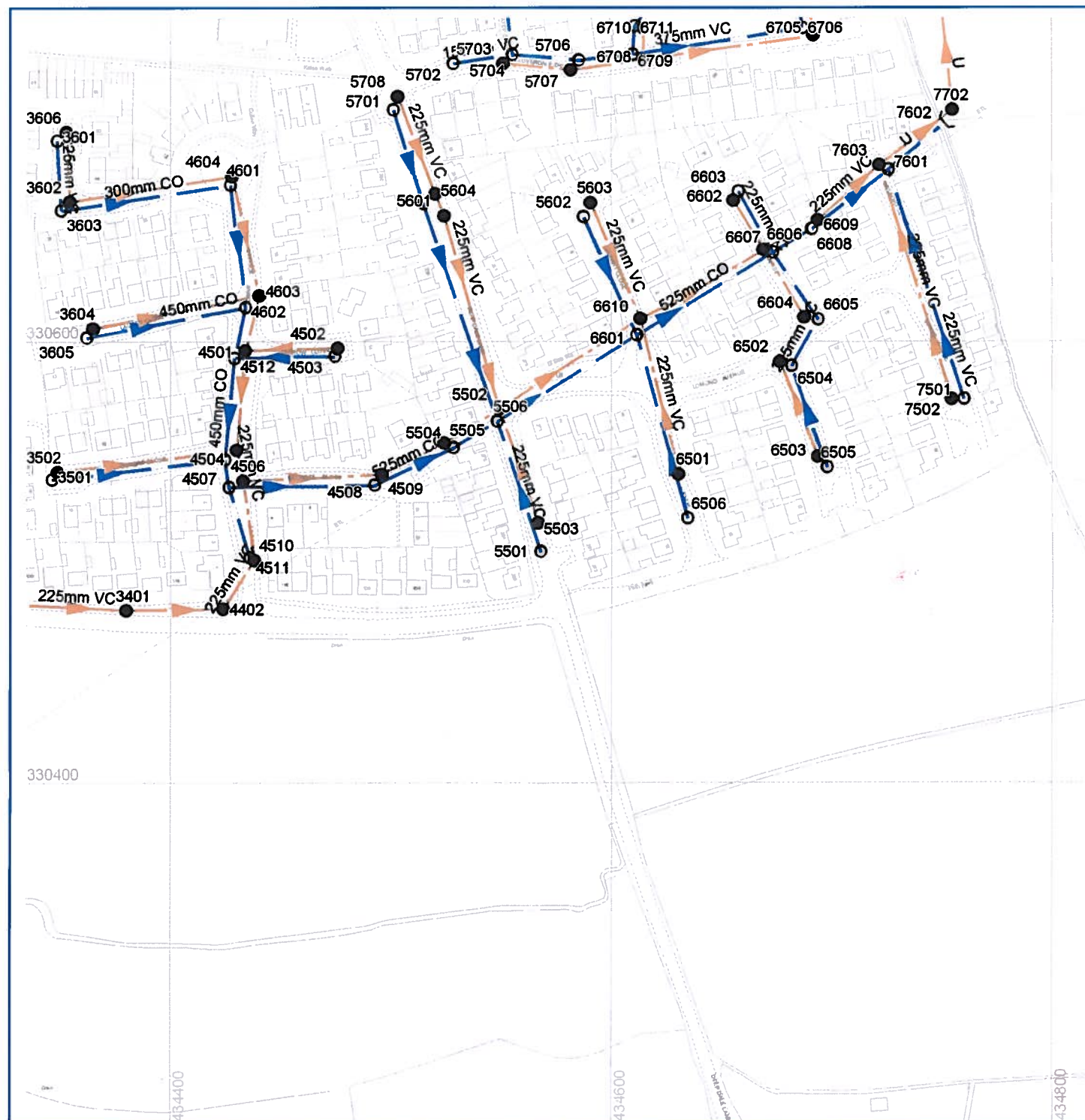
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Approved By	D.P.	Scale	1:5,000 @ A1	P and DG accept no responsibility for any unauthorised amendments to drawings and does not permit unauthorised copying of drawings in order that subsequent reproduction of drawings are internally controlled. Copyright P and DG. This drawing should not be scaled for construction purposes.	
Revision Detail / Date		Date	05/2019		



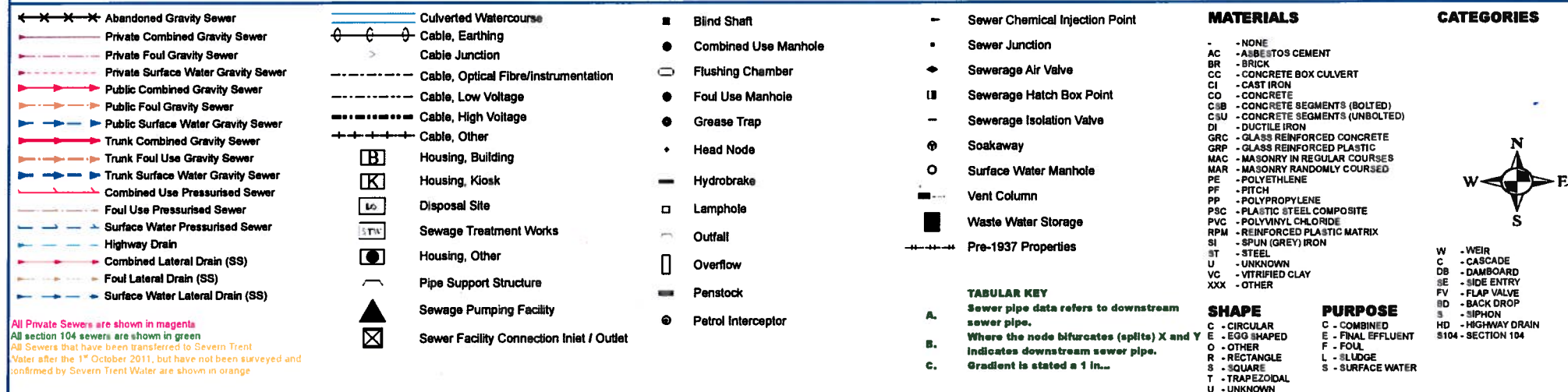
APPENDIX 3: Severn Trent Water DSE & Sewer Mapping



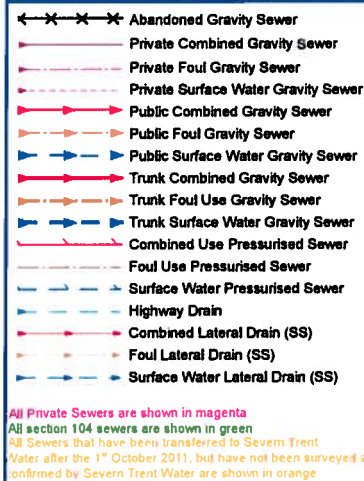
Abandoned Gravity Sewer Private Combined Gravity Sewer Private Foul Gravity Sewer Private Surface Water Gravity Sewer Public Combined Gravity Sewer Public Foul Gravity Sewer Public Surface Water Gravity Sewer Trunk Combined Gravity Sewer Trunk Foul Gravity Sewer Trunk Surface Water Gravity Sewer Combined Use Pressurised Sewer Foul Use Pressurised Sewer Surface Water Pressurised Sewer Highway Drain Combined Lateral Drain (SS) Foul Lateral Drain (SS) Surface Water Lateral Drain (SS)	Culverted Watercourse Cable, Earthing Cable Junction Cable, Optical Fibre/Instrumentation Cable, Low Voltage Cable, High Voltage Cable, Other Housing, Building Housing, Kiosk Disposal Site Sewage Treatment Works Housing, Other Pipe Support Structure Sewage Pumping Facility Sewer Facility Connection Inlet / Outlet	Blind Shaft Combined Use Manhole Flushing Chamber Foul Use Manhole Grease Trap Head Node Hydrobrake Lamphole Outfall Overflow Peristock Petrol Interceptor	Sewer Chemical Injection Point Sewer Junction Sewerage Air Valve Sewerage Hatch Box Point Sewerage Isolation Valve Sockaway Surface Water Manhole Vent Column Waste Water Storage Pre-1937 Properties	MATERIALS AC - NONE AB - ASBESTOS CEMENT BR - BRICK CC - CONCRETE BOX CULVERT CI - CAST IRON CS - CONCRETE CSB - CONCRETE SEGMENTS (BOLTED) CSU - CONCRETE SEGMENTS (UNBOLTED) DI - DUCTILE IRON GRC - GLASS REINFORCED CONCRETE GRP - GLASS REINFORCED PLASTIC MAC - MASONRY IN REGULAR COURSES MAR - MASONRY RANDOMLY COURSED PE - POLYETHYLENE PP - PITCH PP - POLYPROPYLENE PSC - PLASTIC STEEL COMPOSITE PVC - POLYVINYL CHLORIDE RPM - REINFORCED PLASTIC MATRIX SI - SPAN (GREY) IRON ST - STEEL U - UNKNOWN VC - VITRIFIED CLAY OCL - OTHER SHAPE C - CIRCULAR E - EGG SHAPED O - OTHER R - RECTANGLE S - SQUARE T - TRIANGULAR U - UNKNOWN PURPOSE C - COMBINED F - FINAL EFFLUENT F - FOWL L - LULU S - SURFACE WATER	CATEGORIES W - WEIR CB - CARCASS DB - DAMBOARD BE - BIDE ENTRY PV - PLAP VALVE SD - BACK DROP S - SINKHOLE HD - HIGHWAY DRAIN S194 - SECTION 104	Severn Trent Water Limited Asset Data Management PO Box 5344 Coventry CV3 9FT Telephone 0845 601 6616 SEWER RECORD O/S Map scale: 1:2500 Date of issue: 28.02.14 This map is centred upon: O / S Grid reference: x : 434481 y : 330486 Disclaimer 1. Do not scale off this map. 2. This map and any information included with it is furnished as a general guide only and is not to be relied upon as to its accuracy or as to its completeness or as to its correctness in the event of any development or works (including but not limited to alterations) in the vicinity of Severn Trent Water's assets or for the purposes of determining the suitability of a point of connection to the sewerage or distribution systems. 3. On 1 October 2014 most private sewers and private lateral drains in Severn Trent Water's sewerage area, which were vested in a public sewer as at 1 July 2011 transferred to the ownership of Severn Trent Water and became public sewers and public lateral drains. A further transfer takes place on 1 October 2012 (date to be confirmed). Private pumping stations, which form part of these sewers or lateral drains, will transfer to the ownership of Severn Trent Water on or before 1 October 2016. Severn Trent Water does not possess complete records of these assets. These assets may not be displayed on this map. 4. Reproduction by permission of Ordnance Survey on behalf of HESBIO. © Crown Copyright and database right 2004. All rights reserved. Ordnance Survey license number 100012302. Ordnance survey users other than Severn Trent Water business users are advised that this document is provided for reference purposes only and is subject to copyright, therefore no further copies should be made from it.
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Sewer Node		Sewer Pipe Data								
REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SK34308501	41.55	40.01	39.48	F	VC	C	225	nil	137.06	2003
SK34308502	40.76	39.51	39.45	F	VC	C	225	nil	380.50	2003
SK34308503	41.22	39.85	39.53	F	VC	C	225	nil	144.50	2003
SK34308504	40.75	39.90	39.85	S	VC	C	225	nil	483.80	2003
SK34308505	41.22	40.20	39.91	S	VC	C	225	nil	167.93	2003
SK34308506	41.66	40.59	40.07	S	VC	C	225	nil	165.63	2003
SK34308601	41.23	40.04	39.62	S	CO	C	525	nil	172.55	2003
SK34308602	40.79	39.42	39.21	F	VC	C	225	nil	69.36	2003
SK34308603	40.79	39.83	39.62	S	VC	C	225	nil	102.24	2003
SK34308604	40.53	39.44	39.16	F	VC	C	225	nil	166.61	2003
SK34308605	40.55	39.82	39.62	S	VC	C	225	nil	234.35	2003
SK34308606	40.68	39.16	39.09	F	VC	C	225	nil	504.50	2003
SK34308607	40.66	39.64	39.43	S	VC	C	525	nil	109.95	2003
SK34308608	40.45	39.43	nil	S	CO	C	525	nil	0.00	2003
SK34308609	40.44	39.07	38.87	F	VC	C	225	nil	167.70	2003
SK34308610	41.30	39.46	39.17	F	VC	C	225	nil	215.77	2003
SK34308705	41.05	38.83	38.46	F	VC	C	225	nil	156.68	2003
SK34308706	41.11	39.62	39.44	S	CO	C	450	nil	319.78	2003
SK34308706	41.20	39.34	38.98	F	VC	C	225	nil	216.06	2003
SK34308709	41.21	39.87	39.64	S	VC	C	375	nil	338.83	2003
SK34308710	41.23	39.58	39.45	F	VC	C	225	nil	107.69	2003
SK34308711	41.20	40.10	40.03	S	VC	C	225	nil	166.29	2003
SK34307501	40.75	39.62	nil	S	VC	C	225	nil	0.00	2003
SK34307502	40.75	39.40	38.85	F	VC	C	225	nil	197.98	2003
SK34307601	40.29	nil	38.98	S	U	U	nil	nil	0.00	2003
SK34307603	40.31	38.84	nil	F	VC	C	225	nil	0.00	2003
SK34307702	nil	nil	nil	F	U	U	nil	nil	0.00	2003



SEVERN TRENT WATER	Sewern Trent Water Limited Asset Data Management PO Box 5344 Coventry CV3 9PT Telephone: 0845 601 6616		
SEWER RECORD (Tabular)			
O/S Map scale:	1:2500	This map is centred upon:	
Date of Issue:	28.02.14	O / S Grid reference:	
Sheet No.	2 of 2	x :	434576
		y :	330496
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- Blind Shaft
- Combined Use Manhole
- ◁ Flushing Chamber
- Foul Use Manhole
- Grease Trap
- ✦ Head Node
- Hydrobrake
- Lamphole
- ◁ Outfall
- ▮ Overflow
- ▬ Penstock
- ⊙ Petrol Interceptor

- TABULAR KEY**
Sewer pipe data refers to downstream sewer pipe.
Where the node bifurcates (splits) X and Y indicates downstream sewer pipe.
Gradient is stated a 1 in...

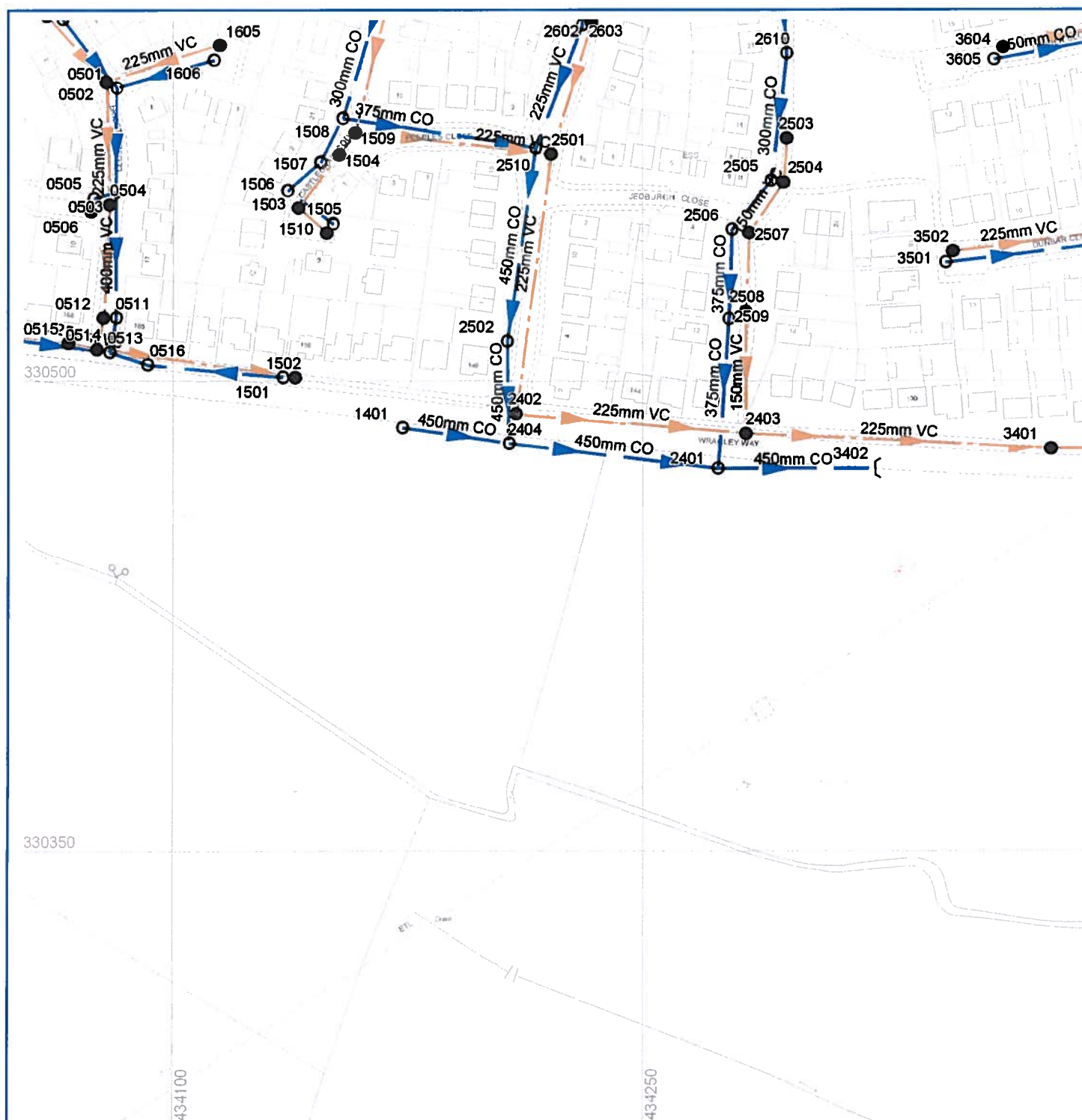
MATERIALS

-	- NONE
AC	- ASBESTOS CEMENT
BR	- BRICK
CC	- CONCRETE BOX CULVERT
CI	- CAST IRON
CO	- CONCRETE
CUB	- CONCRETE SEGMENT (S BOLTED)
CSU	- CONCRETE SEGMENT(S UNBOLTED)
DI	- DUCTILE IRON
GRC	- GLASS REINFORCED CONCRETE
GRP	- GLASS REINFORCED PLASTIC
MAC	- MASONRY IN REGULAR COURSES
MAR	- MASONRY RANDOMLY COURSED
PE	- POLYETHYLENE
PF	- PITCH
PP	- POLYPROPYLENE
PSC	- PLASTIC STEEL COMPOSITE
PVC	- POLY VINYL CHLORIDE
RPM	- REINFORCED PLASTIC MATRIX
SI	- SPUN (GREY) IRON
ST	- STEEL
U	- UNIFORM
VC	- VITRIFIED CLAY
XXX	- OTHER

SHAPE	PURPOSE
C - CIRCULAR	C - COMBINED
E - EGG SHAPED	E - FINAL EFFLUENT
O - OTHER	F - FOUL
R - RECTANGLE	L - SLUDGE
S - SQUARE	S - SURFACE WATER
T - TRIANGULAR	
U - UNKNOWN	

W - WEIR
C - CASCADE
DB - DAMBOARD
SE - SIDE ENTRY
FV - FLAP VALVE
BD - BACK DROP
S - SIPHON
HD - HIGHWAY DRAIN
S104 - SECTION 104

	SEVERN TRENT WATER	Sewern Trent Water Limited Asset Data Management PO Box 5344 Coventry CV3 9PT Telephone: 0845 501 6616	
	SEWER RECORD (Tabular)		
	O/S Map scale:	1:2500	This map is centred upon:
	Date of Issue:	28.02.14	O / S Grid reference:
Sheet No.	1 of 2	x : 434576 y : 330496	



Sewer Node		Sewer Pipe Data								
REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SK34303604	42.82	40.34	40.02	F	VC	C	225	nil	240.56	nil
SK34303605	42.85	40.99	40.55	S	CO	C	450	nil	166.48	1979

- Abandoned Gravity Sewer
- Private Combined Gravity Sewer
- Private Foul Gravity Sewer
- Private Surface Water Gravity Sewer
- Public Combined Gravity Sewer
- Public Foul Gravity Sewer
- Public Surface Water Gravity Sewer
- Trunk Combined Gravity Sewer
- Trunk Foul Use Gravity Sewer
- Trunk Surface Water Gravity Sewer
- Combined Use Pressurised Sewer
- Foul Use Pressurised Sewer
- Surface Water Pressurised Sewer
- Highway Drain
- Combined Lateral Drain (SS)
- Foul Lateral Drain (SS)
- Surface Water Lateral Drain (SS)

- Culverted Watercourse
- Cable, Earthing
- Cable Junction
- Cable, Optical Fibre/Instrumentation
- Cable, Low Voltage
- Cable, High Voltage
- Cable, Other
- Housing, Building
- Housing, Kiosk
- Disposal Site
- Sewage Treatment Works
- Housing, Other
- Pipe Support Structure
- Sewage Pumping Facility
- Sewer Facility Connection Inlet / Outlet

- Blind Shaft
- Combined Use Manhole
- Flushing Chamber
- Foul Use Manhole
- Grease Trap
- Head Node
- Hydrobrake
- Lamphole
- Outfall
- Overflow
- Penstock
- Petrol Interceptor
- Sewer Chemical Injection Point
- Sewer Junction
- Sewerage Air Valve
- Sewerage Hatch Box Point
- Sewerage Isolation Valve
- Soakaway
- Surface Water Manhole
- Vent Column
- Waste Water Storage
- Pre-1937 Properties

- TABULAR KEY**
- A. Sewer pipe data refers to downstream sewer pipe.
- B. Where the node bifurcates (splits) X and Y indicates downstream sewer pipe.
- C. Gradient is stated as 1 in...

MATERIALS

- NONE
- AC - ASBESTOS CEMENT
- BR - BRICK
- CC - CONCRETE BOX CULVERT
- CI - CAST IRON
- CO - CONCRETE
- CIB - CONCRETE SEGMENTS (BOLTED)
- CIBU - CONCRETE SEGMENTS (UNBOLTED)
- DI - DUCTILE IRON
- GRG - GLASS REINFORCED CONCRETE
- GRP - GLASS REINFORCED PLASTIC
- MAC - MASONRY IN REGULAR COURSES
- MAR - MASONRY RANDOMLY COURSED
- PE - POLYETHYLENE
- PF - PITCH
- PP - POLYPROPYLENE
- PSC - PLASTIC STEEL COMPOSITE
- PVC - POLYVINYL CHLORIDE
- RPM - REINFORCED PLASTIC MATRIX
- SI - SPUN (GREY) IRON
- ST - STEEL
- U - UNKNOWN
- VC - VITRIFIED CLAY
- XXX - OTHER

SHAPE

- C - CIRCULAR
- E - EGG SHAPED
- O - OTHER
- R - RECTANGLE
- S - SQUARE
- T - TRAPEZOIDAL
- U - UNKNOWN

PURPOSE

- C - COMBINED
- E - FINAL EFFLUENT
- F - FOUL
- L - SLUDGE
- S - SURFACE WATER

CATEGORIES



- W - WEIR
- C - CASCADE
- DB - DAMBOARD
- SE - SEED ENTRY
- FV - FLAP VALVE
- BD - BACK DROP
- S - SIPHON
- HD - HIGHWAY DRAIN
- 5104 - SECTION 104



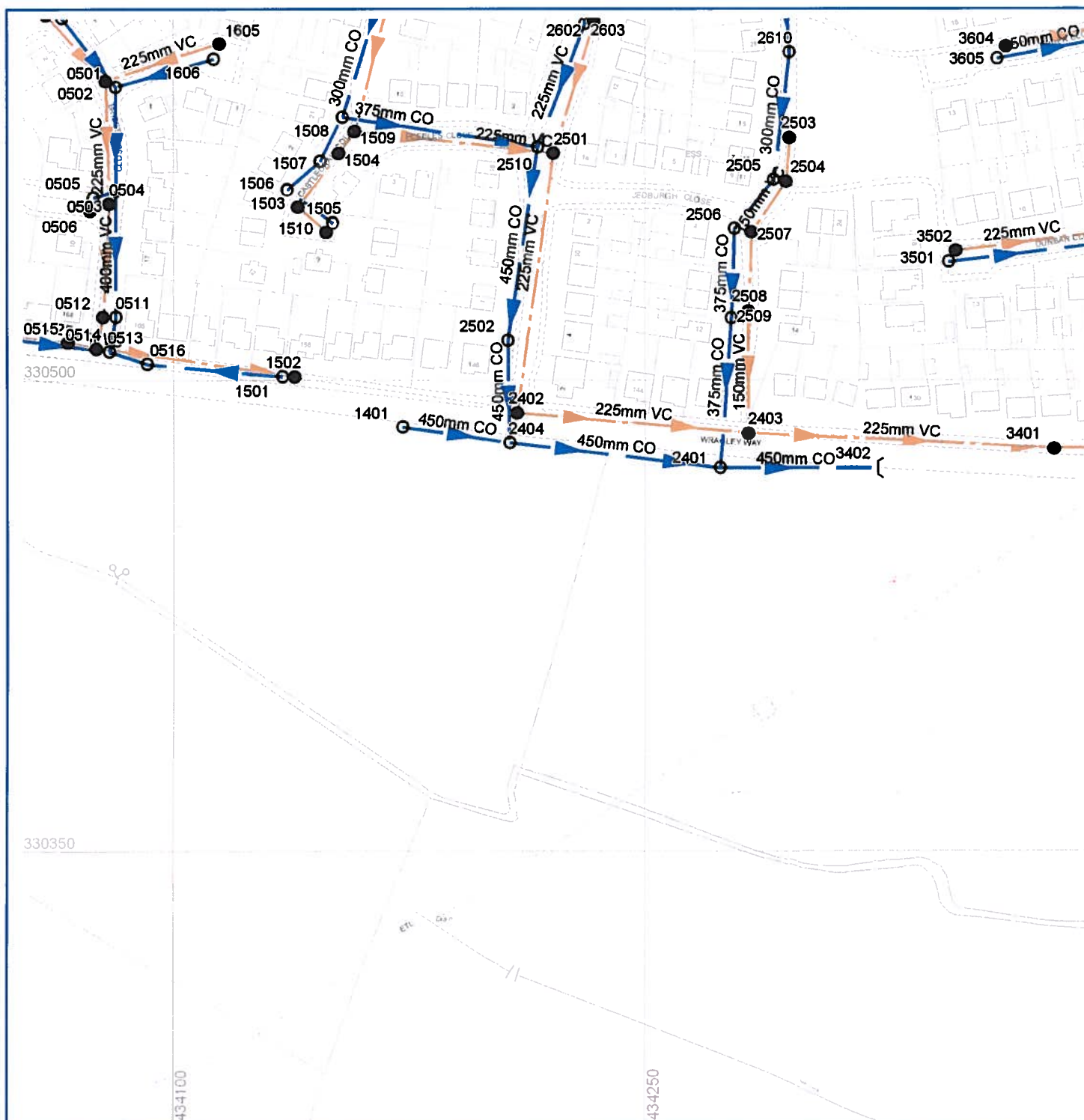
Severn Trent Water Limited
Asset Data Management
PO Box 5344
Coventry
CV3 9FT
Telephone: 0845 601 6616

SEWER RECORD (Tabular)

O/S Map scale: 1:1750
Date of issue: 28.02.14
Sheet No. 2 of 2

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Sewer Node		Sewer Pipe Data								
REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SK34300501	45.61	44.04	43.87	S	VC	C	400	nil	194.12	2003
SK34300502	45.59	43.37	43.13	F	VC	C	225	nil	162.54	2003
SK34300503	45.35	43.87	43.68	S	VC	C	400	nil	210.53	2003
SK34300504	45.37	43.12	42.78	F	VC	C	225	nil	108.06	2003
SK34300505	45.37	44.05	44.02	S	VC	C	225	nil	242.67	2003
SK34300506	45.33	43.17	43.13	F	VC	C	225	nil	158.00	2003
SK34300511	44.87	43.66	43.64	S	CO	C	450	nil	559.00	2003
SK34300512	44.87	42.78	42.27	F	VC	C	225	nil	20.00	2003
SK34300513	44.71	43.58	43.51	S	CO	C	450	nil	180.71	2003
SK34300514	44.25	42.13	42.01	F	VC	C	225	nil	530.33	2003
SK34300515	44.72	42.66	42.15	F	VC	C	225	nil	18.08	2003
SK34300609	45.54	44.25	44.07	S	VC	C	400	nil	154.44	2003
SK34301401	43.90	42.53	42.20	S	CO	C	450	nil	104.15	2003
SK34301501	44.57	43.68	43.52	S	VC	C	225	nil	289.94	2003
SK34301503	44.17	42.70	42.59	F	VC	C	225	nil	178.33	2003
SK34301504	44.27	42.55	42.48	F	VC	C	225	nil	122.86	2003
SK34301505	44.24	43.05	43.04	S	VC	C	225	nil	1790.00	nil
SK34301506	44.19	43.01	42.91	S	VC	C	225	nil	138.30	2003
SK34301507	44.26	42.91	42.83	S	VC	C	225	nil	195.63	2003
SK34301508	44.33	42.76	42.43	S	CO	C	375	nil	190.06	2003
SK34301509	44.34	42.35	41.73	F	VC	C	225	nil	102.24	2003
SK34301510	44.25	42.87	42.75	F	VC	C	150	nil	100.33	2003
SK34301605	45.37	43.64	43.39	F	VC	C	225	nil	151.80	2003
SK34301606	45.40	44.34	44.20	S	VC	C	225	nil	230.57	2003
SK34302401	43.17	41.71	41.51	S	CO	C	450	nil	240.00	2003
SK34302402	43.32	41.45	40.94	F	VC	C	225	nil	144.69	2003
SK34302403	43.00	40.91	40.05	F	VC	C	225	nil	111.84	2003
SK34302404	43.64	42.17	41.75	S	CO	C	450	nil	160.67	2003
SK34302501	43.78	41.57	41.46	F	VC	C	225	nil	757.27	2003
SK34302502	43.40	42.26	42.20	S	CO	C	450	nil	541.67	2003
SK34302503	43.22	41.84	41.69	F	VC	C	150	nil	93.60	2003
SK34302504	43.16	41.66	41.57	F	VC	C	150	nil	215.78	2003
SK34302505	43.15	42.05	41.92	S	CO	C	300	nil	153.15	2003
SK34302506	42.99	41.92	41.88	S	CO	C	375	nil	713.00	2003
SK34302507	42.97	41.56	41.31	F	VC	C	150	nil	100.08	2003
SK34302508	42.82	41.31	40.93	F	VC	C	150	nil	102.63	2003
SK34302509	42.81	41.87	41.78	S	CO	C	375	nil	529.22	2003
SK34302510	43.77	42.40	42.28	S	CO	C	450	nil	518.58	2003
SK34302602	43.98	42.39	41.73	F	VC	C	225	nil	66.62	2003
SK34302603	44.00	42.83	42.55	S	VC	C	225	nil	144.10	2003
SK34302610	43.37	42.29	42.06	S	CO	C	300	nil	177.43	2003
SK34303401	42.35	40.03	39.76	F	VC	C	225	nil	163.00	2003
SK34303501	42.87	40.79	40.20	S	VC	C	225	nil	133.08	2003
SK34303502	42.87	40.37	39.70	F	VC	C	225	nil	121.81	2003

Abandoned Gravity Sewer

Private Combined Gravity Sewer

Private Foul Gravity Sewer

Private Surface Water Gravity Sewer

Public Combined Gravity Sewer

Public Foul Gravity Sewer

Public Surface Water Gravity Sewer

Trunk Combined Gravity Sewer

Trunk Foul Use Gravity Sewer

Trunk Surface Water Gravity Sewer

Combined Use Pressurised Sewer

Foul Use Pressurised Sewer

Surface Water Pressurised Sewer

Highway Drain

Combined Lateral Drain (SS)

Foul Lateral Drain (SS)

Surface Water Lateral Drain (SS)

Culverted Watercourse

Cable, Earthing

Cable Junction

Cable, Optical Fibre/Instrumentation

Cable, Low Voltage

Cable, High Voltage

Cable, Other

Housing, Building

Housing, Kiosk

Disposal Site

Sewage Treatment Works

Housing, Other

Pipe Support Structure

Sewage Pumping Facility

Sewer Facility Connection Inlet / Outlet

Blind Shaft

Combined Use Manhole

Flushing Chamber

Foul Use Manhole

Grease Trap

Head Node

Hydrobrake

Lamphole

Outfall

Overflow

Penstock

Petrol Interceptor

Sewer Chemical Injection Point

Sewer Junction

Sewerage Air Valve

Sewerage Hatch Box Point

Sewerage Isolation Valve

Soakaway

Surface Water Manhole

Vent Column

Waste Water Storage

Pre-1937 Properties

TABULAR KEY

Sewer pipe data refers to downstream sewer pipe.

Where the node bifurcates (splits) X and Y indicates downstream sewer pipe.

Gradient is stated as 1 in...

MATERIALS

AC - NONE

BR - ASBESTOS CEMENT

CC - BRICK

CI - CONCRETE BOX CULVERT

CO - CAST IRON

CSB - CONCRETE SEGMENTS (BOLTED)

CSU - CONCRETE SEGMENTS (UNBOLTED)

DI - DUCTILE IRON

GRC - GLASS REINFORCED CONCRETE

GRP - GLASS REINFORCED PLASTIC

MAC - MASONRY IN REGULAR COURSES

MAR - MASONRY RANDOMLY COURSED

PE - POLYETHYLENE

PF - FITCH

PP - POLYPROPYLENE

PSC - PLASTIC STEEL COMPOSITE

PVC - POLYVINYL CHLORIDE

RPM - REINFORCED PLASTIC MATRIX

SI - SPUN (GREY) IRON

ST - STEEL

U - UNKNOWN

VC - VITRIFIED CLAY

XXX - OTHER

SHAPE

C - CIRCULAR

E - EGG SHAPED

O - OTHER

R - RECTANGLE

S - SQUARE

T - TRAPEZOIDAL

U - UNKNOWN

PURPOSE

C - COMBINED

E - FINAL EFFLUENT

F - FOUL

L - SLUDGE

S - SURFACE WATER

CATEGORIES

W - WEIR

C - CASCADE

DB - DAMBOARD

SE - SIDE ENTRY

FV - FLAP VALVE

BD - BACK DROP

S - SIPHON

HD - HIGHWAY DRAIN

S104 - SECTION 104

W

E

N

S

SEVERN
TRENT
WATER

Sewern Trent Water Limited

Asset Data Management

PO Box 5344

Coventry

CV3 9FT

Telephone: 0845 601 6616

SEWER RECORD (Tabular)

O/S Map scale: 1:1750

Date of issue: 28.02.14

Sheet No. 1 of 2

This map is centred upon: O / S Grid reference: X: 434222 Y: 330439

Disclaimer Statement:

1. Do not scale off this Map.

2. This map and any information supplied with it is furnished as a general guide, is only valid at the date of issue and no warranty as to its correctness is given or implied. In particular this Map and any information shown on it must not be relied upon in the event of any development or works (including but not limited to excavations) in the vicinity of Severn Trent Water's assets or for the purpose of determining the suitability of a point of connection to the sewerage or distribution systems.

3. On 1 October 2011 most private sewers and private lateral drains in Severn Trent Water's sewerage area, which were connected to a public sewer as at 1 July 2011, transferred to the ownership of Severn Trent Water and became public sewers and public lateral drains. A further transfer took place on 1 October 2012 (date to be confirmed). Private pumping stations, which form part of these sewers or lateral drains, will transfer to the ownership of Severn Trent Water on or before 1 October 2016. Severn Trent Water does not possess complete records of these assets. These assets may not be displayed on this Map.

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BWB CONSULTING

03 MAR 2014

RECEIVED

BWB Consulting
Livery Place
35, Livery Street
Colmore Business Park
Birmingham
B3 2PB

BWB CONSULTING

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F.A.O: Carmen Jaimez

28th February 2014

Dear Sirs,

Land off Wragley Way, Derby
Proposed 2000 dwellings (434293,330422)

I refer to your recent Development Enquiry Request in respect of the above site. Please find a copy of the sewer records and 'Additional Guidance Notes' enclosed for your information.

Sewer Crossing

A 450mm dia public surface water sewer appears to be located in the north of the site parallel with Wragley Way. This sewer will require an easement of 10m, 5m each side within which no buildings shall be erected.

Foul Water Drainage

Due to the size of this development and downstream sewer flooding issues, a sewer capacity assessment (SCA) will need to be commissioned to understand the effects this development will have on the public sewers and the various pumping stations and overflows further downstream.

The initial sewer modelling will be funded by the developer. However, any further mitigation modelling and any public sewerage system improvements will be funded by Severn Trent within a reasonable timescale. Sewer modelling will also identify a discharge rate that can be currently accepted to allow a limited

SEVERN
TRENT
WATER

Severn Trent Water

Severn Trent Water Ltd
Leicester Water Centre
Gorse Hill
Anstey
Leicester
LE7 7GU

Tel: 0116 234 3834

Fax: 0116 234 3035

www.stwater.co.uk

net.dev.east@severntrent.co.uk

Contact: Keith Baker

Direct line: 0116 234 3786

Mobile no: 07889 631417

Your ref:

Our ref: WT29675 / 8136144

number of houses for a first phase, i.e whether the 130 can be accepted, until the improvements can be provided. The public foul sewers are between 1.87m and 2.32m deep to invert along Wragley Way, as the site may slope slightly to the south towards the watercourse there may be some part of the development where a pumped discharge may be required, again a pump rate would be determined by the SCA modelling.

A connection point for the first phase can be into any of the public foul manholes in Wragley Way, subject to suitable levels for a gravity connection and which part of the site is to be developed first. For the whole site, a different connection point may be suggested by the sewer modelling report.

Surface Water Drainage

Under the terms of Section H of the Building Regulations 2000, the disposal of surface water by means of soakaways should be considered as the primary method. If this is not practical and no watercourse is available as an alternative, the use of sewerage should be considered. In addition, other sustainable drainage methods should also be explored before a discharge to the public sewerage system is considered.

If these are found to be unsuitable, satisfactory evidence will need to be submitted. The evidence should be either percolation test results or a statement from the SI consultant (extract or a supplementary letter).

Subject to the above, the site area is bordered by a watercourse and crossed by drainage ditches, therefore I expect that the site will drain by gravity into the surrounding natural drainage systems subject to agreement of discharge rates with the Environment Agency. Some part of the site in the north along Wraggley Way may be able to gravitate to the 450mm dia public surface water sewer or the open ditch this sewer discharges to along Wragley Way. This would be limited to a green field run-off rate for that particular area, subject to agreement with this office, once that area is known.

Any flows generated by the site in excess of the permitted discharge rate will have to be attenuated within the development site.

For any new connection(s) into the public sewer network or the reuse of an existing sewer connection(s), you will need to apply

under Section 106 Water Industry Act 1991 as amended by the Water Act 2003. Our New Connections Team currently processes Section 106 applications, please contact them on 0800 707 6600 for an application pack and guidance notes (or visit www.stwater.co.uk). For the avoidance of doubt, it is suggested that you quote the reference number above. Applications to make such connections should be made separately from any application for adoption of the related sewers under Section 104 Water Industry Act 1991 as amended by the Water Act 2003.

I must inform you that this evaluation is only valid for 6 months from the date of this letter. Please quote the reference number above, in all future correspondence.

Yours faithfully,



WF Walton
Asset Protection Manager - East
Waste Water

Additional Guidance Notes

If you experience difficulty in the provision of off-site sewers to serve your proposed development, an application for requisition sewers under Section 98 Water Act 2003 may be appropriate on request to this office.

If there are existing public sewers within the curtilage of the development site that may affect the proposed development, the option to divert them under Section 185 Water Act 2003 may be available. All costs incurred would lay with the Applicant.

All potentially adoptable sewers must be designed and constructed in accordance with the guidelines in Sewers for Adoption (6th Edition), after 1st May 2006. A Severn Trent Water Addendum for Foul Sewage Pumping Stations will be available at www.wrcplc.co.uk/sfa.

If the sewers are to be offered for adoption or if the development works could affect the public sewerage system, the Developer should approach Severn Trent Water Ltd to discuss their proposals in detail. This is to ensure the Developer is aware of the Company's requirements which could affect the development design and/or programme.

In cases where the complexity of both the existing receiving sewerage system and the proposed additional sewerage necessitates the construction of a suitable computer model, Severn Trent Water can offer this service. Enquiries should be addressed to James Arkesden in our Infrastructure Strategy Team who can be contacted on 07583 894202 (Wed – Fri only) or email to: sewer.capacity@severntrent.co.uk.

Severn Trent Water has no knowledge of any specific land drainage issues involving this site. The Developer is to contact and seek approval of The Environment Agency, Local Authority etc. regarding any means of surface water disposal to the land drainage system, required attenuation, discharge consent etc.

All enquiries with respect to the supply of sewer records only should be directed to Severn Trent Water Limited, Asset Data Management, PO Box 5344, Coventry. CV3 9FT (Tel. 0845 601 6616).

Asset Protection
Waste Water East

SUPPLEMENTARY GUIDANCE NOTES

In 2006 the Government issued national advice in the form of "Planning Policy Statement 25: Development and Flood Risk" that seeks to reduce the impact of development on surface water runoff. This advice is generally followed by Local Authorities through both the Building Regulations (Approved Document H) and the imposition of appropriate planning conditions. Severn Trent welcomes this advice and supports such planning conditions that impose flow restrictions. It is considered that in accordance with current guidance disposal of storm runoff from the development should be dealt with as follows:

1. By soakage into the site's subsoil, subject to suitable ground soakage capacity and any contamination present. If ground soakage proves inadequate, evidence should be submitted to Severn Trent Water. The evidence should be either percolation test results or a statement from the SI consultant (extract from report or a supplementary letter) stating that soakaways would be ineffective. **A connection to public sewerage (existing or adoptable) would then be considered reasonable with flows as:**
2. Brown field development site: If storm runoff from the existing development is connected to the public sewerage system, then peak storm flows from the proposed development up to that generated from the previous connected impermeable area may be connected to the network subject to the details of the existing storm connection arrangements being submitted to Severn Trent Water.

For existing storm connections to the public foul sewerage system, any new storm connection to the public storm sewerage system (if available) should be limited to 5 litres/sec/ha (option A) OR a peak flow to be determined by the Company from its developer-funded hydraulic modelling of the public storm sewerage system (option B). The developer may choose either option. Existing flows should be assessed as the lower of $Q=2.78 \times 50 \times A_{imp}$ l/s (A_{imp} ha) and the unsurcharged capacity of the outfall pipe(s).

In addition to this restriction, for Brownfield developments, the Company would also suggest a reduction in surface water flow to the public sewerage systems of 20%. It should be noted that the Company would like to see any flow attenuation based on a 30 year critical duration storm design in accordance with 'Sewers for Adoption' current edition.

3. Green field development site: If the site is a green field development i.e. not involving any demolition of buildings or paved areas connected to the public sewerage system, then the storm runoff from the proposed development may be connected to the public sewerage system subject to peak storm flows (30 year design storm) being limited to a green field runoff of 5 litres/sec/ha (subject to a minimum of 5 litres/sec), applied to the gross area of the site, subject to sufficient capacity in the network.



BETTER SOLUTIONS, INTELLIGENTLY ENGINEERED



BETTER SOLUTIONS, INTELLIGENTLY ENGINEERED

TRANSPORT & INFRASTRUCTURE

Hallam Land Management Ltd
Land off Wragley Way, Derby
Foul Water & Utilities Assessment

TRANSPORT & INFRASTRUCTURE

Hallam Land Management Ltd Land off Wragley Way, Derby Foul Water & Utilities Assessment

Birmingham
Livery Place, 35 Livery Street, Colmore Business District, Birmingham, B3 2PB
T: 0121 233 3322

Cambridge
14-16 High Street, Histon, Cambridge
CB24 9JD
T: 01223 235 173

Leeds
Whitehall Waterfront, 2 Riverside Way, Leeds
LS1 4EH
T: 0113 233 8000

London
11 Borough High Street
London, SE1 9SE
T: 0207 407 3879

Manchester
4th Floor Carvers Warehouse, 77 Dale Street
Manchester, M1 2HG
T: 0161 233 4260

Market Harborough
12a Woodcock House, Compass Point Market Harborough, Leicestershire, LE16 9HW
T: 01858 455020

Nottingham
Waterfront House, Station Street, Nottingham NG2 3DQ
T: 0115 924 1100

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EXECUTIVE SUMMARY

This Foul Water & Utilities Assessment has been prepared by BWB Consulting Limited (BWB) on behalf of Hallam Land Management Ltd. Its purpose is to describe the locations of existing utilities apparatus in the vicinity of the site and to provide an account of the viability of servicing the proposed development with suitable mains services infrastructure. The assessment also considers whether any services diversions are likely to be required as a consequence of the development proposals.

BWB carried out a comprehensive search to establish the approximate location of existing recorded services. The site surrounds are well served by high and low voltage electricity, gas, foul drainage, clean water and telecoms apparatus. However, contain highly sensitive utility assets that are required to be treated with caution. This is strictly the case for the 2no. existing localised high pressure (HP) gas mains that are shown to be crossing the site from west to east.

It is understood that the masterplan will be developed to accommodate these gas mains, however due to the high pressures being conveyed through the mains the HSE's stipulated buffer zones which highlight the stand-offs for permissible development will need to be adhered to.

Discussions are on-going with the relevant statutory authorities to ascertain a supply strategy for the site and to understand the appropriate mitigation and protection measures that can be introduced during and post construction phases of development to maintain the integrity of the assets.

Of note a number of 132kV HV Overhead Lines and the associated towers owned by the incumbent electricity operator are shown to cross within the development footprint of the site. It is understood that the masterplan will be developed to accommodate this apparatus.

However, the 11kV HV overhead lines also shown to be crossing the site are likely to require diverting to accommodate the proposed development layout.

Discussions held with the relevant incumbent water and electricity operators to date indicate that insufficient residual capacity exists within the surrounding network to serve the proposed development, as such reinforcement works are likely to be required to facilitate the overall site demand.

A connection to the nearest foul sewer within the vicinity of the site is envisaged. However, due to the size of the proposed development and the complexity of the receiving sewerage system, sewer modelling is required to be undertaken by STW to understand the impact of the development of the existing network and assess the works that will be required to accommodate the additional flows.

It is recommended that further consultation with the relevant statutory undertakers is undertaken once the development proposals are reasonably fixed, in order to confirm the availability and cost of strategic services supplies and the extent of any diversionary works required to accommodate the proposed development.

CONTENTS

1. INTRODUCTION	1
2. THE SITE.....	3
3. EXISTING SERVICES APPARATUS	3
4. PROPOSED SUPPLY STRATEGY	7
5. DIVERSIONS/DISCONNECTIONS.....	10
6. CONCLUSION AND RECOMMENDATIONS	16

FIGURES

Figure 1: Site Location Plan

TABLES

Table 1: Service Supply Summary

Table 2: Diversions/Disconnections Summary

APPENDICES

Appendix A: Proposed Site Masterplan

Appendix B: Composite Services Plan

Appendix D: Health & Safety Executive (HSE) Guidance

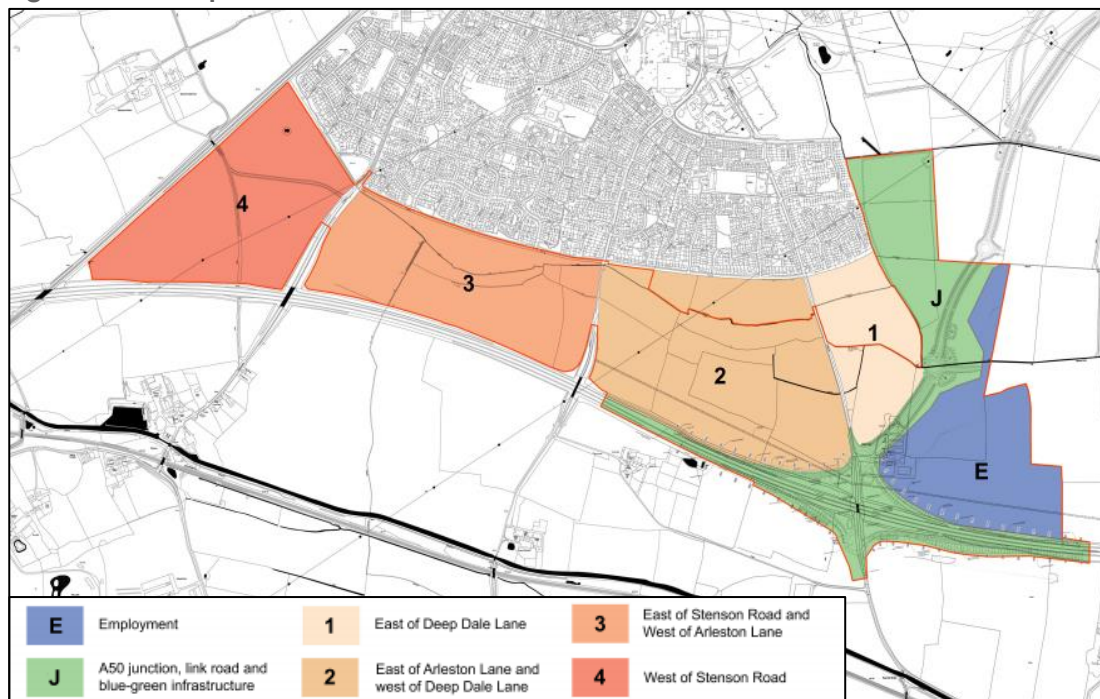
Appendix D: Linesearch Response

1. INTRODUCTION

Instruction

- 1.1 BWB Consulting (BWB) was instructed by Hallam Land Management Ltd (the Client) to carry out a Foul Water and Utilities Assessment.
- 1.2 It is understood that the proposed development known and referred to within the South Derbyshire Local Plan as the Infinity Garden Village is to comprise of 1,850 dwellings, a 2 form entry primary school, a local community centre (including community hall, retail and other local services and facilities), public house, drive through restaurant, petrol filling station, employment uses, strategic road links, public open space including children's play provision, surface water drainage infrastructure, landscaping, earthworks and ancillary supporting infrastructure.
- 1.3 The red line boundary includes residential parcels, 1, 2, 3 and 4, parcel J, the new A50 junction and link road and employment parcel E application extents. These areas are depicted within **Figure 1**, below.

Figure 1: Masterplan Areas



- 1.4 These schemes are considered to be integral to one another and will be delivered as part of the strategic plan of future development as set out within the South Derbyshire and Derby City Council Local Plans. Details of phasing of the scheme are to be confirmed prior to detailed design.
- 1.5 An illustrative masterplan for the site is included within **Appendix A**, which shows how the site could be developed.

Objectives

1.6 The objectives of the report are: -

- To describe the location of existing services on and immediately adjacent to the site.
- To determine whether there is likely to be any difficulty in providing strategic utility services to serve the proposed development.
- To consider the impact of the development itself on the existing services infrastructure and the likelihood of any necessary diversions.

Scope of Works

1.7 The scope of work included:

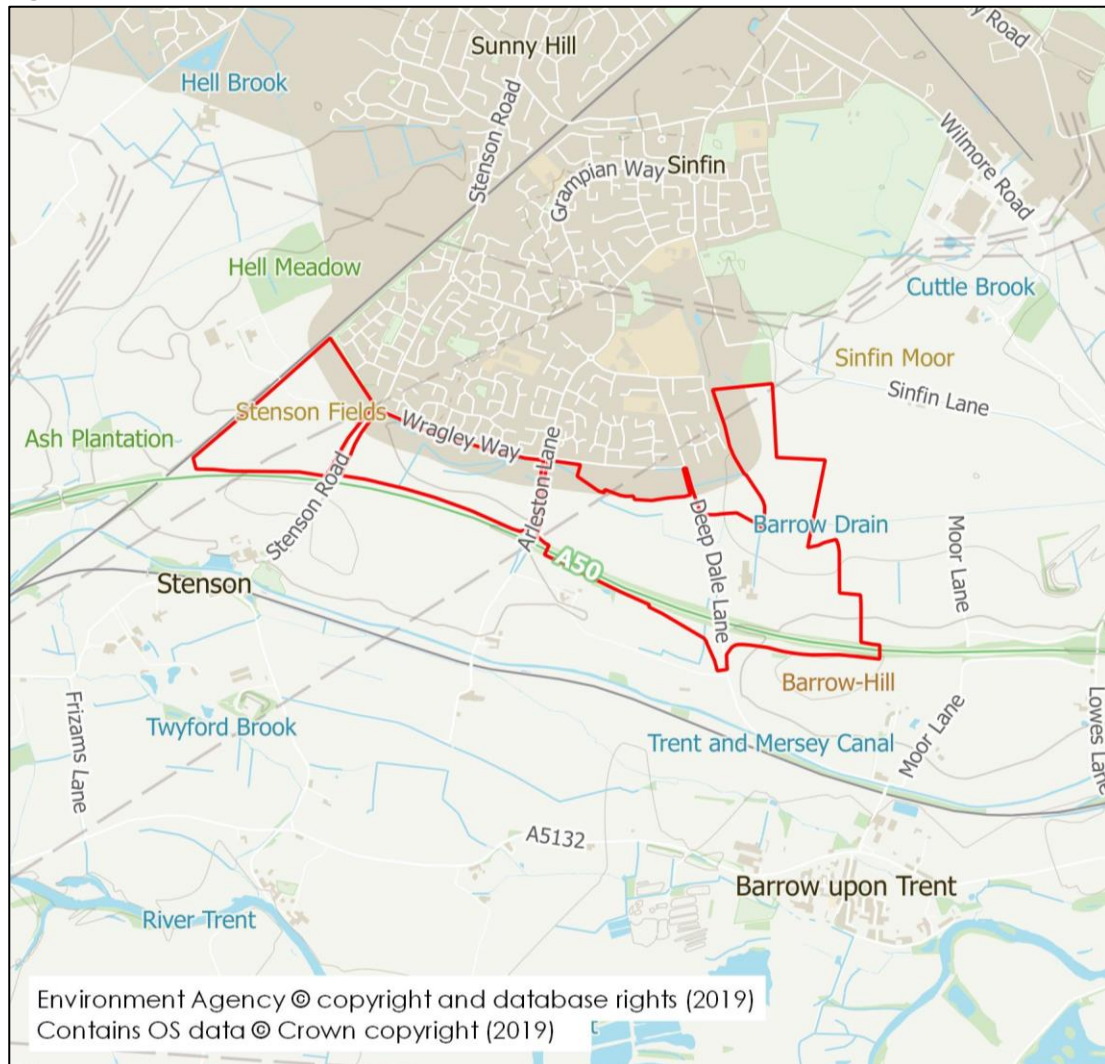
- Obtain up to date stats record plans.
- Conduct a review of the existing record plans received.
- Highlight key risks pertaining to the location of existing assets in relation to the development area.
- Obtain quotations from the relevant statutory authorities regarding supply and diversion/disconnection works.

2. THE SITE

Site Location

- 2.1 The site is located at national grid reference: 433590, 330467. A site location plan is included for reference as **Figure 2**.

Figure 2: Site Location Plan



Site Description

- 2.2 The site comprises predominantly agricultural land and is located to the south of Sinfin and Stenson Fields, a suburb to the southwest of Derby. Wragley Way runs adjacent to the northern boundary of the site beyond which is an area of existing residential housing. An existing railway forms the western boundary of the site. Furthermore, Sinfin Moor is situated to the east of the site and the A50 Bypass to the south. The development site is intersected from north to south by Stenson Road, Arleston Lane and Deep Dale Lane. Ashlea Farm which comprises a number of existing buildings is located within the south-eastern corner of the site adjacent to Deep Dale Lane.

3. EXISTING SERVICES APPARATUS

- 3.1 BWB requested copies of existing services records from the utility companies operating within the vicinity of the site. The following provides a summary of the responses received. A composite services plan showing the location of the existing services within the vicinity of the site is enclosed at **Appendix B**.

Electricity Apparatus

- 3.2 The Western Power Distribution (WPD) electricity record plans show an existing network of extra high voltage (EHV), high voltage (HV) and low voltage (LV) electricity apparatus, both within and surrounding the site.
- 3.3 Most notably, there is a network of 132kV overhead lines (OHL), including 4no. towers that cross within the development footprint. A pair of 132 kV overhead lines are shown to head in a north-easterly direction adjacent to Stenson Fields across the western area of the site. Furthermore, a single 132kV overhead line is shown to run diagonally across the central and eastern areas of the site.
- 3.4 There are also 2no. spans of 11kV HV overhead lines (OHL) with associated poles shown to be present within the development footprint crossing the western and south-eastern areas of the site running adjacent to the existing railway line and distributing supplies to the existing Ashlea Farm buildings respectively.
- 3.5 Furthermore, there is a network of underground 11kV HV cables shown to be present within Arleston Lane which crosses through the centre of the site and the roads within the existing residential development to the north of the site.

Gas Apparatus

- 3.6 The Cadent Gas (CG) gas record plan shows a network of intermediate pressure (IP) and localised high pressure (HP) gas mains within and surrounding the proposed development site.
- 3.7 Of note, the CG gas record plan shows 2no. 300mm and 450mm localised high pressure (LHP) gas mains crossing the site from the western to the eastern boundary. The mains are shown to be running parallel to the A50 crossing the existing railway line, Stenson Road, Arleston Road and Deep Dale Lane.
- 3.8 The northerly 300mm HP gas main distributes gas between Sutton on the Hill and Thane Road, whilst the southerly 450mm HP gas main distributes gas between Sutton on the Hill and Thulston.
- 3.9 Furthermore, there is a 150mm IP gas main that is shown to be present to the north and east of the site. It is shown to emanate from a gas governor located in close proximity to Lea Farm.
- 3.10 The existing residential area to the north of the site is well served by low pressure gas mains.

Water Apparatus

- 3.11 The Severn Trent Water (STW) clean water record plan received shows a network of clean water mains of varying sizes, within the site and the surrounding area.
- 3.12 Of note, the clean water record plans show an existing 4" and 180mm water main situated within Stenson Road and Arleston Lane respectively which intersect the western and central areas of the development site. The record plans also indicate the presence of an abandoned main with Stenson Road.
- 3.13 Furthermore, a 6" diameter water is shown to be located within Wragley Way adjacent to the northern boundary of the site.
- 3.14 There is a network of clean water mains of varying sizes shown to be situated within the smaller roads beyond the northern boundary of the site assumed to be serving the existing residential development.

Public Sewer Apparatus

- 3.15 The Severn Trent Water (STW) sewer record plan shows a number of small diameter sewers within the existing residential area to the north of the site.
- 3.16 Of note, a 375mm foul water sewer is shown to be running within the north-eastern area of the site adjacent to the existing residential development.
- 3.17 A number of surface water sewers and foul water sewers of varying sizes are shown to be situated within Wragley Way along the northern boundary of the site.

Telecommunication Apparatus

BT/Openreach

- 3.18 The BT/Openreach (BT) record plans obtained show a network of below ground and overhead lines within the site and the surrounding area.
- 3.19 Of note, there is underground apparatus present within the footpaths of Stenson Road, and Arleston Road which intersect the western and central area of the site respectively. Furthermore, there is underground apparatus present within Wragley Way and the roads serving the existing residential development to the north of the site.
- 3.20 The record plans obtained also show the presence of a number of overhead lines (OH) within the development site. An overhead line (OH) is shown to be present within the south-eastern area of the site serving the existing Ashlea Farm buildings and within the western area of the site running along the unnamed path in Stenson Fields.

Virgin Media

- 3.21 The Virgin Media (VM) record plan confirms that there is a network of below ground apparatus serving the surrounding area.
- 3.22 Most notably, there is underground VM cables present within Wragley Way to the north of the site.
- 3.23 The VM record plan confirms that there is no apparatus present within the site itself.

Other telecoms providers

- 3.24 BWB contacted several other communications companies including Colt, Instalcom, Interoute, KPN, Sky, Telent and Vodafone, none of whom have any apparatus in the vicinity of the site.

Linesearch apparatus

- 3.25 BWB contacted several other utility companies through Linesearch. The response received confirms the site does not lie within the zone of interest of a number of companies, most notably:
- AWE Pipeline
 - Shell Pipelines
 - Carrington Gas Pipeline
 - ES Pipeline Ltd
- 3.37 The Linesearch response is enclosed at **Appendix D**.

4. PROPOSED SUPPLY STRATEGY

- 4.1 BWB made enquiries to the relevant incumbent utility companies regarding the provision of services to supply the promoted site. Strategic services load demands have been estimated by BWB for a mixed-use development comprising 1,850 residential dwellings, a 2 form entry primary school, a local centre (including community hall, retail and other local services and facilities), public house, drive through restaurant, petrol filling station and employment uses. The following provides a summary of the responses received.

Electricity

- 4.2 Discussions are currently ongoing with Western Power Distribution (WPD) regarding the proposed supply strategy for the site. However, during previous correspondence, WPD have advised that a connection can be made to the existing Normaton Primary Sub-station situated approximately 6.5km north of the site.
- 4.3 WPD have advised that an underground 11kV network will need to be routed from the Primary sub-station point of connection (POC) along Stenson Road through the development site to interconnect with the existing on-site infrastructure. A number of onsite distribution sub-stations will need to be established on site to distribute 11kV and LV supplies to each of the proposed residential and commercial plots.
- 4.4 BWB are currently in on-going discussions with the network provider regarding the current capacity thresholds to understand a suitable phasing strategy for the supply and the associated cost fluctuations.

Gas

- 4.5 Discussions are currently ongoing with Cadent Gas (CG) regarding the proposed supply strategy for the site. However, during previous correspondence, CG have advised a proposed point of connection to the existing intermediate pressure (IP) gas main situated to northeast of the site.
- 4.6 It is assumed that the existing gas main has sufficient capacity to provide a supply capable of meeting the total site demand however a formal response confirming this is awaited.
- 4.7 CG do not provide costs as part of this initial enquiry. Therefore, BWB would recommend progressing discussions and raising enquiries with Independent Gas Transporters (IGT'S), to establish a definitive supply and costing strategy.

Clean Water

- 4.8 Discussions are currently ongoing with Severn Trent Water (STW) regarding the proposed supply strategy for the site.

- 4.9 Due to the number of developments that are being undertaken in the wider area Derby area, STW have advised that it is likely that a feasibility study will need be undertaken to ensure that their existing water network is capable of meeting the cumulative demand.
- 4.10 On completion of the feasibility study STW will be able to confirm the extent of the reinforcements required and provide an indication on the likely timescales for the works. It should be noted that if such reinforcements are required to the network these will be completed at no cost to the developer.

Foul Drainage

- 4.11 Discussions are currently ongoing with Severn Trent Water (STW) regarding the proposed supply strategy for the site.
- 4.12 At present, due to the size of the proposed development and the complexity of the receiving sewerage system, sewer modelling is required to be undertaken by STW to understand the impact of the development of the existing network and assess the works that will be required to accommodate the additional flows.
- 4.13 Nevertheless, there are a number of public foul sewers located in close proximity to the site boundary most notably in Wragley Way. As such a connection to the existing network is considered feasible however additional measures such as on-site pumping and potential improvements to network pumping upgrades may be required.
- 4.14 It is recommended that early engagement with STW is undertaken to ensure that they commence with the necessary sewer modelling to confirm what works will be needed to support the proposed development. Following completion of the modelling works STW will then be responsible for delivering any required improvement works. Typically, following commencement of the modelling, the identification and implementation of the proposals can take 18-24 months and as such it is anticipated that this will be in line with any development programme for first occupations etc.
- 4.15 As such it is considered that a solution on the site would be feasible and therefore would not prevent development occurring. An appropriate solution will ensure that flood risk to the wider catchment is not exacerbated as a result of the proposed development.

Telecommunications

BT/Openreach

- 4.16 The site and its surrounds appear to be well served by BT/Openreach (BT) infrastructure. Proposed new supplies should not therefore be difficult to procure and new BT infrastructure is usually 'free issue'. The provision of new services to suit the development should not be problematical.
- 4.17 In advance of this, it is anticipated that a connection can be made to the existing BT network, within the vicinity of the site.

Service Supply Summary

4.18 The table below summarises the position with regards to the proposed service supply strategy for the development.

Table 1: Connection Costs

	Point of Connection	Reinforcement/ Connection	Supply Cost	Comments
Electricity	Connection to existing Normaton Primary Sub-station.	Yes	TBC	Laying 11kV cables from POC to deliver supply to the site.
Gas	Connection to IP main to the northeast of the site.	TBC	TBC	-
Water	Connection anticipated to existing mains within the vicinity of the site.	TBC	TBC	Feasibility study to be undertaken to assess the loads of cumulative developments on the network.
Foul	Foul network in close proximity to the site most likely to be to the sewers situated within Wragley Way.	Yes	TBC	Sewer modelling required to understand impact of the development on the network.
Telecoms - BT	Anticipated connection to existing infrastructure within vicinity of the site.	No	-	-

5. DIVERSIONS/DISCONNECTIONS

- 5.1 BWB are currently in on-going discussions with the relevant incumbent utility companies regarding the diversion/disconnection of existing services affected by the proposed development. The following provides a summary of the discussions had to date and advice previously received.

Electricity Apparatus

Western Power Distribution – 132kV Overhead Apparatus

- 5.2 The Western Power Distribution (WPD) electricity record plans indicate that there is a network of 132kV overhead lines (OHL), including towers that cross within the development footprint.
- 5.3 WPD recommend that where possible, the site masterplan accommodates the existing overhead 132kV lines within the site layout, with reference to the Health and Safety Executive's (HSE) GS6 Guidance, when working in close proximity to the 132kV OHL.
- 5.4 Previous discussions with WPD, have established that the following stand-offs would need to be adhered to when in close proximity to the 132kV OHL apparatus:
- 3.2m from line conductor to construction, construction traffic, other mobile plant
 - 7m from line conductors to road surface (not a high load route or Motorway)
 - 6.7m from line conductors to ground, other than a road
 - 6.6m from line conductor to building or other structure
 - 10m from excavations and buildings to tower foundations
 - Any building to be sited at least 10m from tower structure

Western Power Distribution – 11kV Overhead Apparatus

- 5.5 The WPD record plan shows 2no. 11kV overhead lines (OHL) present within the proposed development site. One of the OHL is shown to distribute supplies to the existing Ashlea Farm.
- 5.6 It is envisaged that the 11kV OHL's can be diverted underground to facilitate development.
- 5.7 The diverted 11kV cables are proposed to follow the route of the of the development layout and would be subject to obtaining the necessary wayleaves and consents, prior to any WPD apparatus being energised. Alternatively, the existing supply being provided by the connection could be replaced by the new site supplies in due course

which would render the existing cable redundant and therefore it could simply being disconnected and removed.

- 5.8 Furthermore, there is a network of underground 11kV HV cables shown to be present within Arleston Lane which crosses through the centre of the site.
- 5.9 It is recommended that further consultation is undertaken with WPD, at a time when the site access proposals are relatively fixed to establish whether the 11kV main requires protecting/ diverting to accommodate the proposed Wragley Way/ Arleston Lane junction alterations and site access proposals.

Gas Apparatus

Cadent Gas

- 5.10 The Cadent Gas (CG) gas record plans show 2no. 300mm and 450mm localised high pressure (LHP) gas mains crossing the site from the western to the eastern boundary. The mains are shown to be running parallel to the A50 crossing the existing railway line, Stenson Road, Arleston Road and Deep Dale Lane
- 5.11 BWB have held discussions with CG to agree safe working parameters near to the CG owned gas mains. CG are happy for the gas mains to remain in-situ so long as, where possible, the exclusion zones are adhered to and it can be reasonably proved that the construction works will not impact the integrity of the gas mains.
- 5.12 Based on past experiences of working within the vicinity of CG gas mains of this nature it is expected that a set of works will need to be undertaken to prove that the gas main will be unaffected by the proposals at specific points of interest. These areas are defined as those where significant changes will occur to the condition of the ground surrounding the gas main, including; increased loading, road crossing points, retaining wall structures, services crossings and increased ground cover, etc.
- 5.13 Once this information has been collated for each of the areas of specific interest, CG will be presented with the findings so an internal check can be undertaken and approval for the works is given.

Health and Safety Executive

- 5.14 The Health and Safety Executive (HSE) class the HP gas mains as a major accident hazard pipe (MAHP) due to the high pressures being conveyed through the gas mains.
- 5.15 Using their sensitivity matrix in conjunction with the known development proposals for the area, the HSE have provided the following buffer zones which highlight the stand-offs for permissible development within proximity to the gas mains;

Sutton on the Hill / Thane Road – Northern Gas Main (ref 6890);

- Inner Zone 34m (17m each side of the centreline of the pipe)

- Middle Zone 140m (70m each side of the centreline of the pipe)
- Outer Zone 140m (70m each side of the centreline of the pipe)

Sutton on the Hill / Thulston – Southern Gas Main (ref 8883):

- Inner Zone 18m (9m each side of the centreline of the pipe)
- Middle Zone 84m (42m each side of the centreline of the pipe)
- Outer Zone 200m (100m each side of the centreline of the pipe)

- 5.16 Where consultation distances coincide, the inner-most zone is used to determine HSE's stand-off zone.
- 5.17 The implications of these stand-off zones are determined by a detailed assessment of the risks and/or hazards of the installation or pipeline which considers several factors, such as; hazard ranges and consequences of toxic/flammable substances present and method of storage, etc. This information is levied against sensitivity levels, to allow progressively more severe restrictions to be imposed as the sensitivity of the proposed development increases.
- 5.18 Regarding the HSE PADHI stand offs the following is a brief overview as to a number of key uses that would be acceptable development in each zone:
- Inner: Open space, car parking, roads (non-major), workplace for less than 100 occupants
 - Middle: Residential development up to 30 dwellings, all workplace space excluding retail
 - Outer: Any residential use
 - Outside of Zone: Schools, care homes etc.
- 5.19 The Health & Safety Executives guidance is enclosed in **Appendix C**.

Clean Water Apparatus

- 5.20 Severn Trent Water (STW) have confirmed that their clean water mains contain the following protection zones;
- Clean water mains up to 12"/300mm have a 6m (3m each side of the centreline) protection zone
 - Clean water mains greater than 12"/300mm have a 12m (6m each side of the centreline) protection zone
- 5.21 The protection zone is required to protect any such dwellings from damage caused by a burst main as well as allowing STW access for plant, machinery and/or fencing that would be required for repair and maintenance.

- 5.22 The STW clean water record plans show a 6" diameter water main located within Wragley Way adjacent to the northern boundary of the site. Based on the masterplan this main appears to be unaffected by the development proposals as such diversionary works are not envisaged however the standoffs outlined above should be adhered to when developing the detailed proposals.
- 5.23 Furthermore, the STW clean water record plans show an existing 4" and 180mm water main situated within Stenson Road and Arleston Lane respectively which intersect the western and central areas of the development site on which based on the latest masterplan a new roundabout and junction alterations are proposed as such it is recommended that further consultation is undertaken with STW, at a time when the site access proposals are relatively fixed to establish whether the clean water main requires protecting/ diverting to accommodate the site access.
- 5.24 It is also recommended that further consultation is undertaken with STW, nearer to the time of construction, to agree the development proposals and to ensure that suitable protection measures are adhered to, when working in close proximity to the clean water mains.

Public Sewer Apparatus

- 5.25 The Severn Trent Water (STW) sewer record plans obtained indicate a number of public sewers within and in close proximity to the proposed development site.
- 5.26 Of note, 375mm foul water sewer is shown to be running within north-eastern area of the site adjacent to the existing residential development.
- 5.27 STW have confirmed that their sewer assets contain the following protection zones;
- Public sewers up to 300mm have a 10m (5m each side of the centreline) protection zone
 - Public sewers greater than 300mm and up to 1000mm have a 20m (10m each side of the centreline) protection zone
 - Public sewers greater than 1000mm have a 30m (15m each side of the centreline) protection zone
- 5.28 After reviewing the development proposals, it is not envisaged that any STW sewer apparatus will require diverting.
- 5.29 However, it is recommended that further consultation is undertaken with STW, at a time when the site access proposals are relatively fixed to establish whether any affected sewer apparatus with Wragley Way requires protecting/ diverting to accommodate the site access or any highway alteration works.

Telecommunication Apparatus

BT/Openreach

- 5.30 The BT/Openreach (BT) record plans received confirm the location of overhead BT apparatus adjacent to Stenson Road and serving the existing Ashlea Farm.
- 5.31 It is envisaged that BT can divert the apparatus underground to suit the development proposals. However, this would be subject to formal application being submitted to BT.
- 5.32 The diverted cables are proposed to follow the route of the development layout and would be subject to obtaining the necessary wayleaves and consents, prior to any BT apparatus being made live. Alternatively, the existing supply being provided by the connection could be replaced by the new site supplies in due course which would render the existing cable redundant and therefore it could simply being disconnected and removed.
- 5.33 Furthermore, the BT/Openreach record plans show existing underground BT/Openreach (BT) apparatus within Stenson Road and Arleston Lane respectively which intersect the western and central areas of the development site. Based on the latest masterplan a new roundabout and junction alterations are proposed at these locations as such it is recommended that further consultation is undertaken with BT/Openreach, at a time when the site access proposals are relatively fixed to establish whether the telecoms apparatus requires protecting/ diverting to accommodate the site access.

Virgin Media

- 5.34 Based on the site proposals it is not envisaged that Virgin Media (VM) apparatus will be impacted. However, it is recommended that further consultation is undertaken with VM at a time when the site access proposals are relatively fixed to establish whether the telecoms apparatus requires protecting/ diverting to accommodate the site access.

Table 2

	Affected	Easement/BPD	Cost	Comments
Electricity – 132kV OHL	Yes	See section 5.4 for WPD stand-offs.	-	Recommended the site masterplan accommodates the existing overhead 132kV lines within the site layout.
Electricity – 11kV OHL	Yes	-	TBC	Affected HV spans to be rerouted underground across the site.
Gas	Yes	See section 5.17 for HSE buffer zones.	-	Recommended the site masterplan accommodates the existing gas mains within the site layout.
Water	No	-	-	No diversions required. Water main within Stenson Road and Arleston Lane to be reviewed against site access proposals and highway alteration works once fixed.
Public Sewers	No	-	-	No diversions required. Sewers with Wragley to be reviewed against site access proposals and highway alteration works once fixed.
Telecoms - BT	Yes	-	TBC	Diversion of overground telecoms underground to suit development proposals. Telecoms within the vicinity of the site to be reviewed against site access proposals and highway alteration works once fixed.
Telecoms – Virgin Media	No	-	-	No diversions required. Telecoms within the vicinity of the site to be reviewed against site access proposals and highway alteration works once fixed.

6. CONCLUSION AND RECOMMENDATIONS

- 6.1 The main conclusions and recommendations that can be drawn from this foul water and utilities investigation are as follows;

Conclusions

- 6.2 The existing site surrounds appear to be well served by the main utility services.
- 6.3 Having made initial enquiries with the relevant statutory undertakers, it appears as though the existing electricity and water networks require reinforcing in order to facilitate the proposed development.
- 6.4 The incumbent electricity provider has advised connecting to the existing Normaton primary sub-station and laying HV to cables to deliver supplies to the proposed development site.
- 6.5 A connection to the nearest foul sewer within the vicinity of the site is envisaged. However, due to the size of the proposed development and the complexity of the receiving sewerage system, sewer modelling is required to be undertaken by STW to understand the impact of the development of the existing network and assess the works that will be required to accommodate the additional flows.
- 6.6 It is anticipated that the 132kV Overhead Line and associated towers that cross within the site will be accommodated within the final site masterplan and so will not require diverting. However, the affected 11kV Overhead Line will require diverting through the site along an agreed route in line with final site layout.
- 6.7 It is understood that the masterplan will be developed to accommodate the pair of high pressure gas mains, however due to the high pressures being conveyed through the mains the HSE's stipulated buffer zones which highlight the stand-offs for permissible development will need to be adhered to.
- 6.8 A number of main utility services are shown within Wragley Way, Stenson Road and Arleston Lane that could be affected by the site access proposals and highway improvement works. As such, it is recommended that further consultation is undertaken with the incumbent utility providers, at a time when the site access proposals are relatively fixed to establish whether the affected services require protecting/ diverting to accommodate the site access.

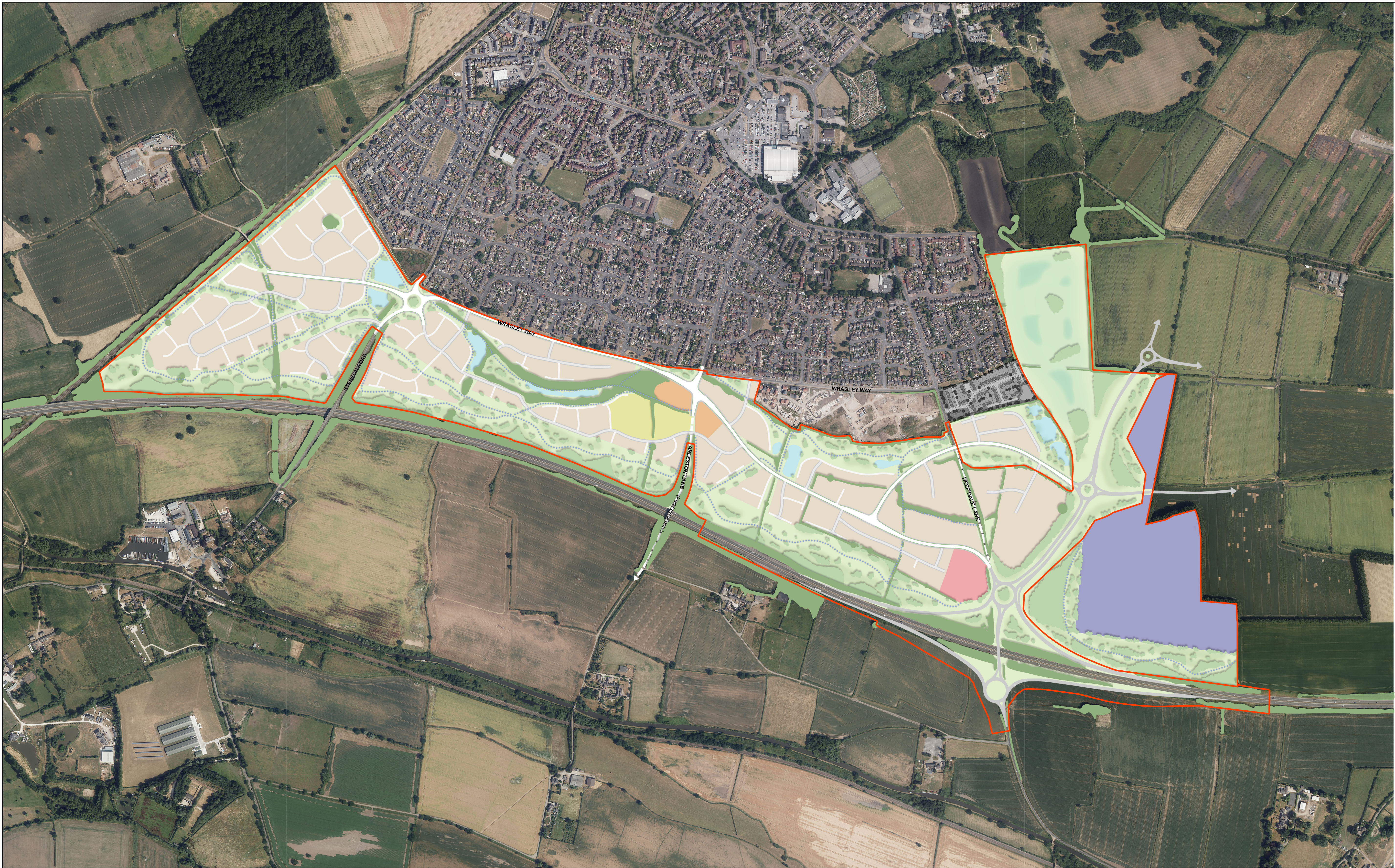
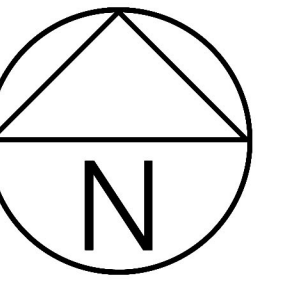
Recommendations

- 6.9 It is recommended that a below ground utility survey is undertaken to ascertain the location of existing and unknown privately-owned assets within proximity to the proposed development.

- 6.10 It is recommended that the site masterplan continues to accommodate the existing high pressure gas mains and 132kV electricity Overhead Line, including their respective easement and building proximity distances.

APPENDICES

APPENDIX A
Proposed Site Masterplan



KEY

- | | | | | | |
|--|-----------------------------|--|---------------------------------|--|-------------------------------------|
| | Application site boundaries | | Proposed employment area | | Proposed link road |
| | Proposed residential | | Proposed attenuation pond | | Proposed secondary road |
| | Proposed primary school | | Existing vegetation | | Proposed minor road |
| | Proposed local centre | | Proposed vegetation | | Proposed A50 junction and link road |
| | Proposed mixed use | | Proposed pedestrian/cycle route | | |

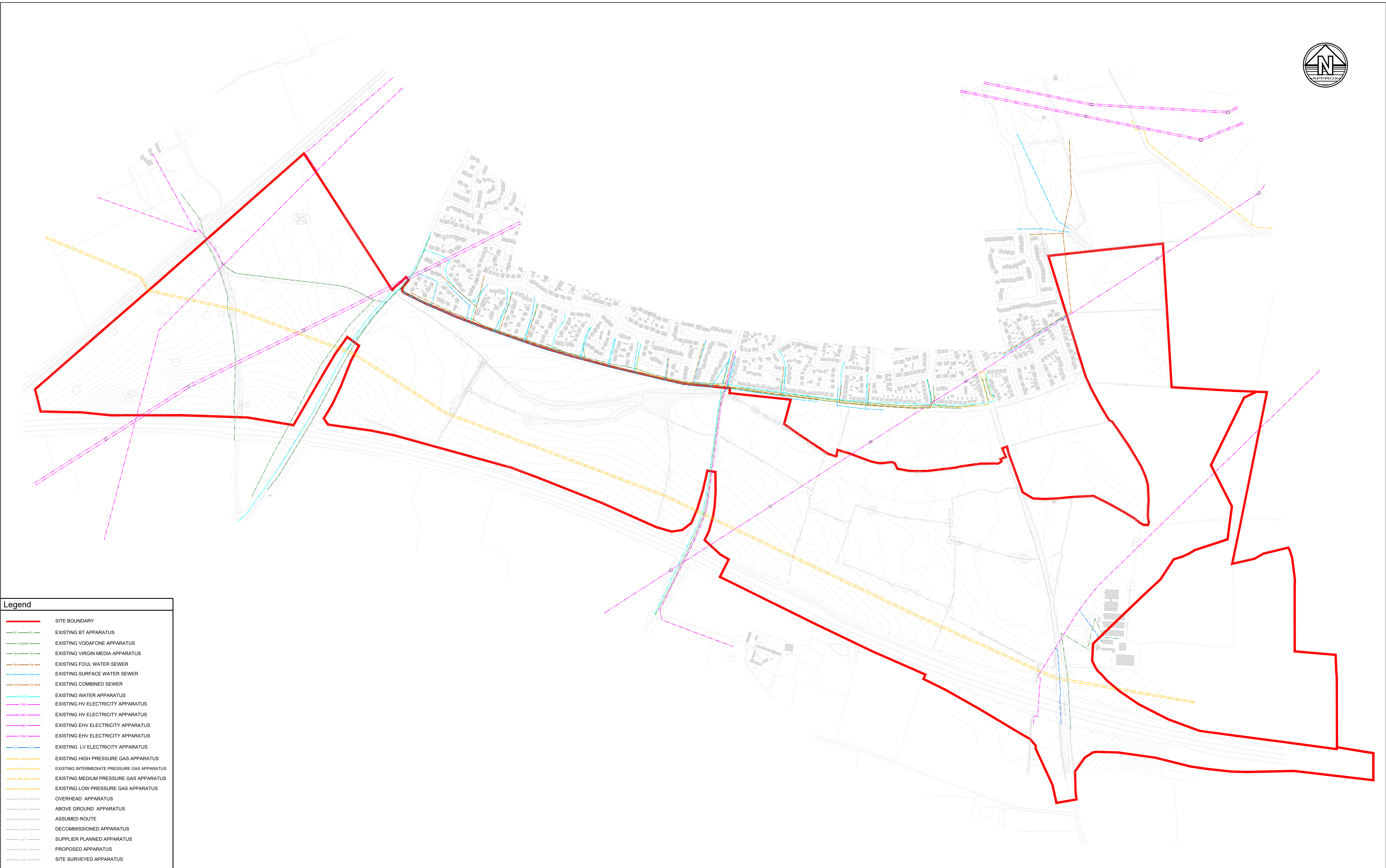
0m 100m 200m 300m 400m 500m

FOR ILLUSTRATIVE PURPOSES ONLY

Drawn By	S.C.M.	Title	Infinity Garden Village (Wragley Way) ILLUSTRATIVE MASTERPLAN	Drawing No	13.060/18
Approved By	D.P.	Scale	1:5,000 @ A1	P and DG accept no responsibility for any unauthorised amendments to drawings and does not permit unauthorised copying of drawings in order that subsequent reproduction of drawings are internally controlled. Copyright P and DG This drawing should not be scaled for construction purposes	
Revision Detail / Date		Date	05/2019		



APPENDIX B
Composite Services Plan



	SITE BOUNDARY
	EXISTING BT APPARATUS
	EXISTING VODAFONE APPARATUS
	EXISTING VIRGIN MEDIA APPARATUS
	EXISTING FOUL WATER SEWER
	EXISTING SURFACE WATER SEWER
	EXISTING COMBINED SEWER
	EXISTING WATER APPARATUS
	EXISTING HV ELECTRICITY APPARATUS
	EXISTING HV ELECTRICITY APPARATUS
	EXISTING EHV ELECTRICITY APPARATUS
	EXISTING EHV ELECTRICITY APPARATUS
	EXISTING LV ELECTRICITY APPARATUS
	EXISTING HIGH PRESSURE GAS APPARATUS
	EXISTING INTERMEDIATE PRESSURE GAS APPARATUS
	EXISTING MEDIUM PRESSURE GAS APPARATUS
	EXISTING LOW PRESSURE GAS APPARATUS
	OVERHEAD APPARATUS
	ABOVE GROUND APPARATUS
	ASSUMED ROUTE
	DECOMMISSIONED APPARATUS
	SUPPLIER PLANNED APPARATUS
	PROPOSED APPARATUS
	SITE SURVEYED APPARATUS

1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.	6. The accuracy of the services information shown on this drawing cannot be guaranteed and is only an indicative representation. The information shown is based upon asset record drawings from statutory authorities. It is given without liability or warranty.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.	7. The contractor shall be responsible for verifying the exact location of all statutory undertakers apparatus and other public/private drainage/services in consultation with the relevant operator/service provider.
3. All dimensions in metres unless noted otherwise. All levels in metres unless noted otherwise.	8. BWS has the capability of tracing and recording on-site services with locations recorded on topographical survey data.
4. Any discrepancies noted on site are to be reported to the engineer immediately.	9. All services are taken from record (TFR) unless otherwise noted as surveyed (S) or proposed (R).
5. All services are underground unless otherwise noted as overhead (OH).	

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Project Title	
Land off Wragley Way Derby	
Drawing Status	
INFORMATION	

Drawing Title		
Composite Services Plan		
Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
WRA-BWB-00-ZZ-DR-G-0050	S2	P1

APPENDIX C

Health & Safety Executive (HSE) Guidance

Dan Bailey

From: Armani Akbar-Roy
Sent: 12 December 2017 10:32
To: Dan Bailey
Subject: FW: HSE ref: HSL-171013091008-509 BWB ref: BMW2401

Hi Dan,

Chellaston HSE response regarding which pipeline is which.

Regards,

Armani Akbar-Roy AMAPM

Consultant | Transport & Infrastructure Management | BWB Consulting Limited

Livery Place, 35 Livery Street, Colmore Business District, Birmingham B3 2PB

mob 07469 855 631 web www.bwbconsulting.com

twitter @bwbconsulting

From: Kate.Wagner@hsl.gsi.gov.uk [mailto:Kate.Wagner@hsl.gsi.gov.uk] **On Behalf Of** lupenquiries@hsl.gsi.gov.uk
Sent: 12 December 2017 10:28
To: Armani Akbar-Roy <Armani.Akbar-Roy@bwbconsulting.com>
Subject: RE: HSE ref: HSL-171013091008-509 BWB ref: BMW2401

Dear Armani

Our pipelines team have received confirmation from Cadent Gas regarding the names of the pipelines, these are the ones that affect your site,

HSE Ref	Transco Ref	Pipeline Operator	Pipeline Name	HSE Sta Ref
6883	1160	Cadent Gas Ltd	Sutton on the Hill / Thulston	SK 24833
6890	1167	Cadent Gas Ltd	Sutton on the Hill / Thulston	SK 24733

but there is also the pipeline below running East:wards from Thulston with the following details, this may be where the confusion has arisen

HSE Ref	Transco Ref	Pipeline Operator	Pipeline Name	HSE Sta Ref
12725	2735	Cadent Gas Ltd	Thulston / Thane Road	SK 41331

Regards

Kate

Land Use Planning Support Team
HSL, Harpur Hill,
Buxton,
SK17 9JN

Please note our new number is 0203 0283708

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FINALIST

From: Armani Akbar-Roy <Armani.Akbar-Roy@bwbconsulting.com>
To: "lupenquiries@hsl.gsi.gov.uk" <lupenquiries@hsl.gsi.gov.uk>,
Date: 05/12/2017 15:14
Subject: RE: HSE ref: HSL-171013091008-509 BWB ref: BMW2401

Hi Kate,

I hope you are well?

I write you today with regard to the below and whether you have received confirmation from National Grid, concerning the correct associations to the pipelines?

Regards,

Armani Akbar-Roy AMAPM

Consultant | Transport & Infrastructure Management | BWB Consulting Limited

Livery Place, 35 Livery Street, Colmore Business District, Birmingham B3 2PB

mob 07469 855 631 **web** www.bwbconsulting.com

twitter @bwbconsulting

From: Armani Akbar-Roy

Sent: 31 October 2017 15:20

To: 'lupenquiries@hsl.gsi.gov.uk' <lupenquiries@hsl.gsi.gov.uk>

Subject: RE: HSE ref: HSL-171013091008-509 BWB ref: BMW2401

Hi Kate,

Many thanks for your response.

I believe the record plan details the information. But I understand that this will need to be corroborated by Cadent Gas.

I look forward to hearing from you.

Regards,

Armani Akbar-Roy

Consultant | Transport & Infrastructure Management | BWB Consulting Limited

Livery Place, 35 Livery Street, Colmore Business District, Birmingham B3 2PB

mob 07469 855 631 **web** www.bwbconsulting.com

twitter @bwbconsulting

From: lupenquiries@hsl.gsi.gov.uk [<mailto:lupenquiries@hsl.gsi.gov.uk>]
Sent: 31 October 2017 15:18
To: Armani Akbar-Roy <Armani.Akbar-Roy@bwbconsulting.com>
Subject: RE: HSE ref: HSL-171013091008-509 BWB ref: BMW2401

Dear Armani

I have consulted our pipelines team regarding this issue. The data that we received from Cadent gas indicates that both pipelines have the same name. I have raised this as an issue that we need to check with Cadent gas however this may take us time as the pipelines team are currently very busy.

For your purposes the pipeline with the Transco reference 6890 is the one that we need to check with Cadent, the other pipeline (ref 6883) appears to have the correct name of Sutton Hill – Thurlston.

Regards

Kate

Land Use Planning Support Team
HSL, Harpur Hill,
Buxton,
SK17 9JN

Please note our new number is 0203 0283708

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From: Armani Akbar-Roy <Armani.Akbar-Roy@bwbconsulting.com>
To: "lupenquiries@hsl.gsi.gov.uk" <lupenquiries@hsl.gsi.gov.uk>,
Date: 26/10/2017 11:47
Subject: RE: HSE ref: HSL-171013091008-509 BWB ref: BMW2401

Good morning Kate,

Many thanks for providing this information, apologies for the delay in responding. I've been out of the office.

We've had a look at the below in context of the National Grid asset plans and it appears as though one of the Pipeline's names has been duplicated.

On the record plan, which I have attached for you review, the two bordering the southern relief road are named as follows;

Sutton Hill – Thane Road

Sutton Hill – Thurlston

I'd be most grateful if you would please confirm which of the Sutton Hill – Thurlston should actually be Thane Road.

Many thanks. Please let me know if anything is unclear.

Best regards,

Armani Akbar-Roy

Consultant | Transport & Infrastructure Management | BWB Consulting Limited

Livery Place, 35 Livery Street, Colmore Business District, Birmingham B3 2PB

mob 07469 855 631 web www.bwbconsulting.com

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From: Kate.Wagner@hsl.gsi.gov.uk [<mailto:Kate.Wagner@hsl.gsi.gov.uk>] **On Behalf Of** lupenquiries@hsl.gsi.gov.uk

Sent: 19 October 2017 13:39

To: Armani Akbar-Roy <Armani.Akbar-Roy@bwbconsulting.com>

Subject: Re: HSE ref: HSL-171013091008-509 BWB ref: BMW2401

Dear **Armani Akbar-Roy**

Thank you for your enquiry.

HSE is a statutory consultee for certain developments within the consultation distance of major hazard sites and major accident hazard pipelines.

I have had a look at the information you have provided and there are HSE Consultation zones for a Major Accident Hazard Pipeline that affect your proposed development.

The details for the Major Accident Hazard Pipelines and their associated HSE zones are:

Name: **Rolls Royce Tee - Rolls Royce**

HSE Ref: **12465**

Transco Ref: **2178**

Operator: **Cadent Gas Ltd**

HSE Consultation Zones

Inner Zone (in meters): **3**

Middle Zone (in meters): **3**

Outer Zone (in meters): **3**

Name: **Sutton on the Hill / Thulston**

HSE Ref: **6890**

Transco Ref: **1167**

Operator: **Cadent Gas Ltd**

HSE Consultation Zones

Inner Zone (in meters): **17**

Middle Zone (in meters): **70**

Outer Zone (in meters): **70**

Name: **Sutton on the Hill / Thulston**

HSE Ref: **6883**

Transco Ref: **1160**

Operator: **Cadent Gas Ltd**

HSE Consultation Zones

Inner Zone (in meters): **9**

Middle Zone (in meters): **42**

Outer Zone (in meters): **100**

These distances apply on either side of the pipeline. All distances should be measured from the centre of the pipeline. Where consultation distances coincide, the inner-most zone is used to determine HSE's Land Use Planning Advice.

Please contact the operator for any constraints they may have around the pipeline, and for a map showing the pipeline route. Please note that we only have indicative maps for the pipeline routes. If you wish to know the exact layout of the pipelines you will need to contact the pipeline operator.

HSE's Land Use Planning advice is based on an assessment of the risks from the pipeline as originally notified to HSE. It may be that in the vicinity of the proposed development the operator has modified the pipeline to reduce risks by, for example, laying thick-walled pipe. You may wish to consider contacting the pipeline operator to see if the pipeline has been modified in this area; if it has, then HSE is willing to reassess the risks from the pipeline, relative to the proposed development, if all the following details are supplied:

a) pipeline diameter, b) wall thickness, c) grade of steel, d) depth of cover over pipeline, e) start and finish points of thick-walled sections (this is not required if it is confirmed that they are more than 750m from all parts of the proposed development site. Please note that reassessment(s) may incur charges under our Option 3 consultancy services.

There is also further information on HSE's land use planning here: www.HSE.gov.uk/landuseplanning/

Please note we are now charging for elements of the pre-application advice to developers. The information provided in this email is part of our Option 1 service and is free, however options 2 and 3 will incur a charge. For further information please see www.hse.gov.uk/landuseplanning/developers.htm

If you require any further help please contact us.

Regards,

Kate Wagner

Land Use Planning Support Team
HSL, Harpur Hill,
Buxton,
SK17 9JN

Please note our new number is 0203 0283708

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FINALIST

From: Armani Akbar-Roy <Armani.Akbar-Roy@bwbcconsulting.com>
To: "lupenquiries@hsl.gsi.gov.uk" <lupenquiries@hsl.gsi.gov.uk>,
Date: 17/10/2017 18:40
Subject: HSE ref: HSL-171013091008-509 BWB ref: BMW2401

Good afternoon,

I raised an enquiry last week regarding the above referenced site. There appears to be multiple HP gas mains present within the site.

Our scheme is made up of residential and office/retail units and so understanding the constraints is key. As such, I would be most grateful if you would confirm the number of assets within this location that are considered Hazardous Installations and confirm each of the buffer zones.

If there is any other additional supporting information that you can provide, this would be most welcome.

Many thanks and I look forward to hearing from you.

Regards,

Armani Akbar-Roy

Consultant | Transport & Infrastructure Management | BWB Consulting Limited

Livery Place, 35 Livery Street, Colmore Business District, Birmingham B3 2PB

mob 07469 855 631 **web** www.bwbconsulting.com

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APPENDIX D
Linesearch Response

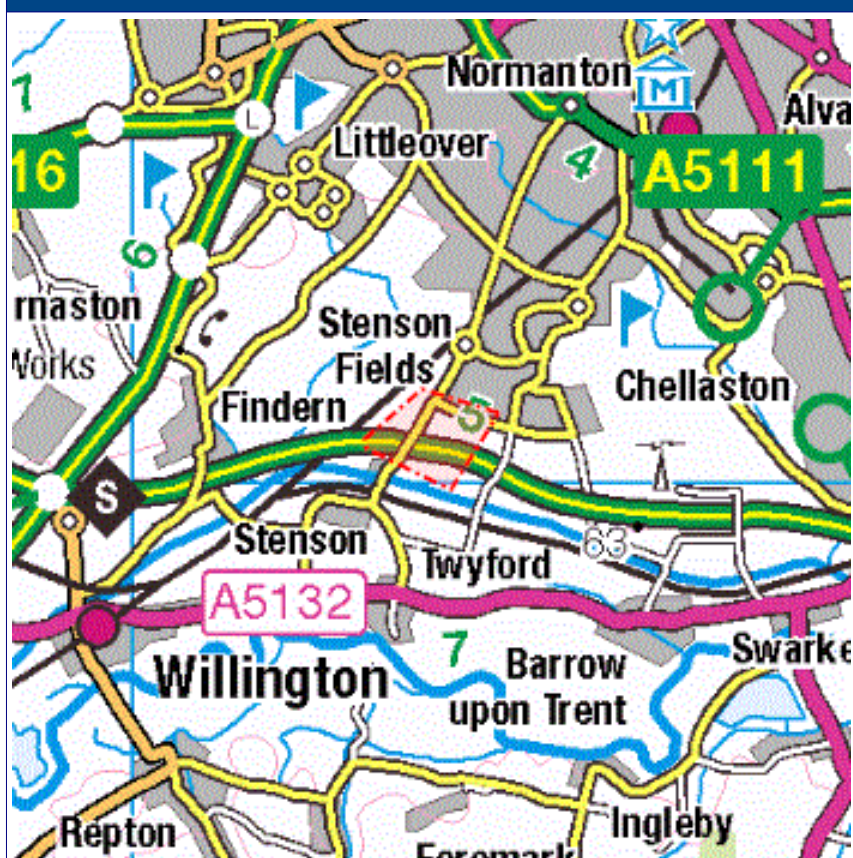
Enquirer

Name	Mr Simon Hilditch	Phone	0115 924 1100
Company	BWB Consulting Limited	Mobile	Not Supplied
Address	Waterfront House Station Street Nottingham Nottinghamshire NG2 3DQ		
Email	Utilities@bwbconsulting.com		

Enquiry Details

Scheme/Reference	Wragley Way		
Enquiry type	Planned Works	Work category	Development Projects
Start date	16/05/2019	Work type	Housing
End date	17/05/2019	Site size	833154 metres square
Searched location	XY= 433967, 330308	Work type buffer*	25 metres
Confirmed location	433044 330412		
Site Contact Name	Not Supplied	Site Phone No	Not Supplied
Description of Works	Not Supplied		

* The WORK TYPE BUFFER is a distance added to your search area based on the Work type you have chosen.

Site Map


Asset Owners

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LSBUD Members who have assets registered on the LSBUD service within the vicinity of your search area.

List of affected LSBUD members			
Asset Owner	Phone/Email	Emergency Only	Status
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Western Power Distribution	08000963080	08006783105	Await response

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BP Exploration Operating Company Limited	BPA	Carrington Gas Pipeline
CATS Pipeline c/o Wood Group PSN	Cemex	Centrica Storage Ltd
CLH Pipeline System Ltd	Concept Solutions People Ltd	ConocoPhillips (UK) Ltd
DIO (MOD Abandoned Pipelines)	Drax Group	E.ON UK CHP Limited
EirGrid	Electricity North West Limited	ENI & Himor c/o Penspen Ltd
EnQuest NNS Limited	EP Langage Limited	ESP Utilities Group
ESSAR	Esso Petroleum Company Limited	Fulcrum Pipelines Limited
Gamma	Gateshead Energy Company	Gigaclear Ltd
Gtt	Hafren Dyfrdwy	Heathrow Airport LTD
Humbly Grove Energy	IGas Energy	INEOS FPS Pipelines
INEOS Manufacturing (Scotland and TSEP)	INOVYN Enterprises Limited	Intergen (Coryton Energy or Spalding Energy)
Mainline Pipelines Limited	Manchester Jetline Limited	Manx Cable Company
Marchwood Power Ltd (Gas Pipeline)	Melbourn Solar Limited	Murphy Utility Assets
Northumbrian Water Group	NPower CHP Pipelines	Oikos Storage Limited
Ørsted	Perenco UK Limited (Purbeck Southampton Pipeline)	Perenco UK Limited (Purbeck Southampton Pipeline)
Petroineos	Phillips 66	Premier Transmission Ltd (SNIP)
Prysmian Cables & Systems Ltd (c/o Western Link)	Redundant Pipelines - LPDA	RWE - Great Yarmouth Pipeline (Bacton to Great Yarmouth Power Station)
RWEnpower (Little Barford and South Haven)	SABIC UK Petrochemicals	Scottish Power Generation
Seabank Power Ltd	Severn Trent (Chester area only)	SGN
Shell (St Fergus to Mossmorran)	Shell Pipelines	SSE (Peterhead Power Station)
Tata Communications (c/o JSM Construction Ltd)	Total (Colnbrook & Colwick Pipelines)	Total Finaline Pipelines
Transmission Capital	UK Power Networks	Uniper UK Ltd
Vattenfall	Veolia ES SELCHP Limited	Wales and West Utilities
Westminster City Council	Wingas Storage UK Ltd	Zayo Group UK Ltd c/o JSM Group Ltd

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Asset Owner	Preferred contact method	Phone	Status
BT	https://www.swns.bt.com/pls/mbe/welcome.home	08009173993	Not Notified
Cadent Gas	plantprotection@cadentgas.com	0800688588	Not Notified
CenturyLink Communications UK Limited	plantenquiries@instalcom.co.uk	02087314613	Not Notified
CityFibre	asset.team@cityfibre.com	033 3150 7282	Not Notified
Colt	plantenquiries@catelecomuk.com	01227768427	Not Notified
Energetics Electricity	plantenquiries@energetics-uk.com	01698404646	Not Notified
ENGIE	nrswa@cofely-gdfsuez.com	01293 549944	Not Notified
GTC	https://pe.gtc-uk.co.uk/PlantEnqMembership	01359240363	Not Notified
KPN (c/-Instalcom)	kpn.plantenquiries@instalcom.co.uk	n/a	Not Notified
Mobile Broadband Network Limited	mbnl.plant.enquiries@turntown.com	01212 621 100	Not Notified
Severn Trent Water	https://www.stwater.co.uk/developers/request-a-water/sewer-map/	03456016616	Not Notified
Sky UK Limited	nrswa@sky.uk	02070323234	Not Notified
Sota	SOTA.plantenquiries@instalcom.co.uk		Not Notified
Utility assets Ltd	assetrecords@utilityassets.co.uk		Not Notified
Verizon Business	osp-team@uk.verizonbusiness.com	01293611736	Not Notified
Virgin Media	http://www.digdat.co.uk	08708883116	Not Notified
Vodafone	osm.enquiries@atkinsglobal.com	01454662881	Not Notified

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Enquirer

Name	Mr Simon Hilditch	Phone	0115 924 1100
Company	BWB Consulting Limited	Mobile	Not Supplied
Address	Waterfront House Station Street Nottingham Nottinghamshire NG2 3DQ		
Email	Utilities@bwbconsulting.com		

Enquiry Details

Scheme/Reference	Wragley Way		
Enquiry type	Planned Works	Work category	Development Projects
Start date	17/05/2019	Work type	Housing
End date	24/05/2019	Site size	748781 metres square
Searched location	XY= 433967, 330308	Work type buffer*	25 metres
Confirmed location	434165 330329		
Site Contact Name	Not Supplied	Site Phone No	Not Supplied
Description of Works	Not Supplied		

* The WORK TYPE BUFFER is a distance added to your search area based on the Work type you have chosen.

Site Map


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BT	https://www.swns.bt.com/pls/mbe/welcome.home	08009173993	Not Notified
Cadent Gas	plantprotection@cadentgas.com	0800688588	Not Notified
CenturyLink Communications UK Limited	plantenquiries@instalcom.co.uk	02087314613	Not Notified
CityFibre	asset.team@cityfibre.com	033 3150 7282	Not Notified
Colt	plantenquiries@catelecomuk.com	01227768427	Not Notified
Derby City Council	R&CHighways&TransportNetworkManagement@derby.gov.uk	01332256004	Not Notified
Energetics Electricity	plantenquiries@energetics-uk.com	01698404646	Not Notified
ENGIE	nrsua@cofely-gdfsuez.com	01293 549944	Not Notified
GTC	https://pe.gtc-uk.co.uk/PlantEnqMembership	01359240363	Not Notified
KPN (c/-Instalcom)	kpn.plantenquiries@instalcom.co.uk	n/a	Not Notified
Mobile Broadband Network Limited	mbnl.plant.enquiries@turntown.com	01212 621 100	Not Notified
Severn Trent Water	https://www.stwater.co.uk/developers/request-a-water/sewer-map/	03456016616	Not Notified
Sky UK Limited	nrsua@sky.uk	02070323234	Not Notified
Sota	SOTA.plantenquiries@instalcom.co.uk		Not Notified
Utility assets Ltd	assetrecords@utilityassets.co.uk		Not Notified
Verizon Business	osp-team@uk.verizonbusiness.com	01293611736	Not Notified
Virgin Media	http://www.digdat.co.uk	08708883116	Not Notified
Vodafone	osm.enquiries@atkinsglobal.com	01454662881	Not Notified

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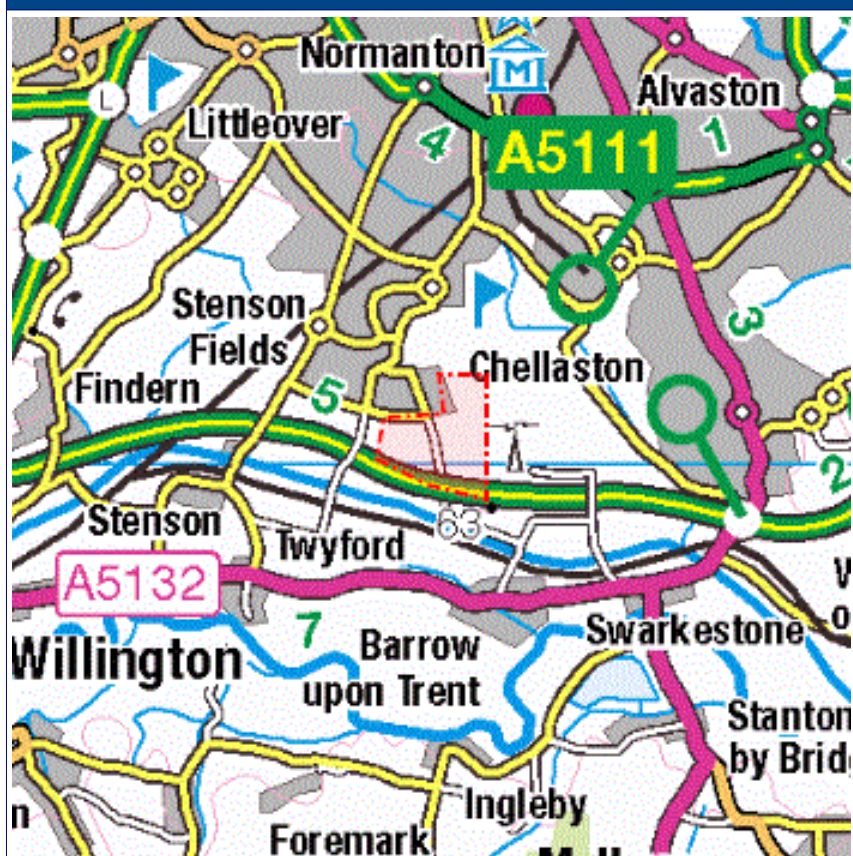
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End date	24/05/2019	Site size	999431 metres square
Searched location	XY= 433967, 330308	Work type buffer*	25 metres
Confirmed location	434664 330260		
Site Contact Name	Not Supplied	Site Phone No	Not Supplied
Description of Works	Not Supplied		

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CenturyLink Communications UK Limited	plantenquiries@instalcom.co.uk	02087314613	Not Notified
CityFibre	asset.team@cityfibre.com	033 3150 7282	Not Notified
Colt	plantenquiries@catelecomuk.com	01227768427	Not Notified
Derby City Council	R&CHighways&TransportNetworkManagement@derby.gov.uk	01332256004	Not Notified
Energetics Electricity	plantenquiries@energetics-uk.com	01698404646	Not Notified
ENGIE	nrsua@cofely-gdfsuez.com	01293 549944	Not Notified
GTC	https://pe.gtc-uk.co.uk/PlantEnqMembership	01359240363	Not Notified
KPN (c/-Instalcom)	kpn.plantenquiries@instalcom.co.uk	n/a	Not Notified
Mobile Broadband Network Limited	mbnl.plant.enquiries@turntown.com	01212 621 100	Not Notified
Severn Trent Water	https://www.stwater.co.uk/developers/request-a-water/sewer-map/	03456016616	Not Notified
Sky UK Limited	nrsua@sky.uk	02070323234	Not Notified
Sota	SOTA.plantenquiries@instalcom.co.uk		Not Notified
Utility assets Ltd	assetrecords@utilityassets.co.uk		Not Notified
Verizon Business	osp-team@uk.verizonbusiness.com	01293611736	Not Notified
Virgin Media	http://www.digdat.co.uk	08708883116	Not Notified
Vodafone	osm.enquiries@atkinsglobal.com	01454662881	Not Notified

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BETTER SOLUTIONS, INTELLIGENTLY ENGINEERED



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ENVIRONMENT

Hallam Land Management Ltd
Infinity Garden Village
Wragley Way
Sustainable Drainage Statement

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Sustainable Drainage Statement

Birmingham
Livery Place, 35 Livery Street, Colmore Business District, Birmingham, B3 2PB
T: 0121 233 3322

Cambridge
14-16 High Street, Histon, Cambridge
CB24 9JD
T: 01223 235 173

Leeds
Whitehall Waterfront, 2 Riverside Way, Leeds
LS1 4EH
T: 0113 233 8000

London
11 Borough High Street
London, SE1 9SE
T: 0207 407 3879

Manchester
4th Floor Carvers Warehouse, 77 Dale Street
Manchester, M1 2HG
T: 0161 233 4260

Market Harborough
12a Woodcock House, Compass Point Market Harborough, Leicestershire, LE16 9HW
T: 01858 455020

Nottingham
Waterfront House, Station Street, Nottingham NG2 3DQ
T: 0115 924 1100

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CONTENTS

1.	INTRODUCTION	1
	Sustainable Drainage Guidance	2
2.	EXISTING CONDITIONS	4
	Existing Runoff Rates	6
	Existing Runoff Volume	7
3.	SURFACE WATER DRAINAGE STRATEGY	8
	Drainage Hierarchy	8
	Peak Flow Control	8
	Attenuated Storage	10
	Runoff Volume Control	12
	Long Term Storage	12
	Sustainable Drainage Systems	13
	Watercourse Standoffs	13
	Residual Risk and Designing for Exceedance	13
4.	FOUL WATER DRAINAGE	15
5.	MAINTENANCE	16
6.	SUMMARY	17

FIGURES

Figure 1.1: Site Location

Figure 1.2: Local Authority Boundaries

Figure 2.1: Catchment Area

Figure 2.2: BGS Bedrock Geology

TABLES

Table 1.1: Site Details

Table 2.1: Existing Greenfield Runoff Rates from the Site

Table 3.1: Surface Water Discharge Rates (l/s)

Table 3.2: Outline Attenuated Storage Requirements

Table 3.3: Runoff Volume Comparison

Table 6.1: Sustainable Drainage Statement Summary

APPENDICES

APPENDIX 1: Site Proposals
APPENDIX 2: Topographical Survey
APPENDIX 3: Micro Drainage Calculations
APPENDIX 4: Outline Surface Water Drainage Strategy
APPENDIX 5: Severn Trent Water DSE & Sewer Records

1. INTRODUCTION

- 1.1 A Sustainable Drainage Statement (SDS) sets out the principles of drainage design for a development and summarises the reasoning behind the chosen design. This includes consideration of national and local guidance, justification of specific flow rates, volumes of attenuated storage, as well as the appropriate level of treatment to be provided to surface water runoff.
- 1.2 This SDS has been produced by BWB Consulting on behalf of Hallam Land Management Ltd in respect of a site located at Wragley Way, Derby. The following application is to support proposals for a large, residential-led mixed-use development incorporating local services and facilities, retail spaces and landscaping. Development proposals are included for reference as **Appendix 1**.
- 1.3 A Flood Risk Assessment has been developed for the site (reference WRA-BWB-ZZ-XX-RP-YE-0002_FRA) and this Sustainable Drainage Statement should be read in conjunction with that FRA.
- 1.4 This SDS is intended to support an outline planning application and as such the level of detail included is commensurate and subject to the nature of the proposals.
- 1.5 In addition to the proposed residential-led development, the red line boundary includes the extent of a proposed new A50 Junction and link road connecting to the existing Infinity Park Way to the northeast of the site, and employment land to the east of Deep Dale Lane. The new A50 junction and employment land are included within other separate planning applications and so will not be considered as part of this Sustainable Drainage Statement.
- 1.6 The location and extent of the site is illustrated within **Figure 1.1**.

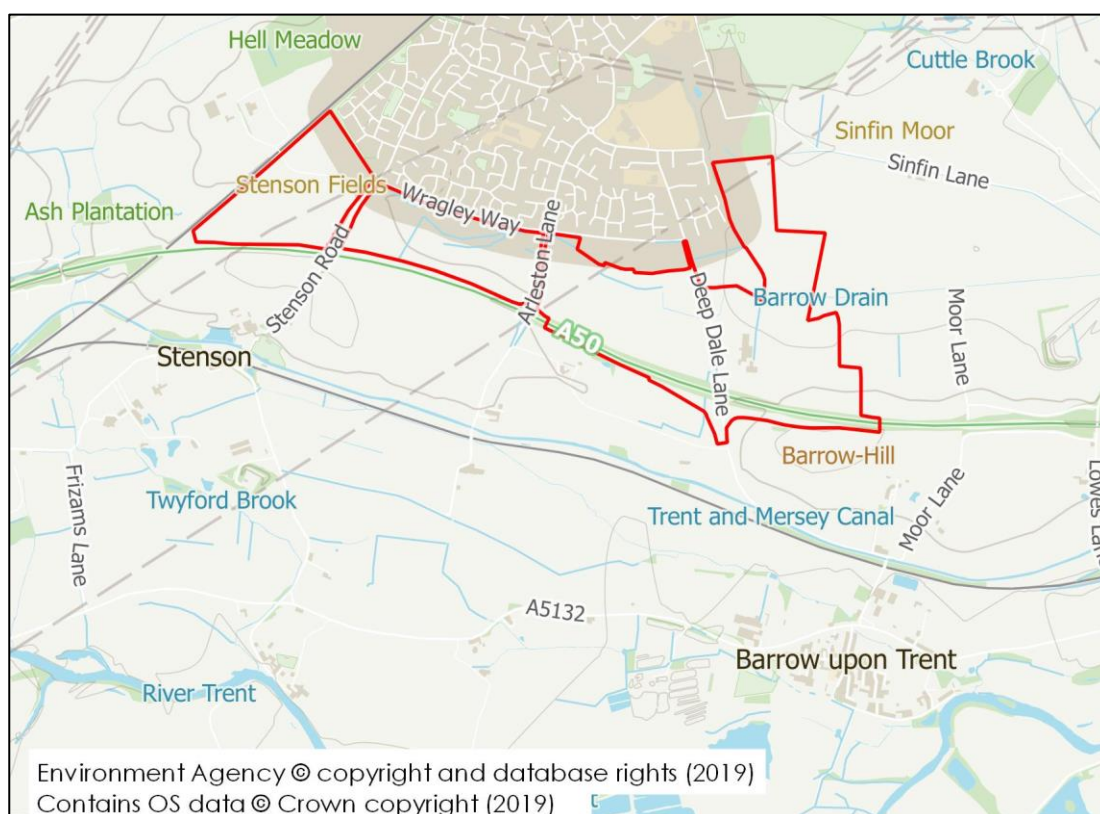


Figure 1.1: Site Location

Table 1.1: Site Details

Site Name	Infinity Garden Village (Wragley Way)
Location	Land off Wragley Way, South Derby
NGR (approx.)	Centre of site: 434340, 330410
Application Site Area (ha)	149ha
Development Area (ha)	54ha
Development Type	Residential-led Mixed-Use
Lead Local Flood Authority	Derbyshire County Council & Derby City Council
Local Planning Authority	South Derbyshire District Council
Environment Agency Area	East Midlands

Sustainable Drainage Guidance

- 1.7 The main built development is located entirely within South Derbyshire District Council's unitary authority boundary. Therefore, Derbyshire County Council will act as Lead Local Flood Authority in this instance. The site is near Derby City Council's boundary and so Derby City Council may have a vested interest as an adjoining Lead Local Flood Authority. These local authority boundaries are shown within **Figure 1.2**.

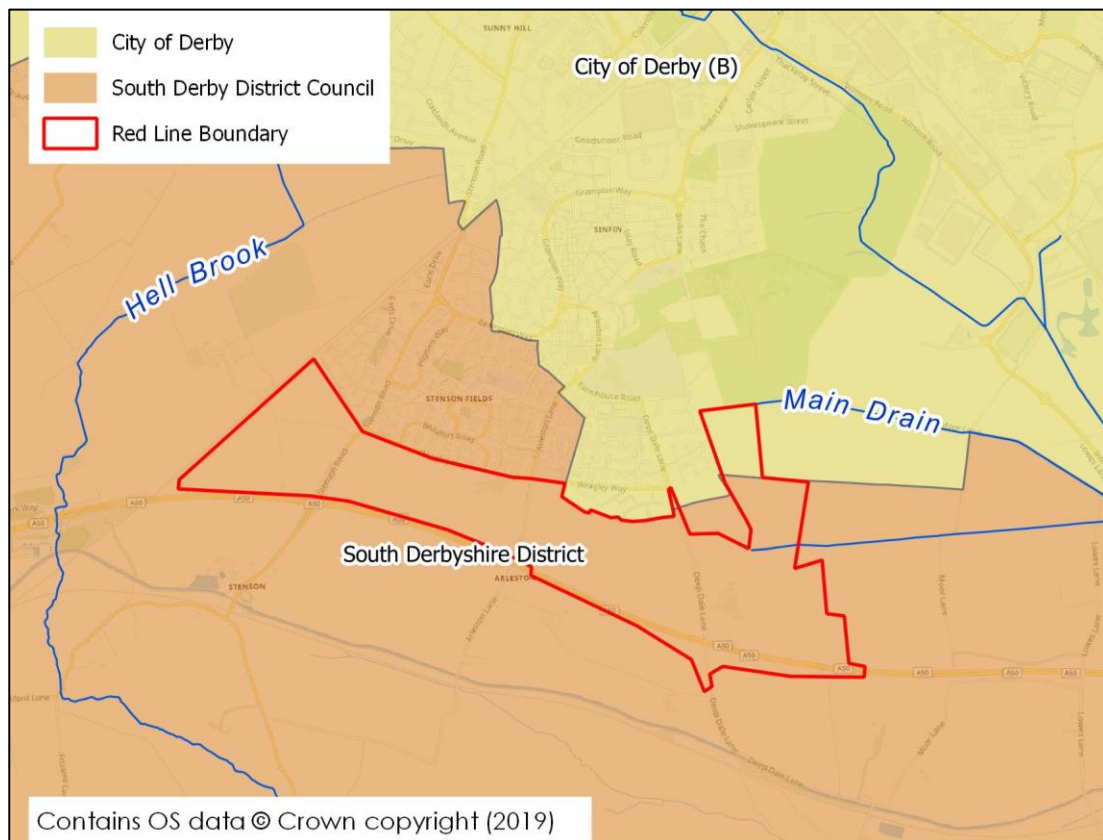


Figure 1.2: Local Authority Boundaries

- 1.8 Derbyshire County Council have published Guidance Notes: 'Planning and Development'¹ which discusses the approach to sustainable drainage and surface water management and aims to ensure that surface water is managed in accordance with the National Planning Policy Framework (NPPF) and associated Planning Practice Guidance.
- 1.9 Both Derbyshire County Council and Derby City Council promote the use of SuDS and to ensure that Derby's continued housing and employment growth is sustainable and the impact on flood risk and the wider environment is managed.
- 1.10 The local guidance has been considered in conjunction with the Non-Statutory Technical Standards for Sustainable Drainage Systems² and the SuDS Manual³ in the development of the drainage strategy.
- 1.11 An open dialogue of review and consultation has been ongoing throughout this project and involvement in the wider area with South Derbyshire District Council, Derbyshire County Council and Derby City Council to understand their preference on key drainage principles and use of SuDS.

¹ Guidance Notes: Planning and Development(Derbyshire County Council, July 2015)

² 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems

³ The SuDS Manual, CIRIA (2007)

2. EXISTING CONDITIONS

- 2.1 The site is largely greenfield in nature currently comprising agricultural fields, farmland and a small collection of associated buildings at Ashlea Farm off Deep Dale Lane. Part of the application area also includes sections of the existing A50 and local roads including Deep Dale Lane, however as these are considered within other planning applications will not be discussed further in this SDS.
- 2.2 The extents of the catchment assessed comprised of the development parcels indicated within the current masterplan is shown within **Figure 2.1** below.

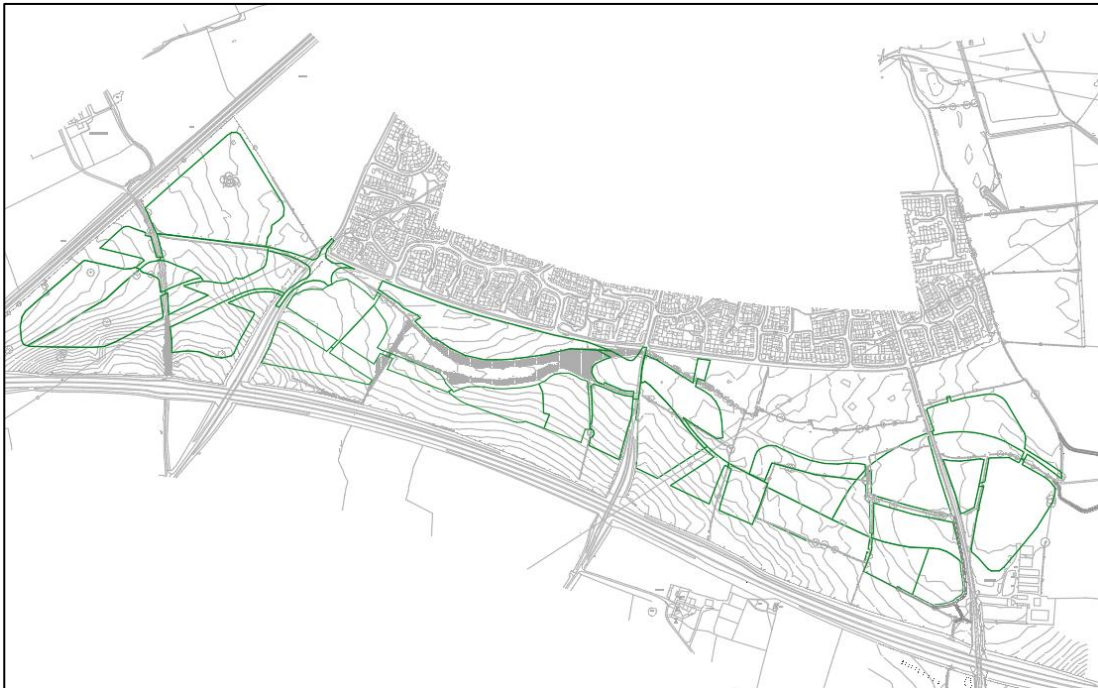


Figure 2.1: Catchment Area

- 2.3 The site is located close to two Environment Agency Main Rivers: the Main Drain and the Barrow Drain. These EA Main Rivers form part of the Cuttle Brook catchment which lies approximately 1.9km downstream.
- 2.4 There is a general fall across the site from west to east, although this is relatively imperceptible on the ground. There are localised falls towards the network of primary ditches but again any gradient is typically quite slight. The only noticeable changes in topography are located towards the A50 to the southern boundary where the ground is elevated in parts and embankments have been formed to enable crossings for Stenson Road and Arleston Lane over the A50. A topographical survey is included for reference as **Appendix 2**.
- 2.5 The bedrock geology is Gunthorpe Member Mudstone across the western site extent, with Branscombe Mudstone Formation - Mudstone to the east and Edwalton Member Mudstone to the southeast. Along the A50 south eastern extent the bedrock is indicated to be a combination of Cotgrave Sandstone Member and Edwalton Member Mudstone. As shown within **Figure 2.2**.

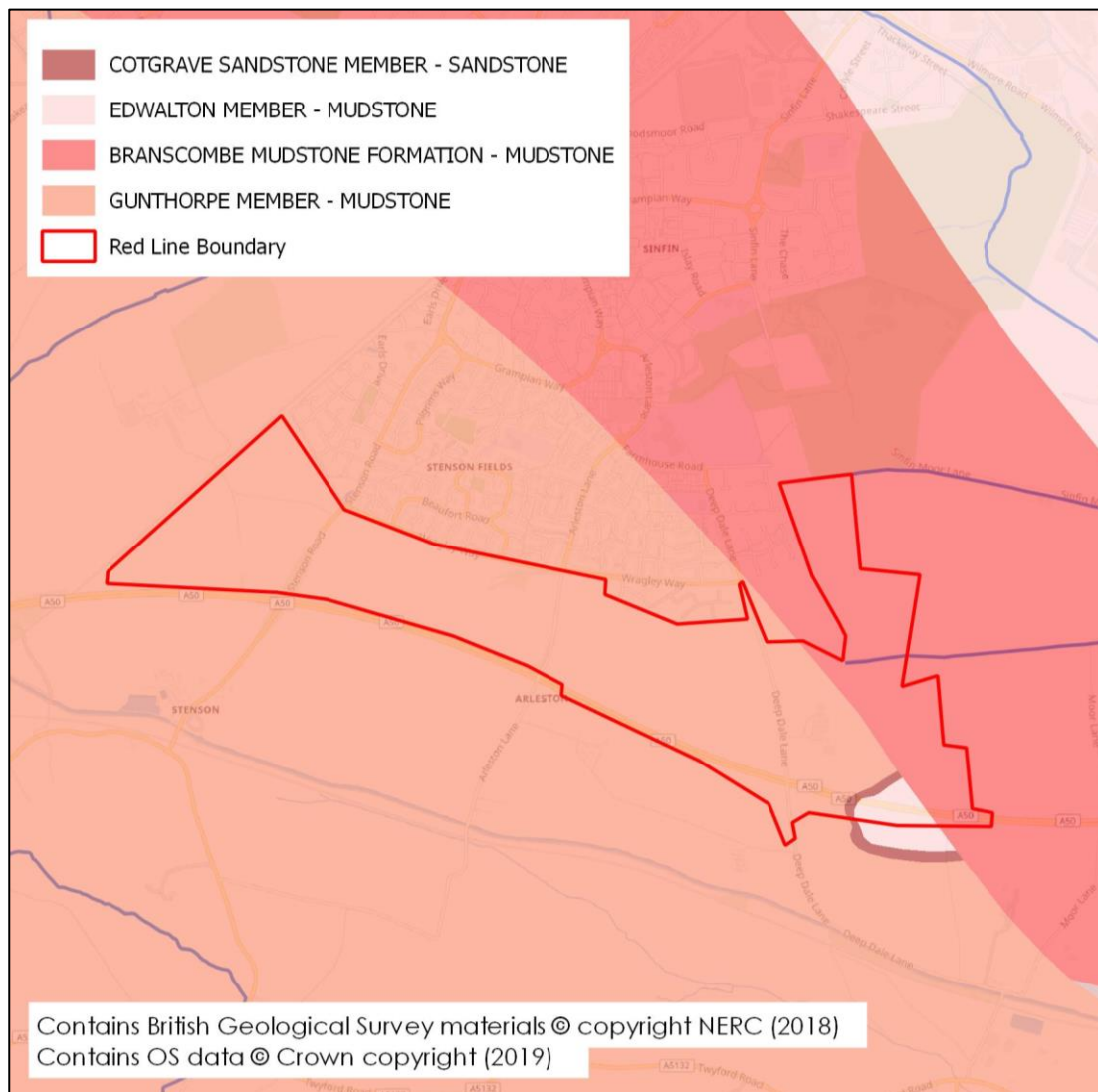


Figure 2.2: BGS Bedrock Geology

- 2.6 The current drainage regime for the site consists of a natural system of runoff to the network of minor watercourses and ditches, which currently act as land drainage for the existing agricultural fields and limited infiltration potential where ground conditions permit. Observations from numerous site visits indicate the presence of several informal clay pipe and perforated plastic pipe outfalls to the ditch network from typical land drainage systems. These appear to assist in draining the land in places to minimise waterlogging and unfavourable farming conditions.
- 2.7 There have been reported instances of standing water in certain sections of the site towards the east following periods of intense rainfall, where water has struggled to drain away in sufficient time due to the lack of gradient and relatively small capacity of the ditch.
- 2.8 The proposed development is located at the head of the catchment of the unnamed watercourse (eventually part of the Barrow Drain) and will seek to capture a large proportion of the catchment flows at source, managing and controlling them within the drainage strategy prior to outfall to the ditch at a controlled rate.

- 2.9 A high pressure gas main passes beneath the Deep Dale Lane, Stenson Road & Arleston Lane carriageways, and crosses the application boundary at Deep Dale Lane, south of Ashlea Farm. It is important to take this into consideration as a constraint when undertaking any works in or around it to ensure the appropriate safety measures are in place to avoid incident.

Existing Runoff Rates

- 2.10 The following calculations are based upon the catchment area wholly dedicated to the residential-led mixed use development as per **Figure 2.1**. The net developable area for these parcels only has been calculated to be approximately 54ha. Considering the proposals are seeking 'garden village' status, it is assumed that the residential parcels defined in this outline application will have an impermeable area of approximately 55% of the net developable area.
- 2.11 Derbyshire County Council Guidance Notes for Planning & Development⁴ refer to the need to factor in urban creep in any new development. Therefore as part of the following strategy a potential 10% increase in impermeable areas has been allowed for to manage urban creep, resulting in an estimated 65% impermeable area across the development parcels. This equates to a total impermeable area of 35ha.
- 2.12 An assessment of the equivalent greenfield surface water runoff rates from the proposed development area has been estimated based upon a measured area of approximately 35ha.
- 2.13 An assessment of the equivalent greenfield surface water runoff rates from the have been undertaken and area summarised within **Table 2.1**. The runoff rates have been estimated using the IH124 method, with appropriate prorated adjustments for a site of less than 50ha, as recommended in Interim Code of Practice for Sustainable Drainage⁵. This was undertaken within Micro Drainage, which makes the necessary adjustments for small sites automatically.

Table 2.1: Existing Greenfield Runoff Rates from the Site

Return Period (Yrs.)	Runoff Rate (l/s)
1	98.8
Mean Annual Flow Rate (QBAR)	119.1
30	233.3
100	306.0

- 2.14 This calculation results in an existing greenfield QBAR rate equivalent to **3.4l/s/ha**.

⁴ Guidance Notes: Planning & Development (DCC, July 2015)

⁵ The National SUDS Working Group (2004), Interim Code of Practice for Sustainable Drainage

Existing Runoff Volume

- 2.15 An assessment of the existing surface water runoff rates from the site area has been made for a 1 in 100-year, 6 hour storm.
- 2.16 As the existing site is previously undeveloped, the runoff volume has been calculated using the Source Control module within Micro Drainage. This returns a predicted result of **8,396.25m³**, results are included within **Appendix 3**.

3. SURFACE WATER DRAINAGE STRATEGY

- 3.1 A proposed surface water drainage strategy will be put forward for the site as a whole to demonstrate appropriate consideration within the illustrative masterplan and confirmation drainage of all parcels is feasible.
- 3.2 The outline nature of the accompanying planning application means that the surface water drainage strategy put forward here seeks to set out a framework of sustainable drainage principles upon which more detailed drainage design can be prepared as various phases and plots are brought forward.

Drainage Hierarchy

- 3.3 The Planning Practice Guidance⁶ and the SuDS Manual⁷ identify that surface water runoff from a development should be disposed of as high up the following hierarchy as reasonably practicable:
- i. into the ground (infiltration);
 - ii. to a surface water body;
 - iii. to a surface water sewer, highway drain, or another drainage system;
 - iv. to a combined sewer.
- 3.4 In line with the drainage hierarchy, BWB Consulting has undertaken previous ground investigations on the land adjacent to Deep Dale Lane as part of a Phase II Geo Environmental Assessment to support adjacent planning applications (Report reference: NTH2136/02/V1/WEST and NTH2136E/02/V1/EAST, February 2014).
- 3.5 The Phase II Geo Environmental Assessment confirmed the underlying geology to be unsuitable to support infiltration as a means of surface water discharge due to the identified geology. The superficial lacustrine deposits are relatively poorly draining, resulting in the shallow groundwater depths encountered. Therefore, the use of soakaways at the site will not be adopted.
- 3.6 The aim of this approach is to manage surface water runoff close to where it falls and mimic natural drainage as closely as possible. As infiltration is not viable at the site, the next preferred method would be discharge to the nearby watercourse.
- 3.7 It is therefore proposed to discharge surface water to the existing watercourses, at a restricted runoff for each sub-catchment.

Peak Flow Control

- 3.8 Derbyshire County Council guidance states that runoff from the site should be discharged at rates and volumes no greater than the event specific greenfield values.

⁶ Planning Practice Guidance, <http://planningguidance.planningportal.gov.uk/>.

⁷ The SuDS Manual (C753). CIRIA 2015.

- 3.9 This is further confirmed by the Non-Statutory Technical Standards for Sustainable Drainage Systems S2-S3⁸, which also states that runoff from greenfield developments should not exceed the equivalent greenfield rates for the 1 and 100-year return period events.
- 3.10 The greenfield QBAR rate for the entire site has been calculated to be 119.10l/s, which results in an equivalent rate of **3.4l/s/ha**. It is therefore proposed to restrict the proposed runoff from the development (on a sub-catchment basis) to a rate of 3.4l/s/ha.
- 3.11 There are approximately 7 out of 19 catchments that are smaller than 1.5ha, which results in a potential restricted discharge rate less than 5l/s. A minimum fixed discharge rate of 5l/s has been adopted on these catchments as it represents a practicable minimum discharge rate from a flow control structure. It strikes a compromise between attenuating to a satisfactory low flow rate while keeping the risk of blockage to an acceptable level, in line with the practicable minimum limit as stated within CIRIA guidance⁹. This is summarised within **Table 3.1**.

Table 3.1: Surface Water Discharge Rates (l/s)

Catchment	Catchment Area (ha)	Impermeable Area (ha)	Discharge Rate (l/s)
A1	3.21	2.09	7.1
A2	5.58	3.63	12.3
A3	7.73	5.02	17.1
A4	2.68	1.74	5.9
A5	1.57	1.02	5.0
A6	1.98	1.29	5.0
A7	3.45	2.24	7.6
A8	1.54	1.00	5.0
A9	0.9	0.59	5.0
A10	1.35	0.88	5.0
A11	4.86	3.16	10.7
A12	2.60	1.69	5.7
A13	3.73	2.42	8.2
A14	2.37	1.54	5.2

⁸ 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems

⁹ The SuDS Manual, CIRIA (2007)

A15	1.62	1.05	5.0
A16	2.48	1.61	5.4
A17	0.79	0.51	5.0
A18	3.54	2.30	7.8
A19	2.30	1.49	5.0
Total	54	35	133

- 3.12 The current sub-catchment arrangement therefore results in a small net increase in the equivalent greenfield (QBAR) rate from the site of 13.9l/s. This is not significant a significant increase and is still much reduced against the baseline conditions for all other return periods.
- 3.13 Detailed design and phasing may seek to refine these catchment areas, and resulting discharge rates such that the existing QBAR rate is met.

Attenuated Storage

- 3.14 As the development proposals require a restricted runoff rate, it will be necessary to provide attenuated storage to balance the excess volume in a safe manner within the site.
- 3.15 The surface water storage should be located within the site in a position where it can receive runoff from the development and discharge by gravity to the receiving watercourse. Existing constraints such as the watercourse invert levels, crossings over the gas main through the site and relatively flat topography has resulted in the formation of such discrete sub-catchments. However, the proliferation of SUDS features throughout the site complements the strategy of blue-green infrastructure inherently embedded into the layout complementing the garden village aesthetic.
- 3.16 Sufficient storage for events up to the 1 in 100-year storm with an allowance for climate change should be provided. In this case, a 40% increase in peak rainfall intensity has been used in line with Environment Agency guidance and to provide future resilience for such a strategic development.
- 3.17 After considering the site constraints and development aspirations it is suggested that the necessary surface water storage volume is located within detention basins located adjacent to the development parcels with suitable outfalls to the adjacent watercourses.
- 3.18 For the purpose of this outline assessment, it has been assumed that a number of proposed detention basins will accommodate all of the necessary storage, but it may be possible to redistribute a portion of the storage within other drainage components during the detailed design of the development (e.g.: in the pipe network, swales, filter drains, rain gardens etc).

- 3.19 A simulation has been run using Micro Drainage to identify the necessary storage provision. Using a restriction of 3.4l/s/ha, or a minimum restriction rate of 5l/s in the identified catchments under 1.5ha, the volume of attenuated storage required for the development has been calculated for storm events up to the 100 year + 40% climate change storm. The results are summarised in **Table 3.2**.
- 3.20 The FEH rainfall method approach has been utilised in the design of attenuation to provide a conservative estimate. Micro Drainage outputs are included as **Appendix 3**.

Table 3.2: Outline Attenuated Storage Requirements

Catchment Area	Rainfall Method	Minimum Required Volume (m ³)
A1	FEH	2,200
A2	FEH	4,200
A3	FEH	5,900
A4	FEH	2,650
A5	FEH	1,100
A6	FEH	1,500
A7	FEH	2,600
A8	FEH	1,080
A9	FEH	600
A10	FEH	960
A11	FEH	3,900
A12	FEH	2,050
A13	FEH	2,950
A14	FEH	2,100
A15	FEH	1,300
A16	FEH	1,950
A17	FEH	600
A18	FEH	1,050
A19	FEH	1,820
Total		40,510

- 3.21 It is expected that approximately 40,510m³ of attenuated storage will be provided across the site as a whole to cater for the maximum anticipated runoff volume for all storm durations up to the 1 in 100-year return period storm, including 40% climate change allowance. This is subject to refinement at detailed design.

Runoff Volume Control

- 3.22 The Non-Statutory Technical Standards for Sustainable Drainage Systems S4-S6¹⁰ states that where reasonably practical the runoff volume from a development for the 1 in 100-year 6 hour rainfall event should not exceed the runoff volume prior to development.
- 3.23 Where it is not reasonably practicable to constrain the volume of runoff from a development at or below the existing volume, then the runoff must be discharged in a manner that does not adversely affect flood risk, i.e.:
- i. The additional runoff volume resulting from the development (the 'long term storage volume') should be discharged separately from the site at a rate of 2L/s/ha or less. Or,
 - ii. All the runoff volume from the development should be discharged at a rate equivalent to the mean annual flow rate (QBAR) rate under greenfield conditions or less. Or,
 - iii. All the runoff volume from the development should be discharged at a rate of 2L/s/ha or less.
- 3.24 An estimate of the post-development runoff volume from the 1 in 100-year 6 hour storm can be derived from the Micro Drainage calculations. The existing and post-development runoff volumes are compared within **Table 3.3**.

Table 3.3: Runoff Volume Comparison

Existing Volume (m ³)	Proposed Volume (m ³)	Difference (m ³)
8,396.25	22,386.0	13,989.75

- 3.25 The 1 in 100-year 6 hour storm runoff volume from the site has been shown to increase as a result of the proposed development. However, as the runoff volume from the proposed development will be discharged at a rate equivalent to the mean annual flow rate (QBAR) rate under greenfield conditions, there is no requirement to consider additional volume control measures.

Long Term Storage

- 3.26 It is proposed to discharge the runoff from the development at a rate equivalent to the mean annual flow rate (QBAR) rate under greenfield conditions or less. Therefore, provision for long term storage is not required.

¹⁰ 2015, DEFRA, Non-statutory technical standards for sustainable drainage systems

Sustainable Drainage Systems

- 3.27 It is recommended that within each proposed catchment, above-ground attenuation systems are used wherever possible to store the additional runoff expected. Swales, permeable paving, rain gardens and tree pits would act to convey runoff around the site and into larger attenuation facilities before being discharged to the watercourses. Inclusion of a range of source control measures would not only provide a holistic and sustainable solution to surface water management but would also contribute to the garden village aspirations.
- 3.28 As a minimum, all runoff should pass through at least two stages of a treatment train prior to discharge to the watercourse. Any large parking areas associated with other uses should be installed with appropriate petrol interceptors and/or permeable paving. Any land uses that have high potential hydrocarbon use, or an increased potential for contamination should be separated and discharged to the public foul sewer system if deemed necessary.
- 3.29 Detailed discharge rates based on actual drainage catchments, points of connection to the watercourse or sewer system and appropriate storage volumes should all be confirmed at detailed design stage and agreed with the appropriate approval body. Future iterations of any masterplan for the site should include an appropriate allowance for above ground storage features as outlined above.
- 3.30 An indicative surface layout for the development is shown on BWB Dwg No. WRA-BWB-ZZ-XX-DR-CD-500 - WRA-BWB-ZZ-XX-DR-CD-506, included for reference as **Appendix 4**. This demonstrates how the required storage has been accommodated within the current illustrative layout.

Watercourse Standoffs

- 3.31 The ordinary watercourses that flow through the site will require an appropriate standoff from the top of bank to be confirmed in consultation with Derbyshire County Council. Any outfalls proposed to the watercourse will also require Land Drainage Consent applications to be submitted at the appropriate juncture.
- 3.32 In line with Derbyshire County Council guidance, a standoff to the built development has been incorporated within the proposals. Their guidance states that a standoff of 3 metres for watercourses less than 2 metres wide and a 4.5m standoff (i.e. vehicle width) for becks/streams over 2m width. If there are culverts then recommended 3 metres or greater to ensure no loading in the 45 degree zone from invert.
- 3.33 Details however are to be confirmed subject to consultation with the appropriate regulatory bodies.

Residual Risk and Designing for Exceedance

- 3.34 Both Derbyshire County Council and Derby City Council encourage developments which accord with the principles of sustainability in design, including appropriate measures to minimise the impact of surface water drainage.

- 3.35 It is recommended that within each proposed catchment, above-ground attenuation systems are used wherever possible to store the additional runoff expected. Swales, permeable paving and tree pits within highway drainage systems would act to convey runoff around the site and into larger attenuation facilities before being discharged to the watercourses.
- 3.36 Where a level of freeboard has been incorporated within all storage features which will provide between 200mm and 300mm additional allowance in addition to the 1 in 100yr plus climate change storm event.
- 3.37 An urban creep allowance of up to 10% has been included within the assumed 65% impermeable area in the sizing of storage. Following receipt of a detailed layout, this approximation can be more accurately assessed.
- 3.38 In addition to the volume of storage provided within the main attenuation, there will be capacity within upstream pipes and manholes which has not been accounted for at this stage and a further level of redundancy to the network will therefore be provided.

4. FOUL WATER DRAINAGE

- 4.1 Severn Trent Water has been consulted with regards to connections to the public foul sewer system.
- 4.2 At present, due to *"the size of the development and the complexity of the receiving sewerage system"* sewer modelling is required by Severn Trent Water to understand the impact of the development and what works will be required to accommodate it. A copy of their correspondence is included as **Appendix 5**.
- 4.3 Nevertheless, there are a number of public foul sewers located in close proximity to the site boundary. As such, a connection to the network is considered feasible, although additional measures such as on-site pumping and potential improvements to network pumping station upgrades may be required.
- 4.4 It is recommended that early engagement with Severn Trent Water is undertaken to ensure that they commence to undertake the necessary sewer modelling to confirm what works will be needed to support the proposed development. Following completion of the modelling works Severn Trent will then be responsible for delivering any required improvement works. Typically speaking following commencement of the modelling the identification and implementation of the proposals can take 18-24 months and as such it is anticipated that this will be in line with any development programme for first occupations etc.
- 4.5 As such it is considered that a solution on the site would be feasible and therefore would not prevent development occurring. An appropriate solution will ensure that flood risk to the wider catchment is not exacerbated as a result of the proposed development.

5. MAINTENANCE

- 5.1 Unless adopted by Severn Trent Water as part of the public sewer network, or Derbyshire County Council as LLFA, it is likely that a management company would adopt the SuDS features and carry out maintenance of these including vegetation management, trash screen clearing and regular outfall inspections.
- 5.2 Requirements for ongoing maintenance of the drainage network should form part of the Operation and Maintenance manual for the site and should be undertaken by the site management. Any specialist or proprietary products that are specified at detailed design should have a manufacturer specific maintenance regime which should be included within the document.
- 5.3 It is envisaged that the Operation and Maintenance manual will be developed at the detailed design stage, but some examples are included below.
- i. All drainage features should be located in open areas which are readily accessible.
 - ii. Gullies should be inspected and de-silted at least once a year, where necessary.
 - iii. Pipes, manholes and silt traps should be inspected and de-silted at least once a year, where necessary.
 - iv. If permeable paving is incorporated within the layout, it should be swept a minimum of every 6 months to maintain flow capacity of the joints between blocks.
 - v. The surface water attenuation areas will be predominantly dry and the base should be seeded with a wildflower grass seed mix that can tolerate wet ground conditions.
 - vi. Regular inspections of the attenuation basin should be undertaken to remove litter/debris, invasive/colonising vegetation and silt build up as necessary. Inlet and outlet structures to be regularly inspected, with remedial work as required to maintain water flows and prevent silt/vegetation build up.
 - vii. Vegetation/grass with the attenuation basin should be maintained appropriately to allow establishment and promote habitat formation, without impeding the operation of the inlet and outlet structure.
 - viii. Flow control devices should be inspected every 6 months, litter/debris and silt build up should be removed as necessary.

6. SUMMARY

- 6.1 This statement and supporting appendices demonstrate that the drainage design for the development will comply with the relevant local and national standards, specifically the hierarchy of discharge, runoff rate and volume criterion.
- 6.2 It also provides a framework for sustainable management of surface water across this strategic development that should be followed as each phase and plot is brought forward for development, contributing to the overall sustainable approach and consideration of above-ground SuDS that complement the garden village aspiration.
- 6.3 This SDS is intended to support an outline planning application and as such the level of detail included is commensurate and subject to the nature of the proposals.

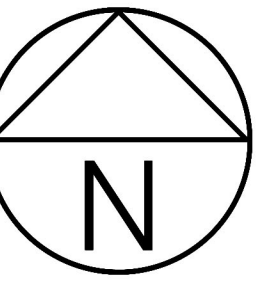
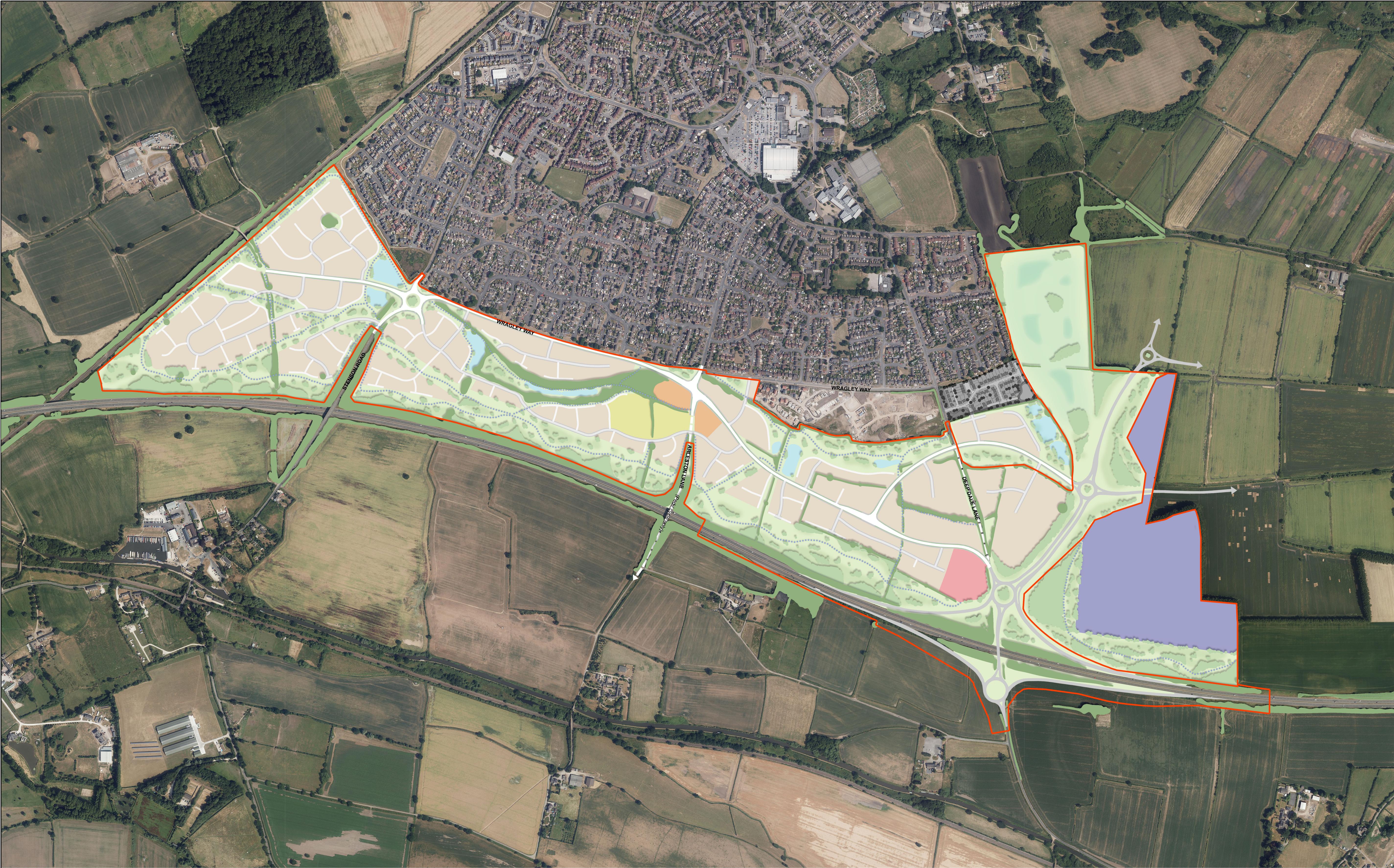
Table 6.1: Sustainable Drainage Statement Summary

		Existing Site	Proposed Development
Site Area (Ha)		54	
Impermeable Area (Ha)		-	35
Outfall Location		Watercourse	Watercourse
Peak Runoff Rate (l/s)	QBAR	119.1	3.4l/s/ha (In areas below 1ha 5l/s in line with CIRIA Guidance)
	1 in 30-Year	233.3	
	1 in 100-Year	306.0	
	1 in 100-Year + CC	-	
Infiltration Rate		N/A	N/A
Runoff Volume (100yr RP 6 hour Storm)		8,396.25m ³	22,386m ³
Volume Control		-	N/A
Proposed Storage Volume		-	40,510m ³
Flow Control Type		-	Vortex
SuDS Features		-	Detention Basins & Swales Use of source control measures (Filter Drains, Permeable Paving, rain gardens, tree pits) once the layout is fixed.
Maintenance Responsibility		-	Management Company unless otherwise adopted.

- 6.4 It is envisaged that the final drainage strategy will be determined during the detailed design stage, as the development layout is finalised.

APPENDICES

APPENDIX 1: Site Proposals



KEY

- | | | | | | |
|--|-----------------------------|--|---------------------------------|--|-------------------------------------|
| | Application site boundaries | | Proposed employment area | | Proposed link road |
| | Proposed residential | | Proposed attenuation pond | | Proposed secondary road |
| | Proposed primary school | | Existing vegetation | | Proposed minor road |
| | Proposed local centre | | Proposed vegetation | | Proposed A50 junction and link road |
| | Proposed mixed use | | Proposed pedestrian/cycle route | | |

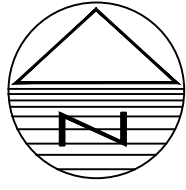
0m 100m 200m 300m 400m 500m

FOR ILLUSTRATIVE PURPOSES ONLY

Drawn By	S.C.M.	Title	Infinity Garden Village (Wragley Way) ILLUSTRATIVE MASTERPLAN	Drawing No	13.060/18
Approved By	D.P.	Scale	1:5,000 @ A1	P and DG accept no responsibility for any unauthorised amendments to drawings and does not permit unauthorised copying of drawings in order that subsequent reproduction of drawings are internally controlled. Copyright P and DG This drawing should not be scaled for construction purposes	
Revision Detail / Date		Date	05/2019		



APPENDIX 2: Topographical Survey



- NOTES
- DO NOT SCALE THIS DRAWING. ALL DIMENSIONS MUST BE CHECKED/ VERIFIED ON SITE. IF IN DOUBT ASK.
 - THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.
 - ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE. ALL LEVELS IN METRES UNLESS NOTED OTHERWISE.
 - ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.
 - ALL HEIGHT INFORMATION HAS BEEN TAKEN FROM LIDAR DATA AND BACKGROUND MAPPING FROM OSMM DATA. NO FIELDWORK HAS BEEN CARRIED OUT, DRAWING HAS BEEN COMPILED FROM OFFICE BASED WORK.

STATION COORDINATES			
STN NAME	EASTINGS (m)	NORTHINGS (m)	HEIGHT (m)
TC1	383428.382	408989.467	104.487
TC2	383393.143	409009.608	104.904
TC3	383381.262	409024.458	105.951
TC4	383300.171	409087.668	113.189

LEGEND

	OS Buildings		Electric		Electric
	Surveyed Buildings		BT		British Telecom
	Buildings / walls		Fh		Fire Hydrant
	Kerb line		St		Stop tap
	Edge of surface		Sv		Stop valve
	Canopy / Overhang		Wo		Wash Out
	Line Marking		Wm		Wash Master
	Centre Line		Mar		Service Marker
	Barrier		Re		Rodding eye
	Security Fence		Av		Air Valve
	Panel Fence		Crmp		Cable Marker
	Open Fence		Lp		Lamp Post
	Hedge		Sp		Sign Post
	Chamber		Ep		Electricity Post
	Overhead Powerline		Tp		Telegraph Post
	Woodland		TL		Traffic light
	Station and Name		Bs		Bus Stop
	Station Level		F1		Floodlight
	Benchmark		Fp		Flagpole
	Borehole		Pb		Post box
	Trial Hole		Lb		Liter Bin
	Tree / Bush / Sapling		Bo		Boiler
	Area of Undergrowth		TCB		Telephone call box
	Gate		Fs		Flagstaff
	IC		WL		Water level
	CL		Ht		Height
	IL		IFL		Internal floor level
	P_invert		THL		Threshold level
	Gy		Re		Rodding Eye
	Bg		Dk		Drop kerb
	MH		Gos		Gos
			Er		Earth rod

Rev	Date	Details of issue / revision	Drw	Rev
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MANAGEMENT LTD**

Project Title

WRAGLEY WAY, DERBY

Drawing Title

**EXISTING SITE PLAN
SITE WIDE**

Scale	1:5000 @ A1	Drawn	SDS
Size	A1	Reviewed	TDP

Drawing Status

PRELIMINARY

Drawing No.	Revision
NTH/2136/SVY/001	

APPENDIX 3: Micro Drainage Calculations

BWB Partnership		Page 1												
Friars Studio 3 Friar Gate Derby DE1 1BU														
Date 23/05/2019 15:59 File A19.srcx	Designed by josephine.green Checked by													
Micro Drainage		Source Control 2018.1.1												
<u>ICP SUDS Mean Annual Flood</u> Input <table><tr><td>Return Period (years)</td><td>100</td><td>Soil</td><td>0.400</td></tr><tr><td>Area (ha)</td><td>35.000</td><td>Urban</td><td>0.000</td></tr><tr><td>SAAR (mm)</td><td>700</td><td>Region Number</td><td>Region 4</td></tr></table> Results l/s QBAR Rural 119.1 QBAR Urban 119.1 Q100 years 306.0 Q1 year 98.8 Q30 years 233.3 Q100 years 306.0			Return Period (years)	100	Soil	0.400	Area (ha)	35.000	Urban	0.000	SAAR (mm)	700	Region Number	Region 4
Return Period (years)	100	Soil	0.400											
Area (ha)	35.000	Urban	0.000											
SAAR (mm)	700	Region Number	Region 4											
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BWB Partnership		Page 1
Friars Studio 3 Friar Gate Derby DE1 1BU		
Date 23/05/2019 13:12 File	Designed by josephine.green Checked by	
Micro Drainage		Source Control 2018.1.1

Greenfield Runoff Volume

FEH Data

Return Period (years)	100
Storm Duration (mins)	360
FEH Rainfall Version	1999
Site Location GB 434950 330200 SK 34950 30200	
C (1km)	-0.026
D1 (1km)	0.336
D2 (1km)	0.331
D3 (1km)	0.294
E (1km)	0.301
F (1km)	2.386
Areal Reduction Factor	1.00
Area (ha)	35.000
SAAR (mm)	700
CWI	105.000
SPR Host	34.090
URBEXT (1990)	0.1882

Results

Percentage Runoff (%)	37.50
Greenfield Runoff Volume (m³)	8396.251

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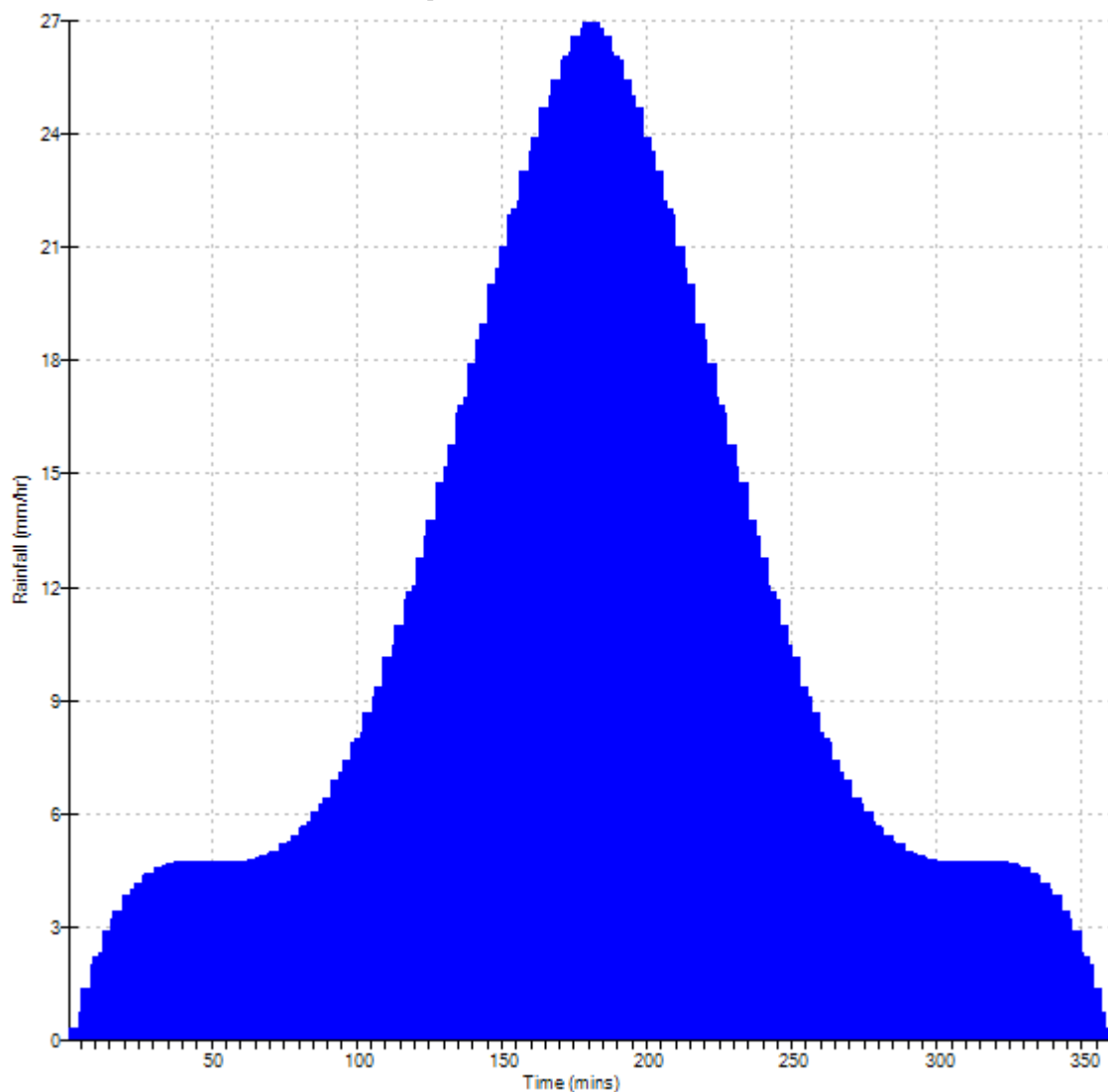
BWB Partnership		Page 1
Friars Studio 3 Friar Gate Derby DE1 1BU		
Date 23/05/2019 14:21	Designed by josephine.green	
File	Checked by	
Micro Drainage		Source Control 2018.1.1

Rainfall profile

Storm duration (mins) 360

FEH Data

FEH Rainfall Version	1999
Site Location	GB 434950 330200 SK 34950 30200
C (1km)	-0.026
D1 (1km)	0.336
D2 (1km)	0.331
D3 (1km)	0.294
E (1km)	0.301
F (1km)	2.386
Peak Intensity (mm/hr)	26.964
Ave. Intensity (mm/hr)	10.661
Return Period (years)	100.0



BWB Partnership					Page 1	
Friars Studio 3 Friar Gate Derby DE1 1BU						
Date 23/05/2019 14:51 File A1.SRCX		Designed by josephine.green Checked by				
Micro Drainage		Source Control 2018.1.1				
<u>Summary of Results for 100 year Return Period (+40%)</u>						
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer		51.063	0.563	7.1	715.8	O K
30 min Summer		51.140	0.640	7.1	823.2	O K
60 min Summer		51.224	0.724	7.1	943.1	O K
120 min Summer		51.314	0.814	7.1	1074.5	O K
180 min Summer		51.367	0.867	7.1	1153.8	O K
240 min Summer		51.403	0.903	7.1	1209.2	O K
360 min Summer		51.452	0.952	7.1	1283.3	O K
480 min Summer		51.482	0.982	7.1	1330.1	O K
600 min Summer		51.502	1.002	7.1	1361.1	O K
720 min Summer		51.515	1.015	7.1	1381.6	O K
960 min Summer		51.536	1.036	7.1	1414.5	O K
1440 min Summer		51.545	1.045	7.1	1428.7	O K
2160 min Summer		51.528	1.028	7.1	1401.2	O K
2880 min Summer		51.506	1.006	7.1	1367.4	O K
4320 min Summer		51.418	0.918	7.1	1231.5	O K
5760 min Summer		51.337	0.837	7.1	1109.8	O K
7200 min Summer		51.251	0.751	7.1	983.3	O K
8640 min Summer		51.170	0.670	7.1	866.3	O K
10080 min Summer		51.098	0.598	7.1	764.8	O K
15 min Winter		51.125	0.625	7.1	802.5	O K
30 min Winter		51.210	0.710	7.1	923.5	O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer		184.626	0.0	586.8	27	
30 min Summer		106.540	0.0	595.5	41	
60 min Summer		61.480	0.0	925.5	72	
120 min Summer		35.478	0.0	1047.8	130	
180 min Summer		25.721	0.0	1102.1	190	
240 min Summer		20.473	0.0	1112.5	250	
360 min Summer		14.842	0.0	1098.5	368	
480 min Summer		11.814	0.0	1081.7	488	
600 min Summer		9.898	0.0	1066.3	606	
720 min Summer		8.565	0.0	1052.5	726	
960 min Summer		6.871	0.0	1028.7	964	
1440 min Summer		5.036	0.0	992.9	1440	
2160 min Summer		3.691	0.0	2018.0	1844	
2880 min Summer		2.961	0.0	2043.7	2224	
4320 min Summer		2.092	0.0	1859.7	3024	
5760 min Summer		1.636	0.0	2452.8	3864	
7200 min Summer		1.351	0.0	2531.9	4616	
8640 min Summer		1.156	0.0	2597.4	5360	
10080 min Summer		1.013	0.0	2648.8	6064	
15 min Winter		184.626	0.0	597.1	27	
30 min Winter		106.540	0.0	590.3	41	
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Friars Studio 3 Friar Gate Derby DE1 1BU					
Date 23/05/2019 14:51 File A1.SRCX		Designed by josephine.green Checked by			
Micro Drainage		Source Control 2018.1.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	51.303	0.803	7.1	1059.2	O K
120 min Winter	51.402	0.902	7.1	1207.5	O K
180 min Winter	51.461	0.961	7.1	1297.6	O K
240 min Winter	51.502	1.002	7.1	1361.4	O K
360 min Winter	51.557	1.057	7.1	1448.0	O K
480 min Winter	51.593	1.093	7.1	1504.0	O K
600 min Winter	51.617	1.117	7.1	1542.4	O K
720 min Winter	51.633	1.133	7.1	1569.1	O K
960 min Winter	51.661	1.161	7.1	1613.8	O K
1440 min Winter	51.680	1.180	7.1	1645.6	O K
2160 min Winter	51.668	1.168	7.1	1624.9	O K
2880 min Winter	51.638	1.138	7.1	1576.2	O K
4320 min Winter	51.530	1.030	7.1	1404.5	O K
5760 min Winter	51.423	0.923	7.1	1239.2	O K
7200 min Winter	51.312	0.812	7.1	1072.8	O K
8640 min Winter	51.184	0.684	7.1	885.4	O K
10080 min Winter	51.074	0.574	7.1	731.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	61.480	0.0	1023.8	70	
120 min Winter	35.478	0.0	1116.0	128	
180 min Winter	25.721	0.0	1115.6	186	
240 min Winter	20.473	0.0	1105.5	246	
360 min Winter	14.842	0.0	1086.8	362	
480 min Winter	11.814	0.0	1072.6	480	
600 min Winter	9.898	0.0	1061.5	596	
720 min Winter	8.565	0.0	1052.4	712	
960 min Winter	6.871	0.0	1040.3	942	
1440 min Winter	5.036	0.0	1035.1	1392	
2160 min Winter	3.691	0.0	2144.0	2036	
2880 min Winter	2.961	0.0	2085.1	2336	
4320 min Winter	2.092	0.0	1919.9	3244	
5760 min Winter	1.636	0.0	2746.8	4160	
7200 min Winter	1.351	0.0	2834.9	5112	
8640 min Winter	1.156	0.0	2908.9	5800	
10080 min Winter	1.013	0.0	2969.4	6472	
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Friars Studio 3 Friar Gate Derby DE1 1BU		
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Micro Drainage Source Control 2018.1.1		

Model Details

Storage is Online Cover Level (m) 52.000

Tank or Pond Structure

Invert Level (m) 50.500

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	1166.7	1.250	1665.0	1.500	1775.2

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0121-7100-1250-7100
Design Head (m)	1.250
Design Flow (l/s)	7.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	121
Invert Level (m)	50.500
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.250	7.1
Flush-Flo™	0.370	7.1
Kick-Flo®	0.788	5.7
Mean Flow over Head Range	-	6.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.3	1.200	7.0	3.000	10.7	7.000	16.0
0.200	6.7	1.400	7.5	3.500	11.5	7.500	16.6
0.300	7.0	1.600	8.0	4.000	12.3	8.000	17.1
0.400	7.1	1.800	8.4	4.500	13.0	8.500	17.6
0.500	7.0	2.000	8.8	5.000	13.7	9.000	18.1
0.600	6.8	2.200	9.2	5.500	14.3	9.500	18.6
0.800	5.8	2.400	9.6	6.000	14.9		
1.000	6.4	2.600	10.0	6.500	15.5		

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Micro Drainage		Source Control 2018.1.1				
<u>Summary of Results for 100 year Return Period (+40%)</u>						
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer		48.449	0.349	12.3	1244.6	O K
30 min Summer		48.499	0.399	12.3	1431.6	O K
60 min Summer		48.555	0.455	12.3	1641.0	O K
120 min Summer		48.616	0.516	12.3	1870.5	O K
180 min Summer		48.653	0.553	12.3	2010.1	O K
240 min Summer		48.679	0.579	12.3	2109.1	O K
360 min Summer		48.714	0.614	12.3	2244.3	O K
480 min Summer		48.737	0.637	12.3	2332.8	O K
600 min Summer		48.753	0.653	12.3	2394.2	O K
720 min Summer		48.764	0.664	12.3	2437.6	O K
960 min Summer		48.783	0.683	12.3	2512.0	O K
1440 min Summer		48.798	0.698	12.3	2569.4	O K
2160 min Summer		48.793	0.693	12.3	2550.7	O K
2880 min Summer		48.782	0.682	12.3	2508.3	O K
4320 min Summer		48.722	0.622	12.3	2274.3	O K
5760 min Summer		48.667	0.567	12.3	2062.6	O K
7200 min Summer		48.616	0.516	12.3	1869.2	O K
8640 min Summer		48.569	0.469	12.3	1691.5	O K
10080 min Summer		48.526	0.426	12.3	1530.9	O K
15 min Winter		48.489	0.389	12.3	1395.1	O K
30 min Winter		48.546	0.446	12.3	1605.4	O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer		184.626	0.0	915.9	27	
30 min Summer		106.540	0.0	999.9	41	
60 min Summer		61.480	0.0	1495.1	72	
120 min Summer		35.478	0.0	1703.3	130	
180 min Summer		25.721	0.0	1822.0	190	
240 min Summer		20.473	0.0	1896.3	250	
360 min Summer		14.842	0.0	1963.6	368	
480 min Summer		11.814	0.0	1963.0	488	
600 min Summer		9.898	0.0	1937.3	606	
720 min Summer		8.565	0.0	1908.1	726	
960 min Summer		6.871	0.0	1845.0	964	
1440 min Summer		5.036	0.0	1726.3	1442	
2160 min Summer		3.691	0.0	3369.9	1872	
2880 min Summer		2.961	0.0	3464.0	2228	
4320 min Summer		2.092	0.0	3260.4	2948	
5760 min Summer		1.636	0.0	4217.4	3752	
7200 min Summer		1.351	0.0	4347.7	4544	
8640 min Summer		1.156	0.0	4450.4	5280	
10080 min Summer		1.013	0.0	4517.2	6056	
15 min Winter		184.626	0.0	987.7	27	
30 min Winter		106.540	0.0	1035.7	41	
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Friars Studio 3 Friar Gate Derby DE1 1BU					
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Micro Drainage		Source Control 2018.1.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	48.608	0.508	12.3	1841.4	O K
120 min Winter	48.677	0.577	12.3	2101.0	O K
180 min Winter	48.718	0.618	12.3	2260.3	O K
240 min Winter	48.748	0.648	12.3	2374.6	O K
360 min Winter	48.788	0.688	12.3	2533.3	O K
480 min Winter	48.816	0.716	12.3	2640.4	O K
600 min Winter	48.835	0.735	12.3	2717.6	O K
720 min Winter	48.850	0.750	12.3	2774.8	O K
960 min Winter	48.875	0.775	12.3	2873.7	O K
1440 min Winter	48.898	0.798	12.3	2965.5	O K
2160 min Winter	48.900	0.800	12.3	2973.3	Flood Risk
2880 min Winter	48.884	0.784	12.3	2908.4	O K
4320 min Winter	48.802	0.702	12.3	2585.3	O K
5760 min Winter	48.722	0.622	12.3	2273.7	O K
7200 min Winter	48.646	0.546	12.3	1984.8	O K
8640 min Winter	48.577	0.477	12.3	1720.9	O K
10080 min Winter	48.513	0.413	12.3	1483.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	61.480	0.0	1661.8	70	
120 min Winter	35.478	0.0	1868.3	128	
180 min Winter	25.721	0.0	1964.2	186	
240 min Winter	20.473	0.0	2000.0	246	
360 min Winter	14.842	0.0	1983.0	362	
480 min Winter	11.814	0.0	1944.5	480	
600 min Winter	9.898	0.0	1903.2	598	
720 min Winter	8.565	0.0	1863.5	714	
960 min Winter	6.871	0.0	1791.5	946	
1440 min Winter	5.036	0.0	1681.9	1402	
2160 min Winter	3.691	0.0	3593.8	2060	
2880 min Winter	2.961	0.0	3492.2	2660	
4320 min Winter	2.092	0.0	3282.6	3252	
5760 min Winter	1.636	0.0	4723.2	4104	
7200 min Winter	1.351	0.0	4869.1	4912	
8640 min Winter	1.156	0.0	4985.7	5712	
10080 min Winter	1.013	0.0	5069.5	6456	
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Date 23/05/2019 14:56 File A2.srcx		
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Micro Drainage		Source Control 2018.1.1

Model Details

Storage is Online Cover Level (m) 49.200

Tank or Pond Structure

Invert Level (m) 48.100

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	3459.9	0.850	4012.1	1.100	4182.2

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0159-1230-1100-1230
Design Head (m)	1.100
Design Flow (l/s)	12.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	159
Invert Level (m)	48.100
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.100	12.3
Flush-Flo™	0.334	12.3
Kick-Flo®	0.740	10.2
Mean Flow over Head Range	-	10.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.7	1.200	12.8	3.000	19.8	7.000	29.8
0.200	11.8	1.400	13.8	3.500	21.3	7.500	30.8
0.300	12.3	1.600	14.7	4.000	22.7	8.000	31.7
0.400	12.2	1.800	15.5	4.500	24.1	8.500	32.7
0.500	12.0	2.000	16.3	5.000	25.3	9.000	33.6
0.600	11.6	2.200	17.1	5.500	26.5	9.500	34.5
0.800	10.6	2.400	17.8	6.000	27.6		
1.000	11.8	2.600	18.5	6.500	28.7		

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BWB Partnership					Page 1	
Friars Studio 3 Friar Gate Derby DE1 1BU						
Date 23/05/2019 14:57 File A3.srcx			Designed by josephine.green Checked by			
Micro Drainage			Source Control 2018.1.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>						
	Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
	15 min Summer	48.681	0.341	16.7	1722.0	O K
	30 min Summer	48.731	0.391	16.7	1980.9	O K
	60 min Summer	48.787	0.447	16.7	2271.4	O K
	120 min Summer	48.847	0.507	16.7	2590.7	O K
	180 min Summer	48.884	0.544	16.7	2785.6	O K
	240 min Summer	48.910	0.570	16.7	2924.4	O K
	360 min Summer	48.945	0.605	16.7	3115.3	O K
	480 min Summer	48.969	0.629	16.7	3241.6	O K
	600 min Summer	48.985	0.645	16.7	3330.4	O K
	720 min Summer	48.997	0.657	16.7	3394.4	O K
	960 min Summer	49.018	0.678	16.7	3505.4	O K
	1440 min Summer	49.035	0.695	16.7	3601.3	O K
	2160 min Summer	49.034	0.694	16.7	3592.1	O K
	2880 min Summer	49.025	0.685	16.7	3544.9	O K
	4320 min Summer	48.968	0.628	16.7	3234.5	O K
	5760 min Summer	48.915	0.575	16.7	2951.4	O K
	7200 min Summer	48.866	0.526	16.7	2690.7	O K
	8640 min Summer	48.820	0.480	16.7	2449.0	O K
	10080 min Summer	48.779	0.439	16.7	2229.0	O K
	15 min Winter	48.721	0.381	16.7	1930.1	O K
	30 min Winter	48.777	0.437	16.7	2221.3	O K
	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
	15 min Summer	184.626	0.0	1210.7	27	
	30 min Summer	106.540	0.0	1335.9	41	
	60 min Summer	61.480	0.0	2012.0	72	
	120 min Summer	35.478	0.0	2292.7	130	
	180 min Summer	25.721	0.0	2452.5	190	
	240 min Summer	20.473	0.0	2553.0	250	
	360 min Summer	14.842	0.0	2648.4	368	
	480 min Summer	11.814	0.0	2653.4	488	
	600 min Summer	9.898	0.0	2615.4	606	
	720 min Summer	8.565	0.0	2572.2	726	
	960 min Summer	6.871	0.0	2479.8	964	
	1440 min Summer	5.036	0.0	2306.5	1442	
	2160 min Summer	3.691	0.0	4568.2	1924	
	2880 min Summer	2.961	0.0	4660.5	2276	
	4320 min Summer	2.092	0.0	4354.6	2984	
	5760 min Summer	1.636	0.0	5804.5	3752	
	7200 min Summer	1.351	0.0	5980.3	4544	
	8640 min Summer	1.156	0.0	6116.6	5352	
	10080 min Summer	1.013	0.0	6199.4	6056	
	15 min Winter	184.626	0.0	1315.9	27	
	30 min Winter	106.540	0.0	1399.3	41	
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Friars Studio 3 Friar Gate Derby DE1 1BU					
Date 23/05/2019 14:57 File A3.srcx			Designed by josephine.green Checked by		
Micro Drainage			Source Control 2018.1.1		
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	48.839	0.499	16.7	2548.5	O K
120 min Winter	48.907	0.567	16.7	2909.2	O K
180 min Winter	48.948	0.608	16.7	3131.4	O K
240 min Winter	48.978	0.638	16.7	3291.3	O K
360 min Winter	49.019	0.679	16.7	3514.3	O K
480 min Winter	49.047	0.707	16.7	3666.3	Flood Risk
600 min Winter	49.067	0.727	16.7	3776.1	Flood Risk
720 min Winter	49.082	0.742	16.7	3857.0	Flood Risk
960 min Winter	49.107	0.767	16.7	3996.3	Flood Risk
1440 min Winter	49.132	0.792	16.7	4129.5	Flood Risk
2160 min Winter	49.135	0.795	16.7	4150.5	Flood Risk
2880 min Winter	49.121	0.781	16.7	4071.8	Flood Risk
4320 min Winter	49.049	0.709	16.7	3678.1	Flood Risk
5760 min Winter	48.972	0.632	16.7	3257.2	O K
7200 min Winter	48.899	0.559	16.7	2866.4	O K
8640 min Winter	48.831	0.491	16.7	2506.2	O K
10080 min Winter	48.769	0.429	16.7	2179.7	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	61.480	0.0	2237.3	70	
120 min Winter	35.478	0.0	2516.0	128	
180 min Winter	25.721	0.0	2648.0	186	
240 min Winter	20.473	0.0	2702.1	246	
360 min Winter	14.842	0.0	2683.0	362	
480 min Winter	11.814	0.0	2626.0	480	
600 min Winter	9.898	0.0	2568.4	598	
720 min Winter	8.565	0.0	2517.2	714	
960 min Winter	6.871	0.0	2426.3	944	
1440 min Winter	5.036	0.0	2283.7	1400	
2160 min Winter	3.691	0.0	4878.4	2056	
2880 min Winter	2.961	0.0	4732.5	2648	
4320 min Winter	2.092	0.0	4356.8	3292	
5760 min Winter	1.636	0.0	6499.9	4144	
7200 min Winter	1.351	0.0	6696.7	4968	
8640 min Winter	1.156	0.0	6851.1	5720	
10080 min Winter	1.013	0.0	6957.6	6472	
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BWB Partnership		Page 4
Friars Studio 3 Friar Gate Derby DE1 1BU		
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Micro Drainage Source Control 2018.1.1		

Model Details

Storage is Online Cover Level (m) 49.340

Tank or Pond Structure

Invert Level (m) 48.340

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	4915.9	0.700	5451.7	1.000	5689.8

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0183-1670-1000-1670
Design Head (m)	1.000
Design Flow (l/s)	16.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	183
Invert Level (m)	48.340
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	16.7
Flush-Flo™	0.330	16.7
Kick-Flo®	0.711	14.2
Mean Flow over Head Range	-	14.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.4	1.200	18.2	3.000	28.2	7.000	42.4
0.200	16.0	1.400	19.6	3.500	30.3	7.500	43.9
0.300	16.6	1.600	20.9	4.000	32.4	8.000	45.2
0.400	16.6	1.800	22.1	4.500	34.3	8.500	46.6
0.500	16.3	2.000	23.2	5.000	36.0	9.000	47.9
0.600	15.7	2.200	24.3	5.500	37.7	9.500	49.2
0.800	15.0	2.400	25.3	6.000	39.4		
1.000	16.7	2.600	26.3	6.500	40.9		

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BWB Partnership					Page 1
Friars Studio 3 Friar Gate Derby DE1 1BU					
Date 23/05/2019 14:58 File A4.srcx		Designed by josephine.green Checked by			
Micro Drainage		Source Control 2018.1.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	47.569	0.169	5.8	597.4	O K
30 min Summer	47.593	0.193	5.9	687.1	O K
60 min Summer	47.621	0.221	5.9	788.0	O K
120 min Summer	47.651	0.251	5.9	899.0	O K
180 min Summer	47.670	0.270	5.9	967.0	O K
240 min Summer	47.683	0.283	5.9	1015.5	O K
360 min Summer	47.701	0.301	5.9	1082.2	O K
480 min Summer	47.712	0.312	5.9	1126.4	O K
600 min Summer	47.721	0.321	5.9	1157.4	O K
720 min Summer	47.727	0.327	5.9	1179.5	O K
960 min Summer	47.737	0.337	5.9	1217.2	O K
1440 min Summer	47.745	0.345	5.9	1247.7	O K
2160 min Summer	47.746	0.346	5.9	1252.7	O K
2880 min Summer	47.744	0.344	5.9	1246.1	O K
4320 min Summer	47.721	0.321	5.9	1157.0	O K
5760 min Summer	47.697	0.297	5.9	1069.7	O K
7200 min Summer	47.675	0.275	5.9	986.6	O K
8640 min Summer	47.654	0.254	5.9	908.9	O K
10080 min Summer	47.635	0.235	5.9	837.6	O K
15 min Winter	47.589	0.189	5.9	669.4	O K
30 min Winter	47.616	0.216	5.9	770.4	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	184.626	0.0	371.5	27	
30 min Summer	106.540	0.0	422.9	41	
60 min Summer	61.480	0.0	650.9	72	
120 min Summer	35.478	0.0	746.8	130	
180 min Summer	25.721	0.0	803.5	190	
240 min Summer	20.473	0.0	841.7	250	
360 min Summer	14.842	0.0	888.0	368	
480 min Summer	11.814	0.0	909.8	486	
600 min Summer	9.898	0.0	916.0	606	
720 min Summer	8.565	0.0	911.9	726	
960 min Summer	6.871	0.0	887.7	964	
1440 min Summer	5.036	0.0	831.5	1440	
2160 min Summer	3.691	0.0	1544.6	1796	
2880 min Summer	2.961	0.0	1593.1	2164	
4320 min Summer	2.092	0.0	1511.8	2940	
5760 min Summer	1.636	0.0	1986.4	3744	
7200 min Summer	1.351	0.0	2043.4	4536	
8640 min Summer	1.156	0.0	2084.5	5280	
10080 min Summer	1.013	0.0	2103.9	6056	
15 min Winter	184.626	0.0	413.4	27	
30 min Winter	106.540	0.0	459.9	41	
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BWB Partnership				Page 2	
Friars Studio 3 Friar Gate Derby DE1 1BU					
Date 23/05/2019 14:58 File A4.srcx		Designed by josephine.green Checked by			
Micro Drainage		Source Control 2018.1.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	47.647	0.247	5.9	884.0	O K
120 min Winter	47.681	0.281	5.9	1009.4	O K
180 min Winter	47.702	0.302	5.9	1086.7	O K
240 min Winter	47.717	0.317	5.9	1142.2	O K
360 min Winter	47.737	0.337	5.9	1219.3	O K
480 min Winter	47.751	0.351	5.9	1271.2	O K
600 min Winter	47.761	0.361	5.9	1308.4	O K
720 min Winter	47.768	0.368	5.9	1335.9	O K
960 min Winter	47.781	0.381	5.9	1383.8	O K
1440 min Winter	47.793	0.393	5.9	1430.5	O K
2160 min Winter	47.795	0.395	5.9	1438.4	O K
2880 min Winter	47.789	0.389	5.9	1415.8	O K
4320 min Winter	47.757	0.357	5.9	1292.6	O K
5760 min Winter	47.723	0.323	5.9	1165.7	O K
7200 min Winter	47.690	0.290	5.9	1042.6	O K
8640 min Winter	47.659	0.259	5.9	927.4	O K
10080 min Winter	47.631	0.231	5.9	823.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	61.480	0.0	727.9	70	
120 min Winter	35.478	0.0	827.0	128	
180 min Winter	25.721	0.0	881.1	186	
240 min Winter	20.473	0.0	913.7	246	
360 min Winter	14.842	0.0	943.0	362	
480 min Winter	11.814	0.0	945.3	480	
600 min Winter	9.898	0.0	934.4	596	
720 min Winter	8.565	0.0	921.3	712	
960 min Winter	6.871	0.0	893.8	942	
1440 min Winter	5.036	0.0	839.8	1394	
2160 min Winter	3.691	0.0	1684.8	2036	
2880 min Winter	2.961	0.0	1691.7	2336	
4320 min Winter	2.092	0.0	1561.1	3204	
5760 min Winter	1.636	0.0	2225.6	4088	
7200 min Winter	1.351	0.0	2289.4	4904	
8640 min Winter	1.156	0.0	2336.9	5712	
10080 min Winter	1.013	0.0	2363.3	6456	
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BWB Partnership		Page 4
Friars Studio 3 Friar Gate Derby DE1 1BU		
Date 23/05/2019 14:58 File A4.srcx		
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Micro Drainage		Source Control 2018.1.1

Model Details

Storage is Online Cover Level (m) 48.100

Tank or Pond Structure

Invert Level (m) 47.400

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	3466.0	0.500	3918.1	0.700	4120.3

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0119-5900-0700-5900
Design Head (m)	0.700
Design Flow (l/s)	5.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	119
Invert Level (m)	47.400
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	5.9
Flush-Flo™	0.220	5.9
Kick-Flo®	0.490	5.0
Mean Flow over Head Range	-	5.0

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.2	1.200	7.6	3.000	11.7	7.000	17.5
0.200	5.9	1.400	8.2	3.500	12.6	7.500	18.1
0.300	5.8	1.600	8.7	4.000	13.4	8.000	18.7
0.400	5.6	1.800	9.2	4.500	14.2	8.500	19.2
0.500	5.0	2.000	9.6	5.000	14.9	9.000	19.8
0.600	5.5	2.200	10.1	5.500	15.6	9.500	20.4
0.800	6.3	2.400	10.5	6.000	16.3		
1.000	7.0	2.600	10.9	6.500	16.9		

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BWB Partnership					Page 1
Friars Studio 3 Friar Gate Derby DE1 1BU					
Date 23/05/2019 14:59 File A5.srcx			Designed by josephine.green Checked by		
Micro Drainage			Source Control 2018.1.1		
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	48.536	0.236	5.0	348.2	O K
30 min Summer	48.570	0.270	5.0	400.1	O K
60 min Summer	48.607	0.307	5.0	457.4	O K
120 min Summer	48.647	0.347	5.0	518.8	O K
180 min Summer	48.670	0.370	5.0	555.1	O K
240 min Summer	48.686	0.386	5.0	580.0	O K
360 min Summer	48.705	0.405	5.0	611.4	Flood Risk
480 min Summer	48.717	0.417	5.0	629.2	Flood Risk
600 min Summer	48.723	0.423	5.0	639.1	Flood Risk
720 min Summer	48.726	0.426	5.0	643.8	Flood Risk
960 min Summer	48.729	0.429	5.0	649.1	Flood Risk
1440 min Summer	48.726	0.426	5.0	644.9	Flood Risk
2160 min Summer	48.717	0.417	5.0	630.0	Flood Risk
2880 min Summer	48.704	0.404	5.0	609.0	Flood Risk
4320 min Summer	48.651	0.351	5.0	525.7	O K
5760 min Summer	48.603	0.303	5.0	450.2	O K
7200 min Summer	48.561	0.261	5.0	385.8	O K
8640 min Summer	48.525	0.225	5.0	331.2	O K
10080 min Summer	48.495	0.195	5.0	285.7	O K
15 min Winter	48.564	0.264	5.0	390.5	O K
30 min Winter	48.602	0.302	5.0	448.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	184.626	0.0	294.8	27	
30 min Summer	106.540	0.0	336.8	41	
60 min Summer	61.480	0.0	441.1	70	
120 min Summer	35.478	0.0	508.9	130	
180 min Summer	25.721	0.0	552.1	190	
240 min Summer	20.473	0.0	584.1	248	
360 min Summer	14.842	0.0	630.5	366	
480 min Summer	11.814	0.0	663.3	486	
600 min Summer	9.898	0.0	687.3	604	
720 min Summer	8.565	0.0	704.6	722	
960 min Summer	6.871	0.0	725.1	960	
1440 min Summer	5.036	0.0	699.7	1188	
2160 min Summer	3.691	0.0	991.4	1564	
2880 min Summer	2.961	0.0	1055.7	1984	
4320 min Summer	2.092	0.0	1104.8	2772	
5760 min Summer	1.636	0.0	1192.1	3528	
7200 min Summer	1.351	0.0	1229.2	4264	
8640 min Summer	1.156	0.0	1258.4	5016	
10080 min Summer	1.013	0.0	1278.7	5656	
15 min Winter	184.626	0.0	328.3	26	
30 min Winter	106.540	0.0	370.4	41	
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Friars Studio 3 Friar Gate Derby DE1 1BU					
Date 23/05/2019 14:59 File A5.srcx		Designed by josephine.green Checked by			
Micro Drainage		Source Control 2018.1.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	48.644	0.344	5.0	513.7	O K
120 min Winter	48.688	0.388	5.0	583.7	O K
180 min Winter	48.714	0.414	5.0	625.1	Flood Risk
240 min Winter	48.732	0.432	5.0	653.4	Flood Risk
360 min Winter	48.754	0.454	5.0	689.8	Flood Risk
480 min Winter	48.768	0.468	5.0	711.3	Flood Risk
600 min Winter	48.775	0.475	5.0	724.0	Flood Risk
720 min Winter	48.780	0.480	5.0	731.2	Flood Risk
960 min Winter	48.786	0.486	5.0	741.3	Flood Risk
1440 min Winter	48.782	0.482	5.0	735.4	Flood Risk
2160 min Winter	48.768	0.468	5.0	712.6	Flood Risk
2880 min Winter	48.750	0.450	5.0	682.2	Flood Risk
4320 min Winter	48.680	0.380	5.0	571.7	O K
5760 min Winter	48.606	0.306	5.0	455.7	O K
7200 min Winter	48.544	0.244	5.0	360.4	O K
8640 min Winter	48.494	0.194	5.0	283.8	O K
10080 min Winter	48.456	0.156	5.0	226.7	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	61.480	0.0	494.3	70	
120 min Winter	35.478	0.0	568.6	128	
180 min Winter	25.721	0.0	615.4	186	
240 min Winter	20.473	0.0	649.7	244	
360 min Winter	14.842	0.0	697.7	360	
480 min Winter	11.814	0.0	729.0	476	
600 min Winter	9.898	0.0	748.5	590	
720 min Winter	8.565	0.0	758.2	704	
960 min Winter	6.871	0.0	753.7	926	
1440 min Winter	5.036	0.0	716.7	1342	
2160 min Winter	3.691	0.0	1109.4	1668	
2880 min Winter	2.961	0.0	1179.5	2136	
4320 min Winter	2.092	0.0	1224.1	3036	
5760 min Winter	1.636	0.0	1335.9	3816	
7200 min Winter	1.351	0.0	1378.1	4544	
8640 min Winter	1.156	0.0	1411.4	5192	
10080 min Winter	1.013	0.0	1435.6	5840	
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BWB Partnership		Page 4
Friars Studio 3 Friar Gate Derby DE1 1BU		
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Micro Drainage Source Control 2018.1.1		

Model Details

Storage is Online Cover Level (m) 49.000

Tank or Pond Structure

Invert Level (m) 48.300

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	1425.3	0.500	1633.2	0.700	1720.2

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0113-5000-0500-5000
Design Head (m)	0.500
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	113
Invert Level (m)	48.300
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	5.0
Flush-Flo™	0.179	5.0
Kick-Flo®	0.372	4.4
Mean Flow over Head Range	-	4.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.9	1.200	7.5	3.000	11.6	7.000	17.4
0.200	5.0	1.400	8.1	3.500	12.5	7.500	18.1
0.300	4.8	1.600	8.6	4.000	13.3	8.000	18.7
0.400	4.5	1.800	9.1	4.500	14.1	8.500	19.2
0.500	5.0	2.000	9.6	5.000	14.8	9.000	19.8
0.600	5.4	2.200	10.0	5.500	15.4	9.500	20.3
0.800	6.2	2.400	10.4	6.000	16.1		
1.000	6.9	2.600	10.8	6.500	16.8		

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BWB Partnership					Page 1	
Friars Studio 3 Friar Gate Derby DE1 1BU						
Date 23/05/2019 15:00 File A6.srcx		Designed by josephine.green Checked by				
Micro Drainage			Source Control 2018.1.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>						
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer		45.724	0.324	5.0	441.4	O K
30 min Summer		45.771	0.371	5.0	507.5	O K
60 min Summer		45.821	0.421	5.0	581.1	O K
120 min Summer		45.876	0.476	5.0	661.3	O K
180 min Summer		45.908	0.508	5.0	709.6	O K
240 min Summer		45.930	0.530	5.0	743.1	O K
360 min Summer		45.959	0.559	5.0	787.3	O K
480 min Summer		45.977	0.577	5.0	814.3	O K
600 min Summer		45.988	0.588	5.0	831.5	O K
720 min Summer		45.995	0.595	5.0	842.2	O K
960 min Summer		46.006	0.606	5.0	858.5	O K
1440 min Summer		46.007	0.607	5.0	859.5	O K
2160 min Summer		45.997	0.597	5.0	844.0	O K
2880 min Summer		45.983	0.583	5.0	823.0	O K
4320 min Summer		45.925	0.525	5.0	735.7	O K
5760 min Summer		45.867	0.467	5.0	649.0	O K
7200 min Summer		45.812	0.412	5.0	568.1	O K
8640 min Summer		45.764	0.364	5.0	498.1	O K
10080 min Summer		45.721	0.321	5.0	436.4	O K
15 min Winter		45.762	0.362	5.0	494.9	O K
30 min Winter		45.813	0.413	5.0	569.3	O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer		184.626	0.0	370.2	27	
30 min Summer		106.540	0.0	405.8	41	
60 min Summer		61.480	0.0	562.1	70	
120 min Summer		35.478	0.0	643.8	130	
180 min Summer		25.721	0.0	692.8	190	
240 min Summer		20.473	0.0	726.2	250	
360 min Summer		14.842	0.0	763.9	368	
480 min Summer		11.814	0.0	773.5	486	
600 min Summer		9.898	0.0	766.3	606	
720 min Summer		8.565	0.0	756.4	724	
960 min Summer		6.871	0.0	736.6	962	
1440 min Summer		5.036	0.0	700.7	1374	
2160 min Summer		3.691	0.0	1250.1	1712	
2880 min Summer		2.961	0.0	1320.2	2104	
4320 min Summer		2.092	0.0	1296.3	2936	
5760 min Summer		1.636	0.0	1510.1	3704	
7200 min Summer		1.351	0.0	1558.4	4472	
8640 min Summer		1.156	0.0	1597.0	5200	
10080 min Summer		1.013	0.0	1625.2	5952	
15 min Winter		184.626	0.0	400.4	27	
30 min Winter		106.540	0.0	418.1	41	
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BWB Partnership					Page 2
Friars Studio 3 Friar Gate Derby DE1 1BU					
Date 23/05/2019 15:00 File A6.srcx		Designed by josephine.green Checked by			
Micro Drainage		Source Control 2018.1.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	45.870	0.470	5.0	652.6	O K
120 min Winter	45.930	0.530	5.0	743.4	O K
180 min Winter	45.967	0.567	5.0	798.1	O K
240 min Winter	45.992	0.592	5.0	836.4	O K
360 min Winter	46.025	0.625	5.0	887.7	O K
480 min Winter	46.046	0.646	5.0	920.1	O K
600 min Winter	46.059	0.659	5.0	941.5	O K
720 min Winter	46.069	0.669	5.0	955.6	O K
960 min Winter	46.083	0.683	5.0	978.5	O K
1440 min Winter	46.090	0.690	5.0	989.3	O K
2160 min Winter	46.075	0.675	5.0	965.7	O K
2880 min Winter	46.058	0.658	5.0	938.8	O K
4320 min Winter	45.983	0.583	5.0	823.8	O K
5760 min Winter	45.908	0.508	5.0	709.5	O K
7200 min Winter	45.823	0.423	5.0	584.3	O K
8640 min Winter	45.750	0.350	5.0	478.5	O K
10080 min Winter	45.687	0.287	5.0	388.7	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	61.480	0.0	626.6	70	
120 min Winter	35.478	0.0	711.2	128	
180 min Winter	25.721	0.0	756.7	186	
240 min Winter	20.473	0.0	780.3	244	
360 min Winter	14.842	0.0	786.4	362	
480 min Winter	11.814	0.0	777.4	478	
600 min Winter	9.898	0.0	768.4	594	
720 min Winter	8.565	0.0	760.0	710	
960 min Winter	6.871	0.0	745.4	938	
1440 min Winter	5.036	0.0	720.9	1378	
2160 min Winter	3.691	0.0	1388.7	1948	
2880 min Winter	2.961	0.0	1443.4	2228	
4320 min Winter	2.092	0.0	1339.9	3160	
5760 min Winter	1.636	0.0	1691.4	4088	
7200 min Winter	1.351	0.0	1745.8	4832	
8640 min Winter	1.156	0.0	1790.1	5552	
10080 min Winter	1.013	0.0	1823.5	6256	
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BWB Partnership		Page 4
Friars Studio 3 Friar Gate Derby DE1 1BU		
Date 23/05/2019 15:00 File A6.srcx		
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Micro Drainage		Source Control 2018.1.1

Model Details

Storage is Online Cover Level (m) 46.400

Tank or Pond Structure

Invert Level (m) 45.400

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	1297.2	0.700	1579.2	1.000	1708.5

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0110-5000-0700-5000
Design Head (m)	0.700
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	110
Invert Level (m)	45.400
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	5.0
Flush-Flo™	0.215	5.0
Kick-Flo®	0.483	4.2
Mean Flow over Head Range	-	4.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.8	1.200	6.4	3.000	9.9	7.000	14.8
0.200	5.0	1.400	6.9	3.500	10.6	7.500	15.3
0.300	4.9	1.600	7.3	4.000	11.3	8.000	15.8
0.400	4.7	1.800	7.8	4.500	12.0	8.500	16.3
0.500	4.3	2.000	8.2	5.000	12.6	9.000	16.7
0.600	4.7	2.200	8.5	5.500	13.2	9.500	17.2
0.800	5.3	2.400	8.9	6.000	13.7		
1.000	5.9	2.600	9.2	6.500	14.3		

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BWB Partnership					Page 1	
Friars Studio 3 Friar Gate Derby DE1 1BU						
Date 23/05/2019 15:00 File A7.srcx		Designed by josephine.green Checked by				
Micro Drainage		Source Control 2018.1.1				
<u>Summary of Results for 100 year Return Period (+40%)</u>						
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer		45.058	0.318	7.6	766.7	O K
30 min Summer		45.103	0.363	7.6	881.5	O K
60 min Summer		45.154	0.414	7.6	1009.5	O K
120 min Summer		45.208	0.468	7.6	1149.0	O K
180 min Summer		45.241	0.501	7.6	1233.0	O K
240 min Summer		45.263	0.523	7.6	1291.6	O K
360 min Summer		45.293	0.553	7.6	1369.4	O K
480 min Summer		45.311	0.571	7.6	1417.9	O K
600 min Summer		45.323	0.583	7.6	1449.7	O K
720 min Summer		45.331	0.591	7.6	1470.2	O K
960 min Summer		45.344	0.604	7.6	1503.0	O K
1440 min Summer		45.348	0.608	7.6	1514.2	O K
2160 min Summer		45.337	0.597	7.6	1486.5	O K
2880 min Summer		45.324	0.584	7.6	1452.5	O K
4320 min Summer		45.270	0.530	7.6	1309.6	O K
5760 min Summer		45.220	0.480	7.6	1179.6	O K
7200 min Summer		45.169	0.429	7.6	1047.4	O K
8640 min Summer		45.122	0.382	7.6	929.7	O K
10080 min Summer		45.081	0.341	7.6	825.3	O K
15 min Winter		45.095	0.355	7.6	859.6	O K
30 min Winter		45.146	0.406	7.6	988.9	O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer		184.626	0.0	624.4	27	
30 min Summer		106.540	0.0	639.8	41	
60 min Summer		61.480	0.0	1016.8	72	
120 min Summer		35.478	0.0	1132.7	130	
180 min Summer		25.721	0.0	1187.7	190	
240 min Summer		20.473	0.0	1211.1	250	
360 min Summer		14.842	0.0	1208.8	368	
480 min Summer		11.814	0.0	1195.3	488	
600 min Summer		9.898	0.0	1182.5	606	
720 min Summer		8.565	0.0	1170.6	726	
960 min Summer		6.871	0.0	1149.4	964	
1440 min Summer		5.036	0.0	1111.7	1440	
2160 min Summer		3.691	0.0	2184.0	1804	
2880 min Summer		2.961	0.0	2232.4	2172	
4320 min Summer		2.092	0.0	2044.3	2984	
5760 min Summer		1.636	0.0	2636.5	3808	
7200 min Summer		1.351	0.0	2722.6	4608	
8640 min Summer		1.156	0.0	2795.0	5360	
10080 min Summer		1.013	0.0	2858.0	6064	
15 min Winter		184.626	0.0	641.4	27	
30 min Winter		106.540	0.0	635.4	41	
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BWB Partnership					Page 2
Friars Studio 3 Friar Gate Derby DE1 1BU					
Date 23/05/2019 15:00 File A7.srcx		Designed by josephine.green Checked by			
Micro Drainage		Source Control 2018.1.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	45.202	0.462	7.6	1133.8	O K
120 min Winter	45.263	0.523	7.6	1291.7	O K
180 min Winter	45.300	0.560	7.6	1387.3	O K
240 min Winter	45.325	0.585	7.6	1454.8	O K
360 min Winter	45.360	0.620	7.6	1545.8	O K
480 min Winter	45.382	0.642	7.6	1604.3	O K
600 min Winter	45.396	0.656	7.6	1643.9	O K
720 min Winter	45.406	0.666	7.6	1671.0	O K
960 min Winter	45.423	0.683	7.7	1716.1	O K
1440 min Winter	45.434	0.694	7.8	1745.8	O K
2160 min Winter	45.424	0.684	7.7	1719.3	O K
2880 min Winter	45.407	0.667	7.6	1671.3	O K
4320 min Winter	45.338	0.598	7.6	1488.8	O K
5760 min Winter	45.271	0.531	7.6	1312.9	O K
7200 min Winter	45.203	0.463	7.6	1136.0	O K
8640 min Winter	45.130	0.390	7.6	950.2	O K
10080 min Winter	45.068	0.328	7.6	793.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	61.480	0.0	1110.7	70	
120 min Winter	35.478	0.0	1206.1	128	
180 min Winter	25.721	0.0	1225.3	186	
240 min Winter	20.473	0.0	1218.9	246	
360 min Winter	14.842	0.0	1206.2	362	
480 min Winter	11.814	0.0	1196.1	478	
600 min Winter	9.898	0.0	1187.8	596	
720 min Winter	8.565	0.0	1180.4	712	
960 min Winter	6.871	0.0	1169.0	942	
1440 min Winter	5.036	0.0	1153.7	1388	
2160 min Winter	3.691	0.0	2350.4	2016	
2880 min Winter	2.961	0.0	2304.2	2284	
4320 min Winter	2.092	0.0	2121.2	3204	
5760 min Winter	1.636	0.0	2953.2	4144	
7200 min Winter	1.351	0.0	3049.5	5048	
8640 min Winter	1.156	0.0	3130.8	5792	
10080 min Winter	1.013	0.0	3200.9	6472	
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BWB Partnership		Page 4
Friars Studio 3 Friar Gate Derby DE1 1BU		
Date 23/05/2019 15:00 File A7.srcx		
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Model Details

Storage is Online Cover Level (m) 45.740

Tank or Pond Structure

Invert Level (m) 44.740

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	2332.0	0.700	2705.4	1.000	2873.8

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0133-7600-0700-7600
Design Head (m)	0.700
Design Flow (l/s)	7.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	133
Invert Level (m)	44.700
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	7.6
Flush-Flo™	0.231	7.6
Kick-Flo®	0.501	6.5
Mean Flow over Head Range	-	6.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.8	1.200	9.8	3.000	15.1	7.000	22.7
0.200	7.6	1.400	10.5	3.500	16.3	7.500	23.4
0.300	7.5	1.600	11.2	4.000	17.3	8.000	24.2
0.400	7.3	1.800	11.9	4.500	18.3	8.500	24.9
0.500	6.5	2.000	12.5	5.000	19.3	9.000	25.6
0.600	7.1	2.200	13.0	5.500	20.2	9.500	26.3
0.800	8.1	2.400	13.6	6.000	21.1		
1.000	9.0	2.600	14.1	6.500	21.9		

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BWB Partnership					Page 1	
Friars Studio 3 Friar Gate Derby DE1 1BU						
Date 23/05/2019 15:01 File A8.srcx		Designed by josephine.green Checked by				
Micro Drainage		Source Control 2018.1.1				
<u>Summary of Results for 100 year Return Period (+40%)</u>						
	Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
	15 min Summer	44.663	0.353	5.0	341.0	O K
	30 min Summer	44.712	0.402	5.0	391.6	O K
	60 min Summer	44.765	0.455	5.0	447.5	O K
	120 min Summer	44.821	0.511	5.0	507.0	O K
	180 min Summer	44.852	0.542	5.0	541.2	O K
	240 min Summer	44.873	0.563	5.0	564.0	O K
	360 min Summer	44.898	0.588	5.0	591.8	O K
	480 min Summer	44.911	0.601	5.0	606.4	O K
	600 min Summer	44.918	0.608	5.0	613.6	O K
	720 min Summer	44.920	0.610	5.0	615.9	O K
	960 min Summer	44.921	0.611	5.0	616.7	O K
	1440 min Summer	44.912	0.602	5.0	606.8	O K
	2160 min Summer	44.893	0.583	5.0	585.7	O K
	2880 min Summer	44.870	0.560	5.0	561.1	O K
	4320 min Summer	44.794	0.484	5.0	478.1	O K
	5760 min Summer	44.717	0.407	5.0	397.3	O K
	7200 min Summer	44.653	0.343	5.0	331.3	O K
	8640 min Summer	44.599	0.289	5.0	275.8	O K
	10080 min Summer	44.553	0.243	5.0	230.1	O K
	15 min Winter	44.703	0.393	5.0	382.4	O K
	30 min Winter	44.758	0.448	5.0	439.6	O K
	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
	15 min Summer	184.626	0.0	313.4	27	
	30 min Summer	106.540	0.0	356.3	41	
	60 min Summer	61.480	0.0	447.3	70	
	120 min Summer	35.478	0.0	515.6	130	
	180 min Summer	25.721	0.0	559.6	188	
	240 min Summer	20.473	0.0	592.6	248	
	360 min Summer	14.842	0.0	641.2	366	
	480 min Summer	11.814	0.0	676.1	484	
	600 min Summer	9.898	0.0	702.2	604	
	720 min Summer	8.565	0.0	721.3	722	
	960 min Summer	6.871	0.0	742.0	954	
	1440 min Summer	5.036	0.0	712.9	1174	
	2160 min Summer	3.691	0.0	985.7	1560	
	2880 min Summer	2.961	0.0	1052.0	1968	
	4320 min Summer	2.092	0.0	1107.3	2812	
	5760 min Summer	1.636	0.0	1173.9	3528	
	7200 min Summer	1.351	0.0	1211.3	4264	
	8640 min Summer	1.156	0.0	1241.7	5008	
	10080 min Summer	1.013	0.0	1265.2	5656	
	15 min Winter	184.626	0.0	347.6	26	
	30 min Winter	106.540	0.0	388.3	41	
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BWB Partnership					Page 2
Friars Studio 3 Friar Gate Derby DE1 1BU					
Date 23/05/2019 15:01 File A8.srcx		Designed by josephine.green Checked by			
Micro Drainage		Source Control 2018.1.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	44.817	0.507	5.0	502.9	O K
120 min Winter	44.879	0.569	5.0	570.1	O K
180 min Winter	44.914	0.604	5.0	609.3	O K
240 min Winter	44.938	0.628	5.0	635.8	O K
360 min Winter	44.967	0.657	5.0	669.1	O K
480 min Winter	44.984	0.674	5.0	687.8	O K
600 min Winter	44.993	0.683	5.0	698.1	O K
720 min Winter	44.997	0.687	5.0	703.0	O K
960 min Winter	45.002	0.692	5.0	708.9	O K
1440 min Winter	44.991	0.681	5.0	696.5	O K
2160 min Winter	44.966	0.656	5.0	667.8	O K
2880 min Winter	44.935	0.625	5.0	632.8	O K
4320 min Winter	44.832	0.522	5.0	519.7	O K
5760 min Winter	44.718	0.408	5.0	398.5	O K
7200 min Winter	44.623	0.313	5.0	300.6	O K
8640 min Winter	44.546	0.236	5.0	223.6	O K
10080 min Winter	44.489	0.179	5.0	168.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	61.480	0.0	500.7	70	
120 min Winter	35.478	0.0	576.2	128	
180 min Winter	25.721	0.0	624.5	186	
240 min Winter	20.473	0.0	660.1	244	
360 min Winter	14.842	0.0	710.8	360	
480 min Winter	11.814	0.0	743.9	476	
600 min Winter	9.898	0.0	763.7	590	
720 min Winter	8.565	0.0	770.6	704	
960 min Winter	6.871	0.0	760.2	924	
1440 min Winter	5.036	0.0	728.3	1332	
2160 min Winter	3.691	0.0	1103.3	1664	
2880 min Winter	2.961	0.0	1176.7	2136	
4320 min Winter	2.092	0.0	1232.3	3032	
5760 min Winter	1.636	0.0	1315.1	3808	
7200 min Winter	1.351	0.0	1357.3	4536	
8640 min Winter	1.156	0.0	1391.7	5184	
10080 min Winter	1.013	0.0	1419.0	5752	
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BWB Partnership		Page 4
Friars Studio 3 Friar Gate Derby DE1 1BU		
Date 23/05/2019 15:01 File A8.srcx		
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Micro Drainage		Source Control 2018.1.1

Model Details

Storage is Online Cover Level (m) 45.310

Tank or Pond Structure

Invert Level (m) 44.310

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	908.5	0.700	1146.7	1.000	1257.3

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0110-5000-0700-5000
Design Head (m)	0.700
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	110
Invert Level (m)	44.310
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	5.0
Flush-Flo™	0.215	5.0
Kick-Flo®	0.483	4.2
Mean Flow over Head Range	-	4.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.8	1.200	6.4	3.000	9.9	7.000	14.8
0.200	5.0	1.400	6.9	3.500	10.6	7.500	15.3
0.300	4.9	1.600	7.3	4.000	11.3	8.000	15.8
0.400	4.7	1.800	7.8	4.500	12.0	8.500	16.3
0.500	4.3	2.000	8.2	5.000	12.6	9.000	16.7
0.600	4.7	2.200	8.5	5.500	13.2	9.500	17.2
0.800	5.3	2.400	8.9	6.000	13.7		
1.000	5.9	2.600	9.2	6.500	14.3		

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BWB Partnership					Page 1
Friars Studio 3 Friar Gate Derby DE1 1BU					
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Micro Drainage		Source Control 2018.1.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	44.085	0.235	5.0	199.5	O K
30 min Summer	44.117	0.267	5.0	228.3	O K
60 min Summer	44.151	0.301	5.0	259.3	O K
120 min Summer	44.185	0.335	5.0	290.0	O K
180 min Summer	44.202	0.352	5.0	306.2	Flood Risk
240 min Summer	44.213	0.363	5.0	315.9	Flood Risk
360 min Summer	44.222	0.372	5.0	324.9	Flood Risk
480 min Summer	44.224	0.374	5.0	326.2	Flood Risk
600 min Summer	44.221	0.371	5.0	323.5	Flood Risk
720 min Summer	44.217	0.367	5.0	320.2	Flood Risk
960 min Summer	44.213	0.363	5.0	315.7	Flood Risk
1440 min Summer	44.198	0.348	5.0	302.0	O K
2160 min Summer	44.170	0.320	5.0	276.1	O K
2880 min Summer	44.141	0.291	5.0	249.4	O K
4320 min Summer	44.073	0.223	5.0	188.5	O K
5760 min Summer	44.023	0.173	5.0	144.8	O K
7200 min Summer	43.989	0.139	4.9	116.2	O K
8640 min Summer	43.971	0.121	4.8	100.0	O K
10080 min Summer	43.959	0.109	4.3	90.7	O K
15 min Winter	44.112	0.262	5.0	223.9	O K
30 min Winter	44.148	0.298	5.0	256.6	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	184.626	0.0	187.9	26	
30 min Summer	106.540	0.0	217.6	41	
60 min Summer	61.480	0.0	264.1	70	
120 min Summer	35.478	0.0	305.4	128	
180 min Summer	25.721	0.0	332.4	186	
240 min Summer	20.473	0.0	352.9	246	
360 min Summer	14.842	0.0	383.7	364	
480 min Summer	11.814	0.0	407.1	480	
600 min Summer	9.898	0.0	426.1	558	
720 min Summer	8.565	0.0	442.2	608	
960 min Summer	6.871	0.0	472.1	728	
1440 min Summer	5.036	0.0	516.1	988	
2160 min Summer	3.691	0.0	582.7	1388	
2880 min Summer	2.961	0.0	622.9	1788	
4320 min Summer	2.092	0.0	657.1	2516	
5760 min Summer	1.636	0.0	692.0	3224	
7200 min Summer	1.351	0.0	713.8	3888	
8640 min Summer	1.156	0.0	731.5	4504	
10080 min Summer	1.013	0.0	744.9	5248	
15 min Winter	184.626	0.0	211.2	26	
30 min Winter	106.540	0.0	244.1	40	
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BWB Partnership					Page 2
Friars Studio 3 Friar Gate Derby DE1 1BU					
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Micro Drainage			Source Control 2018.1.1		
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	44.187	0.337	5.0	291.7	O K
120 min Winter	44.225	0.375	5.0	327.6	Flood Risk
180 min Winter	44.246	0.396	5.0	346.8	Flood Risk
240 min Winter	44.258	0.408	5.0	358.4	Flood Risk
360 min Winter	44.270	0.420	5.0	369.9	Flood Risk
480 min Winter	44.273	0.423	5.0	372.9	Flood Risk
600 min Winter	44.272	0.422	5.0	371.3	Flood Risk
720 min Winter	44.267	0.417	5.0	366.9	Flood Risk
960 min Winter	44.259	0.409	5.0	359.3	Flood Risk
1440 min Winter	44.239	0.389	5.0	340.4	Flood Risk
2160 min Winter	44.195	0.345	5.0	299.2	O K
2880 min Winter	44.148	0.298	5.0	256.1	O K
4320 min Winter	44.048	0.198	5.0	167.3	O K
5760 min Winter	43.986	0.136	4.9	113.6	O K
7200 min Winter	43.962	0.112	4.4	93.0	O K
8640 min Winter	43.949	0.099	3.9	81.9	O K
10080 min Winter	43.940	0.090	3.4	74.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	61.480	0.0	296.3	68	
120 min Winter	35.478	0.0	342.5	126	
180 min Winter	25.721	0.0	372.6	184	
240 min Winter	20.473	0.0	395.5	242	
360 min Winter	14.842	0.0	430.0	356	
480 min Winter	11.814	0.0	456.1	468	
600 min Winter	9.898	0.0	477.2	576	
720 min Winter	8.565	0.0	495.1	680	
960 min Winter	6.871	0.0	528.1	772	
1440 min Winter	5.036	0.0	575.7	1082	
2160 min Winter	3.691	0.0	653.0	1520	
2880 min Winter	2.961	0.0	698.1	1932	
4320 min Winter	2.092	0.0	737.2	2640	
5760 min Winter	1.636	0.0	775.4	3232	
7200 min Winter	1.351	0.0	800.0	3888	
8640 min Winter	1.156	0.0	820.0	4576	
10080 min Winter	1.013	0.0	835.6	5248	
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BWB Partnership		Page 4																																																																																																																					
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Micro Drainage		Source Control 2018.1.1																																																																																																																					
<u>Model Details</u> Storage is Online Cover Level (m) 44.500 <u>Tank or Pond Structure</u> Invert Level (m) 43.850 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>810.1</td><td>0.650</td><td>1035.9</td></tr></table> <u>Hydro-Brake® Optimum Outflow Control</u> <table><tr><td>Unit Reference</td><td>MD-SHE-0113-5000-0500-5000</td></tr><tr><td>Design Head (m)</td><td>0.500</td></tr><tr><td>Design Flow (l/s)</td><td>5.0</td></tr><tr><td>Flush-Flo™</td><td>Calculated</td></tr><tr><td>Objective</td><td>Minimise upstream storage</td></tr><tr><td>Application</td><td>Surface</td></tr><tr><td>Sump Available</td><td>Yes</td></tr><tr><td>Diameter (mm)</td><td>113</td></tr><tr><td>Invert Level (m)</td><td>43.850</td></tr><tr><td>Minimum Outlet Pipe Diameter (mm)</td><td>150</td></tr><tr><td>Suggested Manhole Diameter (mm)</td><td>1200</td></tr></table> <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>0.500</td><td>5.0</td></tr><tr><td>Flush-Flo™</td><td>0.179</td><td>5.0</td></tr><tr><td>Kick-Flo®</td><td>0.372</td><td>4.4</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>4.1</td></tr></table> The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>3.9</td><td>1.200</td><td>7.5</td><td>3.000</td><td>11.6</td><td>7.000</td><td>17.4</td></tr><tr><td>0.200</td><td>5.0</td><td>1.400</td><td>8.1</td><td>3.500</td><td>12.5</td><td>7.500</td><td>18.1</td></tr><tr><td>0.300</td><td>4.8</td><td>1.600</td><td>8.6</td><td>4.000</td><td>13.3</td><td>8.000</td><td>18.7</td></tr><tr><td>0.400</td><td>4.5</td><td>1.800</td><td>9.1</td><td>4.500</td><td>14.1</td><td>8.500</td><td>19.2</td></tr><tr><td>0.500</td><td>5.0</td><td>2.000</td><td>9.6</td><td>5.000</td><td>14.8</td><td>9.000</td><td>19.8</td></tr><tr><td>0.600</td><td>5.4</td><td>2.200</td><td>10.0</td><td>5.500</td><td>15.4</td><td>9.500</td><td>20.3</td></tr><tr><td>0.800</td><td>6.2</td><td>2.400</td><td>10.4</td><td>6.000</td><td>16.1</td><td></td><td></td></tr><tr><td>1.000</td><td>6.9</td><td>2.600</td><td>10.8</td><td>6.500</td><td>16.8</td><td></td><td></td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	810.1	0.650	1035.9	Unit Reference	MD-SHE-0113-5000-0500-5000	Design Head (m)	0.500	Design Flow (l/s)	5.0	Flush-Flo™	Calculated	Objective	Minimise upstream storage	Application	Surface	Sump Available	Yes	Diameter (mm)	113	Invert Level (m)	43.850	Minimum Outlet Pipe Diameter (mm)	150	Suggested Manhole Diameter (mm)	1200	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	0.500	5.0	Flush-Flo™	0.179	5.0	Kick-Flo®	0.372	4.4	Mean Flow over Head Range	-	4.1	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	3.9	1.200	7.5	3.000	11.6	7.000	17.4	0.200	5.0	1.400	8.1	3.500	12.5	7.500	18.1	0.300	4.8	1.600	8.6	4.000	13.3	8.000	18.7	0.400	4.5	1.800	9.1	4.500	14.1	8.500	19.2	0.500	5.0	2.000	9.6	5.000	14.8	9.000	19.8	0.600	5.4	2.200	10.0	5.500	15.4	9.500	20.3	0.800	6.2	2.400	10.4	6.000	16.1			1.000	6.9	2.600	10.8	6.500	16.8		
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Friars Studio 3 Friar Gate Derby DE1 1BU						
Date 23/05/2019 15:03 File A10.srcx		Designed by josephine.green Checked by				
Micro Drainage		Source Control 2018.1.1				
<u>Summary of Results for 100 year Return Period (+40%)</u>						
	Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
	15 min Summer	44.353	0.353	5.0	299.4	O K
	30 min Summer	44.402	0.402	5.0	343.7	O K
	60 min Summer	44.454	0.454	5.0	391.9	O K
	120 min Summer	44.507	0.507	5.0	442.0	O K
	180 min Summer	44.536	0.536	5.0	470.5	O K
	240 min Summer	44.556	0.556	5.0	489.1	O K
	360 min Summer	44.579	0.579	5.0	511.3	O K
	480 min Summer	44.590	0.590	5.0	522.3	O K
	600 min Summer	44.594	0.594	5.0	526.6	O K
	720 min Summer	44.594	0.594	5.0	526.6	O K
	960 min Summer	44.591	0.591	5.0	524.0	O K
	1440 min Summer	44.578	0.578	5.0	511.0	O K
	2160 min Summer	44.552	0.552	5.0	485.5	O K
	2880 min Summer	44.523	0.523	5.0	457.1	O K
	4320 min Summer	44.438	0.438	5.0	377.0	O K
	5760 min Summer	44.365	0.365	5.0	310.3	O K
	7200 min Summer	44.304	0.304	5.0	255.5	O K
	8640 min Summer	44.254	0.254	5.0	211.5	O K
	10080 min Summer	44.214	0.214	4.9	177.2	O K
	15 min Winter	44.393	0.393	5.0	335.9	O K
	30 min Winter	44.447	0.447	5.0	385.7	O K
	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
	15 min Summer	184.626	0.0	280.8	26	
	30 min Summer	106.540	0.0	321.9	41	
	60 min Summer	61.480	0.0	395.8	70	
	120 min Summer	35.478	0.0	456.8	130	
	180 min Summer	25.721	0.0	496.5	188	
	240 min Summer	20.473	0.0	526.5	248	
	360 min Summer	14.842	0.0	571.3	366	
	480 min Summer	11.814	0.0	604.7	484	
	600 min Summer	9.898	0.0	631.1	604	
	720 min Summer	8.565	0.0	652.7	722	
	960 min Summer	6.871	0.0	689.5	914	
	1440 min Summer	5.036	0.0	715.9	1132	
	2160 min Summer	3.691	0.0	869.8	1512	
	2880 min Summer	2.961	0.0	929.4	1908	
	4320 min Summer	2.092	0.0	981.8	2688	
	5760 min Summer	1.636	0.0	1033.4	3456	
	7200 min Summer	1.351	0.0	1066.4	4184	
	8640 min Summer	1.156	0.0	1093.3	4848	
	10080 min Summer	1.013	0.0	1114.4	5552	
	15 min Winter	184.626	0.0	313.2	26	
	30 min Winter	106.540	0.0	356.3	41	
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Friars Studio 3 Friar Gate Derby DE1 1BU					
Date 23/05/2019 15:03 File A10.srcx		Designed by josephine.green Checked by			
Micro Drainage		Source Control 2018.1.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	44.505	0.505	5.0	440.4	O K
120 min Winter	44.565	0.565	5.0	498.1	O K
180 min Winter	44.599	0.599	5.0	531.7	O K
240 min Winter	44.622	0.622	5.0	554.4	O K
360 min Winter	44.651	0.651	5.0	583.0	O K
480 min Winter	44.667	0.667	5.0	598.7	O K
600 min Winter	44.675	0.675	5.0	606.8	O K
720 min Winter	44.678	0.678	5.0	610.0	O K
960 min Winter	44.681	0.681	5.0	613.4	O K
1440 min Winter	44.666	0.666	5.0	598.0	O K
2160 min Winter	44.627	0.627	5.0	559.5	O K
2880 min Winter	44.582	0.582	5.0	514.7	O K
4320 min Winter	44.456	0.456	5.0	393.9	O K
5760 min Winter	44.349	0.349	5.0	295.4	O K
7200 min Winter	44.263	0.263	5.0	219.4	O K
8640 min Winter	44.200	0.200	4.8	164.8	O K
10080 min Winter	44.156	0.156	4.6	127.4	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	61.480	0.0	443.5	70	
120 min Winter	35.478	0.0	511.4	128	
180 min Winter	25.721	0.0	555.3	186	
240 min Winter	20.473	0.0	588.2	244	
360 min Winter	14.842	0.0	636.6	360	
480 min Winter	11.814	0.0	671.5	476	
600 min Winter	9.898	0.0	697.7	590	
720 min Winter	8.565	0.0	716.8	704	
960 min Winter	6.871	0.0	736.3	928	
1440 min Winter	5.036	0.0	710.2	1346	
2160 min Winter	3.691	0.0	973.7	1672	
2880 min Winter	2.961	0.0	1040.4	2108	
4320 min Winter	2.092	0.0	1098.8	2904	
5760 min Winter	1.636	0.0	1157.8	3688	
7200 min Winter	1.351	0.0	1194.9	4336	
8640 min Winter	1.156	0.0	1225.3	5016	
10080 min Winter	1.013	0.0	1249.6	5640	
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BWB Partnership		Page 4
Friars Studio 3 Friar Gate Derby DE1 1BU		
Date 23/05/2019 15:03 File A10.srcx		
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Micro Drainage		Source Control 2018.1.1

Model Details

Storage is Online Cover Level (m) 45.000

Tank or Pond Structure

Invert Level (m) 44.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	794.0	0.700	1017.6	1.000	1121.9

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0105-5000-1000-5000
Design Head (m)	1.000
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	105
Invert Level (m)	44.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	5.0
Flush-Flo™	0.296	5.0
Kick-Flo®	0.637	4.1
Mean Flow over Head Range	-	4.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.6	1.200	5.4	3.000	8.4	7.000	12.5
0.200	4.8	1.400	5.8	3.500	9.0	7.500	12.9
0.300	5.0	1.600	6.2	4.000	9.6	8.000	13.3
0.400	4.9	1.800	6.6	4.500	10.1	8.500	13.7
0.500	4.7	2.000	6.9	5.000	10.6	9.000	14.1
0.600	4.3	2.200	7.2	5.500	11.1	9.500	14.5
0.800	4.5	2.400	7.5	6.000	11.6		
1.000	5.0	2.600	7.8	6.500	12.1		

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BWB Partnership				Page 1		
Friars Studio 3 Friar Gate Derby DE1 1BU						
Date 23/05/2019 15:03 File All.srcx		Designed by josephine.green Checked by				
Micro Drainage		Source Control 2018.1.1				
<u>Summary of Results for 100 year Return Period (+40%)</u>						
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer		42.296	0.296	10.7	1083.8	O K
30 min Summer		42.339	0.339	10.7	1246.6	O K
60 min Summer		42.387	0.387	10.7	1429.1	O K
120 min Summer		42.439	0.439	10.7	1629.5	O K
180 min Summer		42.471	0.471	10.7	1751.5	O K
240 min Summer		42.493	0.493	10.7	1838.1	O K
360 min Summer		42.523	0.523	10.7	1956.6	O K
480 min Summer		42.543	0.543	10.7	2034.1	O K
600 min Summer		42.557	0.557	10.7	2088.0	O K
720 min Summer		42.566	0.566	10.7	2126.0	O K
960 min Summer		42.583	0.583	10.7	2190.7	O K
1440 min Summer		42.595	0.595	10.7	2239.6	O K
2160 min Summer		42.593	0.593	10.7	2229.4	O K
2880 min Summer		42.585	0.585	10.7	2199.7	O K
4320 min Summer		42.536	0.536	10.7	2008.4	O K
5760 min Summer		42.491	0.491	10.7	1830.3	O K
7200 min Summer		42.448	0.448	10.7	1665.7	O K
8640 min Summer		42.409	0.409	10.7	1513.8	O K
10080 min Summer		42.373	0.373	10.7	1376.1	O K
15 min Winter		42.330	0.330	10.7	1214.7	O K
30 min Winter		42.379	0.379	10.7	1397.9	O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer		184.626	0.0	771.2	27	
30 min Summer		106.540	0.0	851.0	41	
60 min Summer		61.480	0.0	1276.3	72	
120 min Summer		35.478	0.0	1455.6	130	
180 min Summer		25.721	0.0	1558.9	190	
240 min Summer		20.473	0.0	1625.2	250	
360 min Summer		14.842	0.0	1692.7	368	
480 min Summer		11.814	0.0	1705.3	488	
600 min Summer		9.898	0.0	1688.3	606	
720 min Summer		8.565	0.0	1665.2	726	
960 min Summer		6.871	0.0	1614.3	964	
1440 min Summer		5.036	0.0	1514.2	1440	
2160 min Summer		3.691	0.0	2909.0	1840	
2880 min Summer		2.961	0.0	2996.3	2216	
4320 min Summer		2.092	0.0	2819.7	2944	
5760 min Summer		1.636	0.0	3659.3	3752	
7200 min Summer		1.351	0.0	3770.8	4544	
8640 min Summer		1.156	0.0	3857.4	5280	
10080 min Summer		1.013	0.0	3910.8	6056	
15 min Winter		184.626	0.0	838.1	27	
30 min Winter		106.540	0.0	893.1	41	
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BWB Partnership					Page 2
Friars Studio 3 Friar Gate Derby DE1 1BU					
Date 23/05/2019 15:03 File All.srcx			Designed by josephine.green Checked by		
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	42.432	0.432	10.7	1603.5	O K
120 min Winter	42.491	0.491	10.7	1829.9	O K
180 min Winter	42.526	0.526	10.7	1969.0	O K
240 min Winter	42.552	0.552	10.7	2068.7	O K
360 min Winter	42.587	0.587	10.7	2206.8	O K
480 min Winter	42.610	0.610	10.7	2299.6	O K
600 min Winter	42.627	0.627	10.7	2366.1	O K
720 min Winter	42.639	0.639	10.7	2415.2	O K
960 min Winter	42.661	0.661	10.7	2502.1	O K
1440 min Winter	42.683	0.683	10.7	2588.6	O K
2160 min Winter	42.686	0.686	10.7	2602.6	O K
2880 min Winter	42.672	0.672	10.7	2544.7	O K
4320 min Winter	42.602	0.602	10.7	2268.7	O K
5760 min Winter	42.537	0.537	10.7	2010.5	O K
7200 min Winter	42.474	0.474	10.7	1766.3	O K
8640 min Winter	42.416	0.416	10.7	1541.2	O K
10080 min Winter	42.363	0.363	10.7	1338.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	61.480	0.0	1420.0	70	
120 min Winter	35.478	0.0	1600.0	128	
180 min Winter	25.721	0.0	1688.7	186	
240 min Winter	20.473	0.0	1730.0	246	
360 min Winter	14.842	0.0	1734.3	362	
480 min Winter	11.814	0.0	1708.4	480	
600 min Winter	9.898	0.0	1679.2	596	
720 min Winter	8.565	0.0	1649.6	714	
960 min Winter	6.871	0.0	1588.9	944	
1440 min Winter	5.036	0.0	1481.5	1402	
2160 min Winter	3.691	0.0	3116.7	2060	
2880 min Winter	2.961	0.0	3052.4	2664	
4320 min Winter	2.092	0.0	2870.7	3244	
5760 min Winter	1.636	0.0	4098.5	4096	
7200 min Winter	1.351	0.0	4223.2	4912	
8640 min Winter	1.156	0.0	4321.8	5712	
10080 min Winter	1.013	0.0	4389.7	6456	
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Model Details Storage is Online Cover Level (m) 43.000 Tank or Pond Structure Invert Level (m) 42.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>3570.9</td><td>0.700</td><td>4029.6</td><td>1.000</td><td>4234.7</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0150-1070-1000-1070 Design Head (m) 1.000 Design Flow (l/s) 10.7 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 150 Invert Level (m) 42.000 Minimum Outlet Pipe Diameter (mm) 225 Suggested Manhole Diameter (mm) 1200 Control Points <table><tr><th></th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>1.000</td><td>10.7</td></tr><tr><td>Flush-Flo™</td><td>0.306</td><td>10.7</td></tr><tr><td>Kick-Flo®</td><td>0.679</td><td>8.9</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>9.2</td></tr></table> The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>5.4</td><td>1.200</td><td>11.7</td><td>3.000</td><td>18.0</td><td>7.000</td><td>27.1</td></tr><tr><td>0.200</td><td>10.4</td><td>1.400</td><td>12.5</td><td>3.500</td><td>19.4</td><td>7.500</td><td>28.0</td></tr><tr><td>0.300</td><td>10.7</td><td>1.600</td><td>13.4</td><td>4.000</td><td>20.7</td><td>8.000</td><td>28.9</td></tr><tr><td>0.400</td><td>10.6</td><td>1.800</td><td>14.1</td><td>4.500</td><td>21.9</td><td>8.500</td><td>29.7</td></tr><tr><td>0.500</td><td>10.3</td><td>2.000</td><td>14.9</td><td>5.000</td><td>23.0</td><td>9.000</td><td>30.5</td></tr><tr><td>0.600</td><td>9.8</td><td>2.200</td><td>15.5</td><td>5.500</td><td>24.1</td><td>9.500</td><td>31.4</td></tr><tr><td>0.800</td><td>9.6</td><td>2.400</td><td>16.2</td><td>6.000</td><td>25.1</td><td></td><td></td></tr><tr><td>1.000</td><td>10.7</td><td>2.600</td><td>16.8</td><td>6.500</td><td>26.1</td><td></td><td></td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	3570.9	0.700	4029.6	1.000	4234.7		Head (m)	Flow (l/s)	Design Point (Calculated)	1.000	10.7	Flush-Flo™	0.306	10.7	Kick-Flo®	0.679	8.9	Mean Flow over Head Range	-	9.2	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	5.4	1.200	11.7	3.000	18.0	7.000	27.1	0.200	10.4	1.400	12.5	3.500	19.4	7.500	28.0	0.300	10.7	1.600	13.4	4.000	20.7	8.000	28.9	0.400	10.6	1.800	14.1	4.500	21.9	8.500	29.7	0.500	10.3	2.000	14.9	5.000	23.0	9.000	30.5	0.600	9.8	2.200	15.5	5.500	24.1	9.500	31.4	0.800	9.6	2.400	16.2	6.000	25.1			1.000	10.7	2.600	16.8	6.500	26.1		
Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)																																																																																																
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0.600	9.8	2.200	15.5	5.500	24.1	9.500	31.4																																																																																														
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BWB Partnership					Page 1	
Friars Studio 3 Friar Gate Derby DE1 1BU						
Date 23/05/2019 15:04 File A12.srcx		Designed by josephine.green Checked by				
Micro Drainage		Source Control 2018.1.1				
<u>Summary of Results for 100 year Return Period (+40%)</u>						
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer		40.808	0.308	5.7	579.3	O K
30 min Summer		40.852	0.352	5.7	666.3	O K
60 min Summer		40.901	0.401	5.7	763.7	O K
120 min Summer		40.954	0.454	5.7	870.2	O K
180 min Summer		40.986	0.486	5.7	934.8	O K
240 min Summer		41.008	0.508	5.7	980.6	O K
360 min Summer		41.038	0.538	5.7	1043.0	O K
480 min Summer		41.058	0.558	5.7	1083.7	O K
600 min Summer		41.072	0.572	5.7	1111.9	O K
720 min Summer		41.081	0.581	5.7	1131.6	O K
960 min Summer		41.097	0.597	5.7	1165.6	O K
1440 min Summer		41.110	0.610	5.7	1191.2	O K
2160 min Summer		41.104	0.604	5.7	1179.2	O K
2880 min Summer		41.093	0.593	5.7	1156.3	O K
4320 min Summer		41.038	0.538	5.7	1042.8	O K
5760 min Summer		40.989	0.489	5.7	942.3	O K
7200 min Summer		40.945	0.445	5.7	851.8	O K
8640 min Summer		40.904	0.404	5.7	768.9	O K
10080 min Summer		40.866	0.366	5.7	694.4	O K
15 min Winter		40.843	0.343	5.7	649.4	O K
30 min Winter		40.893	0.393	5.7	747.3	O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer		184.626	0.0	437.9	27	
30 min Summer		106.540	0.0	468.5	41	
60 min Summer		61.480	0.0	711.2	72	
120 min Summer		35.478	0.0	808.3	130	
180 min Summer		25.721	0.0	862.1	190	
240 min Summer		20.473	0.0	893.3	250	
360 min Summer		14.842	0.0	914.4	368	
480 min Summer		11.814	0.0	907.8	488	
600 min Summer		9.898	0.0	896.1	606	
720 min Summer		8.565	0.0	883.1	726	
960 min Summer		6.871	0.0	854.6	964	
1440 min Summer		5.036	0.0	801.7	1442	
2160 min Summer		3.691	0.0	1584.1	1888	
2880 min Summer		2.961	0.0	1620.3	2256	
4320 min Summer		2.092	0.0	1524.4	2980	
5760 min Summer		1.636	0.0	1970.7	3752	
7200 min Summer		1.351	0.0	2032.3	4544	
8640 min Summer		1.156	0.0	2081.8	5288	
10080 min Summer		1.013	0.0	2116.3	6056	
15 min Winter		184.626	0.0	465.1	27	
30 min Winter		106.540	0.0	478.1	41	
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BWB Partnership					Page 2																																																																																																													
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BWB Partnership				Page 2	
Friars Studio 3 Friar Gate Derby DE1 1BU					
Date 23/05/2019 15:04 File A13.srcx		Designed by josephine.green Checked by			
Micro Drainage		Source Control 2018.1.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	39.940	0.440	8.2	1227.6	O K
120 min Winter	40.000	0.500	8.2	1400.7	O K
180 min Winter	40.036	0.536	8.2	1506.9	O K
240 min Winter	40.061	0.561	8.2	1583.0	O K
360 min Winter	40.096	0.596	8.2	1688.4	O K
480 min Winter	40.120	0.620	8.2	1759.4	O K
600 min Winter	40.137	0.637	8.2	1810.4	O K
720 min Winter	40.149	0.649	8.2	1848.1	O K
960 min Winter	40.171	0.671	8.2	1915.1	O K
1440 min Winter	40.192	0.692	8.2	1978.5	O K
2160 min Winter	40.194	0.694	8.2	1985.6	O K
2880 min Winter	40.180	0.680	8.2	1942.9	O K
4320 min Winter	40.107	0.607	8.2	1721.6	O K
5760 min Winter	40.039	0.539	8.2	1517.3	O K
7200 min Winter	39.974	0.474	8.2	1326.7	O K
8640 min Winter	39.915	0.415	8.2	1152.2	O K
10080 min Winter	39.860	0.360	8.2	995.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	61.480	0.0	1108.2	70	
120 min Winter	35.478	0.0	1244.8	128	
180 min Winter	25.721	0.0	1307.4	186	
240 min Winter	20.473	0.0	1330.4	246	
360 min Winter	14.842	0.0	1321.3	362	
480 min Winter	11.814	0.0	1298.6	480	
600 min Winter	9.898	0.0	1274.0	596	
720 min Winter	8.565	0.0	1249.4	714	
960 min Winter	6.871	0.0	1199.6	946	
1440 min Winter	5.036	0.0	1122.4	1402	
2160 min Winter	3.691	0.0	2391.4	2060	
2880 min Winter	2.961	0.0	2323.6	2680	
4320 min Winter	2.092	0.0	2197.7	3248	
5760 min Winter	1.636	0.0	3149.6	4096	
7200 min Winter	1.351	0.0	3246.8	4912	
8640 min Winter	1.156	0.0	3324.4	5712	
10080 min Winter	1.013	0.0	3380.5	6464	
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BWB Partnership		Page 4
Friars Studio 3 Friar Gate Derby DE1 1BU		
Date 23/05/2019 15:04 File A13.srcx		
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Micro Drainage		Source Control 2018.1.1

Model Details

Storage is Online Cover Level (m) 40.500

Tank or Pond Structure

Invert Level (m) 39.500

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	2664.2	0.700	3062.3	1.000	3241.4

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0133-8200-1000-8200
Design Head (m)	1.000
Design Flow (l/s)	8.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	133
Invert Level (m)	39.500
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	8.2
Flush-Flo™	0.301	8.2
Kick-Flo®	0.662	6.8
Mean Flow over Head Range	-	7.0

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.8	1.200	8.9	3.000	13.8	7.000	20.6
0.200	7.9	1.400	9.6	3.500	14.8	7.500	21.3
0.300	8.2	1.600	10.2	4.000	15.8	8.000	22.0
0.400	8.1	1.800	10.8	4.500	16.7	8.500	22.7
0.500	7.8	2.000	11.4	5.000	17.6	9.000	23.3
0.600	7.4	2.200	11.9	5.500	18.4	9.500	23.9
0.800	7.4	2.400	12.4	6.000	19.2		
1.000	8.2	2.600	12.9	6.500	19.9		

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BWB Partnership					Page 1	
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Date 23/05/2019 15:05 File A14.srcx		Designed by josephine.green Checked by				
Micro Drainage		Source Control 2018.1.1				
<u>Summary of Results for 100 year Return Period (+40%)</u>						
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer		38.919	0.219	5.2	528.2	O K
30 min Summer		38.950	0.250	5.2	607.6	O K
60 min Summer		38.985	0.285	5.2	696.6	O K
120 min Summer		39.024	0.324	5.2	794.3	O K
180 min Summer		39.047	0.347	5.2	853.7	O K
240 min Summer		39.063	0.363	5.2	896.0	O K
360 min Summer		39.085	0.385	5.2	953.8	O K
480 min Summer		39.099	0.399	5.2	991.6	O K
600 min Summer		39.109	0.409	5.2	1017.8	O K
720 min Summer		39.116	0.416	5.2	1036.2	O K
960 min Summer		39.128	0.428	5.2	1067.5	O K
1440 min Summer		39.137	0.437	5.2	1090.5	O K
2160 min Summer		39.135	0.435	5.2	1086.6	O K
2880 min Summer		39.130	0.430	5.2	1073.3	O K
4320 min Summer		39.096	0.396	5.2	982.7	O K
5760 min Summer		39.063	0.363	5.2	897.3	O K
7200 min Summer		39.033	0.333	5.2	818.2	O K
8640 min Summer		39.004	0.304	5.2	745.1	O K
10080 min Summer		38.978	0.278	5.2	678.8	O K
15 min Winter		38.944	0.244	5.2	592.0	O K
30 min Winter		38.979	0.279	5.2	681.3	O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer		184.626	0.0	371.1	27	
30 min Summer		106.540	0.0	409.9	41	
60 min Summer		61.480	0.0	618.8	72	
120 min Summer		35.478	0.0	705.6	130	
180 min Summer		25.721	0.0	755.5	190	
240 min Summer		20.473	0.0	787.5	250	
360 min Summer		14.842	0.0	820.7	368	
480 min Summer		11.814	0.0	828.6	488	
600 min Summer		9.898	0.0	822.4	606	
720 min Summer		8.565	0.0	812.1	726	
960 min Summer		6.871	0.0	789.1	964	
1440 min Summer		5.036	0.0	742.1	1440	
2160 min Summer		3.691	0.0	1414.9	1820	
2880 min Summer		2.961	0.0	1457.5	2188	
4320 min Summer		2.092	0.0	1371.9	2944	
5760 min Summer		1.636	0.0	1782.2	3744	
7200 min Summer		1.351	0.0	1836.2	4544	
8640 min Summer		1.156	0.0	1878.0	5280	
10080 min Summer		1.013	0.0	1903.5	6056	
15 min Winter		184.626	0.0	403.6	27	
30 min Winter		106.540	0.0	431.5	41	
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BWB Partnership				Page 2	
Friars Studio 3 Friar Gate Derby DE1 1BU					
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	39.019	0.319	5.2	781.6	O K
120 min Winter	39.061	0.361	5.2	891.9	O K
180 min Winter	39.087	0.387	5.2	959.7	O K
240 min Winter	39.106	0.406	5.2	1008.3	O K
360 min Winter	39.131	0.431	5.2	1075.5	O K
480 min Winter	39.148	0.448	5.2	1120.5	O K
600 min Winter	39.160	0.460	5.2	1152.6	O K
720 min Winter	39.169	0.469	5.2	1176.1	O K
960 min Winter	39.184	0.484	5.2	1217.3	O K
1440 min Winter	39.199	0.499	5.2	1256.9	O K
2160 min Winter	39.200	0.500	5.2	1260.8	Flood Risk
2880 min Winter	39.189	0.489	5.2	1231.8	O K
4320 min Winter	39.143	0.443	5.2	1107.3	O K
5760 min Winter	39.097	0.397	5.2	984.8	O K
7200 min Winter	39.052	0.352	5.2	867.9	O K
8640 min Winter	39.010	0.310	5.2	759.9	O K
10080 min Winter	38.972	0.272	5.2	662.4	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	61.480	0.0	688.4	70	
120 min Winter	35.478	0.0	775.5	128	
180 min Winter	25.721	0.0	818.7	186	
240 min Winter	20.473	0.0	839.6	246	
360 min Winter	14.842	0.0	845.7	362	
480 min Winter	11.814	0.0	835.4	480	
600 min Winter	9.898	0.0	823.2	596	
720 min Winter	8.565	0.0	810.6	712	
960 min Winter	6.871	0.0	784.8	944	
1440 min Winter	5.036	0.0	737.8	1400	
2160 min Winter	3.691	0.0	1526.3	2056	
2880 min Winter	2.961	0.0	1506.7	2596	
4320 min Winter	2.092	0.0	1404.8	3208	
5760 min Winter	1.636	0.0	1996.1	4096	
7200 min Winter	1.351	0.0	2056.5	4904	
8640 min Winter	1.156	0.0	2104.0	5712	
10080 min Winter	1.013	0.0	2136.3	6456	
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BWB Partnership		Page 4
Friars Studio 3 Friar Gate Derby DE1 1BU		
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Micro Drainage		Source Control 2018.1.1

Model Details

Storage is Online Cover Level (m) 39.500

Tank or Pond Structure

Invert Level (m) 38.700

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	2336.5	0.500	2710.2	0.800	2878.8

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0110-5200-0800-5200
Design Head (m)	0.800
Design Flow (l/s)	5.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	110
Invert Level (m)	38.700
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	5.2
Flush-Flo™	0.241	5.2
Kick-Flo®	0.537	4.3
Mean Flow over Head Range	-	4.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.8	1.200	6.3	3.000	9.7	7.000	14.5
0.200	5.2	1.400	6.7	3.500	10.4	7.500	14.9
0.300	5.2	1.600	7.2	4.000	11.1	8.000	15.4
0.400	5.0	1.800	7.6	4.500	11.7	8.500	15.8
0.500	4.6	2.000	8.0	5.000	12.3	9.000	16.3
0.600	4.6	2.200	8.3	5.500	12.9	9.500	16.8
0.800	5.2	2.400	8.7	6.000	13.4		
1.000	5.8	2.600	9.0	6.500	14.0		

BWB Partnership					Page 1																																																																																																																																					
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Friars Studio 3 Friar Gate Derby DE1 1BU					
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Micro Drainage			Source Control 2018.1.1		
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	39.053	0.353	5.0	528.8	O K
120 min Winter	39.097	0.397	5.0	600.4	O K
180 min Winter	39.123	0.423	5.0	643.0	O K
240 min Winter	39.141	0.441	5.0	672.4	O K
360 min Winter	39.164	0.464	5.0	710.9	O K
480 min Winter	39.178	0.478	5.0	734.4	O K
600 min Winter	39.187	0.487	5.0	749.0	O K
720 min Winter	39.192	0.492	5.0	757.9	O K
960 min Winter	39.200	0.500	5.0	771.8	Flood Risk
1440 min Winter	39.200	0.500	5.0	770.7	O K
2160 min Winter	39.182	0.482	5.0	741.5	O K
2880 min Winter	39.162	0.462	5.0	707.7	O K
4320 min Winter	39.089	0.389	5.0	588.2	O K
5760 min Winter	39.022	0.322	5.0	480.3	O K
7200 min Winter	38.963	0.263	5.0	387.9	O K
8640 min Winter	38.914	0.214	5.0	312.8	O K
10080 min Winter	38.876	0.176	4.9	254.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	61.480	0.0	509.0	70	
120 min Winter	35.478	0.0	585.7	128	
180 min Winter	25.721	0.0	633.9	186	
240 min Winter	20.473	0.0	668.9	244	
360 min Winter	14.842	0.0	717.3	360	
480 min Winter	11.814	0.0	747.5	476	
600 min Winter	9.898	0.0	764.6	592	
720 min Winter	8.565	0.0	770.6	708	
960 min Winter	6.871	0.0	759.5	934	
1440 min Winter	5.036	0.0	720.5	1368	
2160 min Winter	3.691	0.0	1141.4	1708	
2880 min Winter	2.961	0.0	1213.7	2164	
4320 min Winter	2.092	0.0	1261.5	3024	
5760 min Winter	1.636	0.0	1375.5	3808	
7200 min Winter	1.351	0.0	1419.0	4544	
8640 min Winter	1.156	0.0	1453.4	5272	
10080 min Winter	1.013	0.0	1478.5	5864	
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BWB Partnership		Page 4																																																																																																																									
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Friars Studio 3 Friar Gate Derby DE1 1BU						
Date 23/05/2019 15:07 File A16.srcx		Designed by josephine.green Checked by				
Micro Drainage		Source Control 2018.1.1				
<u>Summary of Results for 100 year Return Period (+40%)</u>						
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer		39.305	0.305	5.4	545.0	O K
30 min Summer		39.349	0.349	5.4	626.8	O K
60 min Summer		39.397	0.397	5.4	718.3	O K
120 min Summer		39.450	0.450	5.4	818.4	O K
180 min Summer		39.481	0.481	5.4	879.1	O K
240 min Summer		39.503	0.503	5.4	921.9	O K
360 min Summer		39.533	0.533	5.4	980.3	O K
480 min Summer		39.553	0.553	5.4	1018.3	O K
600 min Summer		39.566	0.566	5.4	1044.4	O K
720 min Summer		39.575	0.575	5.4	1062.7	O K
960 min Summer		39.591	0.591	5.4	1093.9	O K
1440 min Summer		39.602	0.602	5.4	1116.3	O K
2160 min Summer		39.596	0.596	5.4	1104.0	O K
2880 min Summer		39.585	0.585	5.4	1082.2	O K
4320 min Summer		39.531	0.531	5.4	975.4	O K
5760 min Summer		39.482	0.482	5.4	880.6	O K
7200 min Summer		39.438	0.438	5.4	795.2	O K
8640 min Summer		39.397	0.397	5.4	717.3	O K
10080 min Summer		39.360	0.360	5.4	647.1	O K
15 min Winter		39.340	0.340	5.4	610.9	O K
30 min Winter		39.389	0.389	5.4	703.0	O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer		184.626	0.0	414.3	27	
30 min Summer		106.540	0.0	443.7	41	
60 min Summer		61.480	0.0	670.9	72	
120 min Summer		35.478	0.0	763.1	130	
180 min Summer		25.721	0.0	814.5	190	
240 min Summer		20.473	0.0	844.9	250	
360 min Summer		14.842	0.0	866.9	368	
480 min Summer		11.814	0.0	862.0	488	
600 min Summer		9.898	0.0	851.7	606	
720 min Summer		8.565	0.0	839.9	726	
960 min Summer		6.871	0.0	813.8	964	
1440 min Summer		5.036	0.0	764.7	1442	
2160 min Summer		3.691	0.0	1496.1	1880	
2880 min Summer		2.961	0.0	1536.7	2232	
4320 min Summer		2.092	0.0	1449.3	2948	
5760 min Summer		1.636	0.0	1854.8	3752	
7200 min Summer		1.351	0.0	1912.9	4544	
8640 min Summer		1.156	0.0	1959.6	5280	
10080 min Summer		1.013	0.0	1992.2	6056	
15 min Winter		184.626	0.0	440.3	27	
30 min Winter		106.540	0.0	453.3	41	
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Friars Studio 3 Friar Gate Derby DE1 1BU					
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Micro Drainage		Source Control 2018.1.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	39.443	0.443	5.4	806.1	O K
120 min Winter	39.502	0.502	5.4	919.4	O K
180 min Winter	39.538	0.538	5.4	988.9	O K
240 min Winter	39.563	0.563	5.4	1038.6	O K
360 min Winter	39.598	0.598	5.4	1107.4	O K
480 min Winter	39.621	0.621	5.4	1153.8	O K
600 min Winter	39.637	0.637	5.4	1187.0	O K
720 min Winter	39.649	0.649	5.4	1211.5	O K
960 min Winter	39.670	0.670	5.4	1254.0	O K
1440 min Winter	39.689	0.689	5.4	1292.7	O K
2160 min Winter	39.690	0.690	5.4	1294.0	O K
2880 min Winter	39.675	0.675	5.4	1263.5	O K
4320 min Winter	39.601	0.601	5.4	1113.5	O K
5760 min Winter	39.530	0.530	5.4	974.3	O K
7200 min Winter	39.464	0.464	5.4	846.5	O K
8640 min Winter	39.404	0.404	5.4	730.7	O K
10080 min Winter	39.349	0.349	5.4	627.4	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	61.480	0.0	744.7	70	
120 min Winter	35.478	0.0	834.0	128	
180 min Winter	25.721	0.0	870.6	186	
240 min Winter	20.473	0.0	879.4	246	
360 min Winter	14.842	0.0	868.9	362	
480 min Winter	11.814	0.0	852.4	480	
600 min Winter	9.898	0.0	834.6	598	
720 min Winter	8.565	0.0	817.4	714	
960 min Winter	6.871	0.0	785.9	946	
1440 min Winter	5.036	0.0	738.7	1402	
2160 min Winter	3.691	0.0	1582.4	2060	
2880 min Winter	2.961	0.0	1535.9	2680	
4320 min Winter	2.092	0.0	1457.6	3252	
5760 min Winter	1.636	0.0	2077.2	4104	
7200 min Winter	1.351	0.0	2142.3	4912	
8640 min Winter	1.156	0.0	2194.9	5712	
10080 min Winter	1.013	0.0	2234.7	6456	
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<u>Summary of Results for 100 year Return Period (+40%)</u>						
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer		38.970	0.270	5.0	175.1	O K
30 min Summer		39.005	0.305	5.0	200.1	O K
60 min Summer		39.042	0.342	5.0	226.5	O K
120 min Summer		39.076	0.376	5.0	251.7	O K
180 min Summer		39.092	0.392	5.0	263.8	O K
240 min Summer		39.101	0.401	5.0	270.0	O K
360 min Summer		39.105	0.405	5.0	273.4	O K
480 min Summer		39.102	0.402	5.0	270.9	O K
600 min Summer		39.098	0.398	5.0	267.8	O K
720 min Summer		39.093	0.393	5.0	264.1	O K
960 min Summer		39.085	0.385	5.0	258.2	O K
1440 min Summer		39.064	0.364	5.0	242.5	O K
2160 min Summer		39.028	0.328	5.0	216.0	O K
2880 min Summer		38.992	0.292	5.0	190.5	O K
4320 min Summer		38.916	0.216	5.0	138.0	O K
5760 min Summer		38.865	0.165	4.9	103.6	O K
7200 min Summer		38.833	0.133	4.7	82.6	O K
8640 min Summer		38.816	0.116	4.3	71.9	O K
10080 min Summer		38.805	0.105	3.9	64.6	O K
15 min Winter		39.000	0.300	5.0	196.6	O K
30 min Winter		39.040	0.340	5.0	225.0	O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer		184.626	0.0	170.6	26	
30 min Summer		106.540	0.0	197.5	40	
60 min Summer		61.480	0.0	235.4	70	
120 min Summer		35.478	0.0	272.0	128	
180 min Summer		25.721	0.0	296.0	186	
240 min Summer		20.473	0.0	314.2	244	
360 min Summer		14.842	0.0	341.8	362	
480 min Summer		11.814	0.0	362.8	432	
600 min Summer		9.898	0.0	379.8	490	
720 min Summer		8.565	0.0	394.3	550	
960 min Summer		6.871	0.0	421.5	680	
1440 min Summer		5.036	0.0	462.2	954	
2160 min Summer		3.691	0.0	515.4	1352	
2880 min Summer		2.961	0.0	551.0	1740	
4320 min Summer		2.092	0.0	582.0	2468	
5760 min Summer		1.636	0.0	610.8	3128	
7200 min Summer		1.351	0.0	630.3	3816	
8640 min Summer		1.156	0.0	646.2	4496	
10080 min Summer		1.013	0.0	658.8	5240	
15 min Winter		184.626	0.0	191.6	26	
30 min Winter		106.540	0.0	221.5	40	
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BWB Partnership				Page 2	
Friars Studio 3 Friar Gate Derby DE1 1BU					
Date 23/05/2019 15:08 File A17.srcx		Designed by josephine.green Checked by			
Micro Drainage		Source Control 2018.1.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	39.081	0.381	5.0	255.0	O K
120 min Winter	39.120	0.420	5.0	284.4	O K
180 min Winter	39.139	0.439	5.0	299.3	O K
240 min Winter	39.150	0.450	5.0	307.7	O K
360 min Winter	39.159	0.459	5.0	314.2	O K
480 min Winter	39.158	0.458	5.0	313.4	O K
600 min Winter	39.151	0.451	5.0	308.6	O K
720 min Winter	39.143	0.443	5.0	301.9	O K
960 min Winter	39.131	0.431	5.0	293.2	O K
1440 min Winter	39.099	0.399	5.0	268.8	O K
2160 min Winter	39.043	0.343	5.0	227.1	O K
2880 min Winter	38.987	0.287	5.0	187.2	O K
4320 min Winter	38.882	0.182	4.9	115.1	O K
5760 min Winter	38.826	0.126	4.7	78.3	O K
7200 min Winter	38.806	0.106	4.0	65.7	O K
8640 min Winter	38.794	0.094	3.5	57.6	O K
10080 min Winter	38.785	0.085	3.1	52.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	61.480	0.0	264.0	68	
120 min Winter	35.478	0.0	305.0	126	
180 min Winter	25.721	0.0	331.8	182	
240 min Winter	20.473	0.0	352.2	240	
360 min Winter	14.842	0.0	383.0	354	
480 min Winter	11.814	0.0	406.5	464	
600 min Winter	9.898	0.0	425.6	568	
720 min Winter	8.565	0.0	441.8	600	
960 min Winter	6.871	0.0	472.0	740	
1440 min Winter	5.036	0.0	517.4	1042	
2160 min Winter	3.691	0.0	577.5	1472	
2880 min Winter	2.961	0.0	617.5	1872	
4320 min Winter	2.092	0.0	652.6	2552	
5760 min Winter	1.636	0.0	684.3	3120	
7200 min Winter	1.351	0.0	706.2	3824	
8640 min Winter	1.156	0.0	724.2	4504	
10080 min Winter	1.013	0.0	738.7	5240	
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BWB Partnership		Page 4
Friars Studio 3 Friar Gate Derby DE1 1BU		
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Micro Drainage		Source Control 2018.1.1

Model Details

Storage is Online Cover Level (m) 39.500

Tank or Pond Structure

Invert Level (m) 38.700

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	598.0	0.500	793.9	0.800	886.3

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0109-5000-0800-5000
Design Head (m)	0.800
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	109
Invert Level (m)	38.700
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	5.0
Flush-Flo™	0.241	5.0
Kick-Flo®	0.537	4.2
Mean Flow over Head Range	-	4.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.7	1.200	6.0	3.000	9.3	7.000	13.9
0.200	5.0	1.400	6.5	3.500	10.0	7.500	14.4
0.300	5.0	1.600	6.9	4.000	10.6	8.000	14.8
0.400	4.8	1.800	7.3	4.500	11.3	8.500	15.2
0.500	4.5	2.000	7.7	5.000	11.8	9.000	15.7
0.600	4.4	2.200	8.0	5.500	12.4	9.500	16.1
0.800	5.0	2.400	8.4	6.000	12.9		
1.000	5.5	2.600	8.7	6.500	13.4		

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BWB Partnership					Page 1	
Friars Studio 3 Friar Gate Derby DE1 1BU						
Date 23/05/2019 15:08 File A18.srcx		Designed by josephine.green Checked by				
Micro Drainage		Source Control 2018.1.1				
<u>Summary of Results for 100 year Return Period (+40%)</u>						
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer		38.803	0.303	7.8	788.6	O K
30 min Summer		38.847	0.347	7.8	907.0	O K
60 min Summer		38.895	0.395	7.8	1039.6	O K
120 min Summer		38.948	0.448	7.8	1184.8	O K
180 min Summer		38.980	0.480	7.8	1273.1	O K
240 min Summer		39.002	0.502	7.8	1335.6	O K
360 min Summer		39.033	0.533	7.8	1420.8	O K
480 min Summer		39.052	0.552	7.8	1476.3	O K
600 min Summer		39.066	0.566	7.8	1514.7	O K
720 min Summer		39.076	0.576	7.8	1541.6	O K
960 min Summer		39.092	0.592	7.8	1587.4	O K
1440 min Summer		39.103	0.603	7.8	1620.9	O K
2160 min Summer		39.099	0.599	7.8	1607.9	O K
2880 min Summer		39.089	0.589	7.8	1581.1	O K
4320 min Summer		39.037	0.537	7.8	1433.7	O K
5760 min Summer		38.990	0.490	7.8	1299.7	O K
7200 min Summer		38.946	0.446	7.8	1177.5	O K
8640 min Summer		38.905	0.405	7.8	1065.5	O K
10080 min Summer		38.868	0.368	7.8	964.3	O K
15 min Winter		38.838	0.338	7.8	883.9	O K
30 min Winter		38.887	0.387	7.8	1017.1	O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer		184.626	0.0	583.2	27	
30 min Summer		106.540	0.0	634.4	41	
60 min Summer		61.480	0.0	951.8	72	
120 min Summer		35.478	0.0	1084.0	130	
180 min Summer		25.721	0.0	1159.1	190	
240 min Summer		20.473	0.0	1205.9	250	
360 min Summer		14.842	0.0	1247.8	368	
480 min Summer		11.814	0.0	1247.8	488	
600 min Summer		9.898	0.0	1233.4	606	
720 min Summer		8.565	0.0	1216.4	726	
960 min Summer		6.871	0.0	1179.2	964	
1440 min Summer		5.036	0.0	1107.4	1442	
2160 min Summer		3.691	0.0	2144.0	1856	
2880 min Summer		2.961	0.0	2207.6	2224	
4320 min Summer		2.092	0.0	2079.9	2948	
5760 min Summer		1.636	0.0	2674.6	3752	
7200 min Summer		1.351	0.0	2757.4	4544	
8640 min Summer		1.156	0.0	2822.9	5280	
10080 min Summer		1.013	0.0	2866.2	6056	
15 min Winter		184.626	0.0	627.2	27	
30 min Winter		106.540	0.0	655.7	41	
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Friars Studio 3 Friar Gate Derby DE1 1BU					
Date 23/05/2019 15:08 File A18.srcx		Designed by josephine.green Checked by			
Micro Drainage		Source Control 2018.1.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	38.942	0.442	7.8	1166.6	O K
120 min Winter	39.001	0.501	7.8	1330.9	O K
180 min Winter	39.037	0.537	7.8	1431.6	O K
240 min Winter	39.062	0.562	7.8	1503.8	O K
360 min Winter	39.097	0.597	7.8	1603.7	O K
480 min Winter	39.121	0.621	7.8	1670.8	O K
600 min Winter	39.138	0.638	7.8	1719.0	O K
720 min Winter	39.150	0.650	7.8	1754.5	O K
960 min Winter	39.172	0.672	7.8	1817.6	O K
1440 min Winter	39.192	0.692	7.8	1876.9	O K
2160 min Winter	39.194	0.694	7.8	1882.3	O K
2880 min Winter	39.180	0.680	7.8	1840.3	O K
4320 min Winter	39.106	0.606	7.8	1627.6	O K
5760 min Winter	39.037	0.537	7.8	1432.2	O K
7200 min Winter	38.972	0.472	7.8	1250.3	O K
8640 min Winter	38.912	0.412	7.8	1084.2	O K
10080 min Winter	38.857	0.357	7.8	935.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	61.480	0.0	1057.6	70	
120 min Winter	35.478	0.0	1188.4	128	
180 min Winter	25.721	0.0	1248.6	186	
240 min Winter	20.473	0.0	1271.0	246	
360 min Winter	14.842	0.0	1262.8	362	
480 min Winter	11.814	0.0	1241.7	480	
600 min Winter	9.898	0.0	1218.4	596	
720 min Winter	8.565	0.0	1195.2	714	
960 min Winter	6.871	0.0	1147.8	946	
1440 min Winter	5.036	0.0	1073.9	1402	
2160 min Winter	3.691	0.0	2284.2	2060	
2880 min Winter	2.961	0.0	2222.7	2680	
4320 min Winter	2.092	0.0	2105.6	3248	
5760 min Winter	1.636	0.0	2995.4	4096	
7200 min Winter	1.351	0.0	3088.1	4912	
8640 min Winter	1.156	0.0	3162.4	5712	
10080 min Winter	1.013	0.0	3216.3	6456	
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BWB Partnership		Page 4
Friars Studio 3 Friar Gate Derby DE1 1BU		
Date 23/05/2019 15:08 File A18.srcx		
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Micro Drainage		Source Control 2018.1.1

Model Details

Storage is Online Cover Level (m) 39.500

Tank or Pond Structure

Invert Level (m) 38.500

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	2521.8	0.700	2909.5	1.000	3084.1

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0130-7800-1000-7800
Design Head (m)	1.000
Design Flow (l/s)	7.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	130
Invert Level (m)	38.500
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	7.8
Flush-Flo™	0.302	7.8
Kick-Flo®	0.664	6.4
Mean Flow over Head Range	-	6.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.7	1.200	8.5	3.000	13.1	7.000	19.6
0.200	7.6	1.400	9.1	3.500	14.1	7.500	20.3
0.300	7.8	1.600	9.7	4.000	15.0	8.000	20.9
0.400	7.7	1.800	10.3	4.500	15.9	8.500	21.6
0.500	7.5	2.000	10.8	5.000	16.7	9.000	22.2
0.600	7.1	2.200	11.3	5.500	17.5	9.500	22.7
0.800	7.0	2.400	11.8	6.000	18.2		
1.000	7.8	2.600	12.2	6.500	18.9		

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BWB Partnership					Page 1	
Friars Studio 3 Friar Gate Derby DE1 1BU						
Date 23/05/2019 15:15 File A19.srcx		Designed by josephine.green Checked by				
Micro Drainage		Source Control 2018.1.1				
<u>Summary of Results for 100 year Return Period (+40%)</u>						
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer		38.307	0.307	5.0	510.8	O K
30 min Summer		38.351	0.351	5.0	587.5	O K
60 min Summer		38.400	0.400	5.0	673.3	O K
120 min Summer		38.453	0.453	5.0	767.1	O K
180 min Summer		38.484	0.484	5.0	824.0	O K
240 min Summer		38.507	0.507	5.0	864.4	O K
360 min Summer		38.537	0.537	5.0	919.3	O K
480 min Summer		38.556	0.556	5.0	955.1	O K
600 min Summer		38.570	0.570	5.0	979.9	O K
720 min Summer		38.579	0.579	5.0	997.4	O K
960 min Summer		38.595	0.595	5.0	1027.3	O K
1440 min Summer		38.607	0.607	5.0	1050.0	O K
2160 min Summer		38.601	0.601	5.0	1038.8	O K
2880 min Summer		38.590	0.590	5.0	1018.0	O K
4320 min Summer		38.535	0.535	5.0	917.0	O K
5760 min Summer		38.487	0.487	5.0	828.2	O K
7200 min Summer		38.442	0.442	5.0	748.4	O K
8640 min Summer		38.401	0.401	5.0	675.4	O K
10080 min Summer		38.364	0.364	5.0	609.8	O K
15 min Winter		38.343	0.343	5.0	572.5	O K
30 min Winter		38.392	0.392	5.0	658.8	O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer		184.626	0.0	387.5	27	
30 min Summer		106.540	0.0	412.1	41	
60 min Summer		61.480	0.0	630.0	72	
120 min Summer		35.478	0.0	715.5	130	
180 min Summer		25.721	0.0	762.1	190	
240 min Summer		20.473	0.0	788.3	250	
360 min Summer		14.842	0.0	803.6	368	
480 min Summer		11.814	0.0	797.0	488	
600 min Summer		9.898	0.0	786.8	606	
720 min Summer		8.565	0.0	775.3	726	
960 min Summer		6.871	0.0	750.4	964	
1440 min Summer		5.036	0.0	704.3	1442	
2160 min Summer		3.691	0.0	1398.7	1924	
2880 min Summer		2.961	0.0	1426.7	2276	
4320 min Summer		2.092	0.0	1341.9	2984	
5760 min Summer		1.636	0.0	1738.9	3752	
7200 min Summer		1.351	0.0	1793.4	4544	
8640 min Summer		1.156	0.0	1837.3	5288	
10080 min Summer		1.013	0.0	1868.4	6056	
15 min Winter		184.626	0.0	409.7	27	
30 min Winter		106.540	0.0	419.5	41	
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BWB Partnership					Page 2
Friars Studio 3 Friar Gate Derby DE1 1BU					
Date 23/05/2019 15:15 File A19.srcx		Designed by josephine.green Checked by			
Micro Drainage		Source Control 2018.1.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	38.446	0.446	5.0	755.5	O K
120 min Winter	38.505	0.505	5.0	861.8	O K
180 min Winter	38.541	0.541	5.0	927.0	O K
240 min Winter	38.566	0.566	5.0	973.8	O K
360 min Winter	38.601	0.601	5.0	1038.6	O K
480 min Winter	38.625	0.625	5.0	1082.4	O K
600 min Winter	38.642	0.642	5.0	1114.0	O K
720 min Winter	38.654	0.654	5.0	1137.1	O K
960 min Winter	38.675	0.675	5.0	1177.0	O K
1440 min Winter	38.694	0.694	5.0	1213.7	O K
2160 min Winter	38.695	0.695	5.0	1215.9	O K
2880 min Winter	38.681	0.681	5.0	1188.4	O K
4320 min Winter	38.608	0.608	5.0	1050.3	O K
5760 min Winter	38.537	0.537	5.0	919.4	O K
7200 min Winter	38.471	0.471	5.0	799.8	O K
8640 min Winter	38.410	0.410	5.0	691.3	O K
10080 min Winter	38.355	0.355	5.0	594.4	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	61.480	0.0	698.6	70	
120 min Winter	35.478	0.0	779.5	128	
180 min Winter	25.721	0.0	809.4	186	
240 min Winter	20.473	0.0	813.3	246	
360 min Winter	14.842	0.0	801.6	362	
480 min Winter	11.814	0.0	784.9	480	
600 min Winter	9.898	0.0	767.5	598	
720 min Winter	8.565	0.0	751.7	714	
960 min Winter	6.871	0.0	723.6	946	
1440 min Winter	5.036	0.0	681.6	1402	
2160 min Winter	3.691	0.0	1465.9	2064	
2880 min Winter	2.961	0.0	1419.4	2684	
4320 min Winter	2.092	0.0	1342.0	3288	
5760 min Winter	1.636	0.0	1947.2	4144	
7200 min Winter	1.351	0.0	2008.3	4968	
8640 min Winter	1.156	0.0	2057.7	5712	
10080 min Winter	1.013	0.0	2095.4	6464	
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BWB Partnership		Page 4
Friars Studio 3 Friar Gate Derby DE1 1BU		
Date 23/05/2019 15:15 File A19.srcx		
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Micro Drainage		Source Control 2018.1.1

Model Details

Storage is Online Cover Level (m) 39.000

Tank or Pond Structure

Invert Level (m) 38.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	1596.3	0.700	1907.5	1.000	2049.4

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0105-5000-1000-5000
Design Head (m)	1.000
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	105
Invert Level (m)	38.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

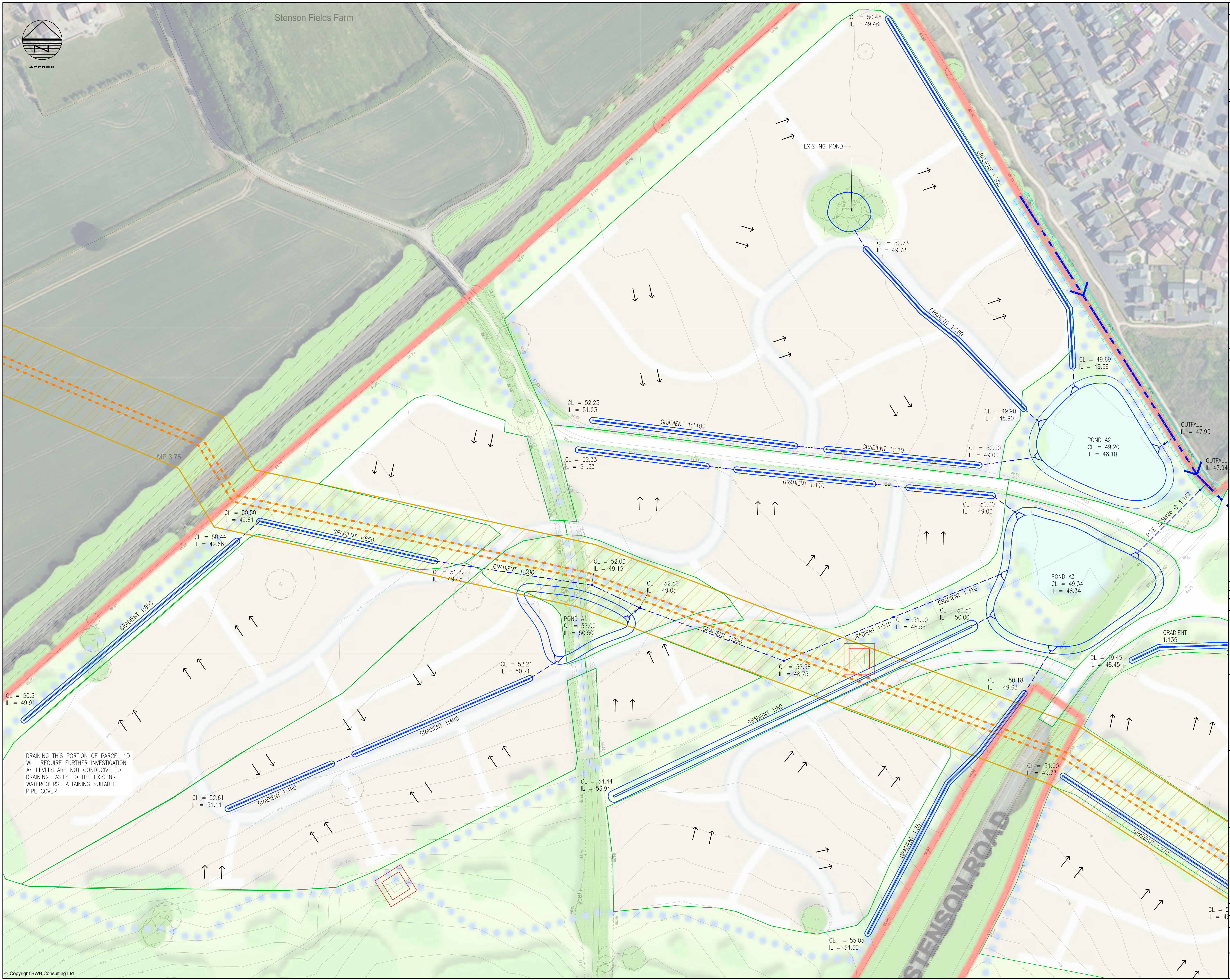
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	5.0
Flush-Flo™	0.296	5.0
Kick-Flo®	0.637	4.1
Mean Flow over Head Range	-	4.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.6	1.200	5.4	3.000	8.4	7.000	12.5
0.200	4.8	1.400	5.8	3.500	9.0	7.500	12.9
0.300	5.0	1.600	6.2	4.000	9.6	8.000	13.3
0.400	4.9	1.800	6.6	4.500	10.1	8.500	13.7
0.500	4.7	2.000	6.9	5.000	10.6	9.000	14.1
0.600	4.3	2.200	7.2	5.500	11.1	9.500	14.5
0.800	4.5	2.400	7.5	6.000	11.6		
1.000	5.0	2.600	7.8	6.500	12.1		

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APPENDIX 4: Outline Surface Water Drainage Strategy



1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.

	ATTENUATION POND
	SWALE
	CATCHMENT BOUNDARIES
	GAS MAIN EASEMENT (APPROXIMATELY 17M FROM MAIN CENTERLINE)
	WATERCOURSE EASEMENT (IN LINE WITH LOCAL COUNTY GUIDANCE)
	WATERCOURSE REMOVAL/ ALTERATIONS TBC
	APPROXIMATE PYLON STANDOFF TBC
	EXISTING WATERCOURSE ROUTE
	PROPOSED SW NETWORK
	HP GAS MAIN
	SURFACE WATER FLOW ROUTE

1. ALL CALCULATIONS ARE BASED UPON SURVEY DATA FROM BWS CONSULTING LTD REF: NTH/2136/SVY/001.
2. ALL ATTENUATION FEATURES ARE INDICATIVE AND HAVE BEEN SIZED TO STORE THE REQUIRED VOLUME FROM A 100YR + 40% CLIMATE CHANGE EVENT.
3. ATTENUATION FEATURES SHOWN VARY BETWEEN 0.7 -1.1m DEEP, TYPICALLY WITH 1 IN 3 SIDES.
4. CALCULATIONS HAVE BEEN BASED UPON THE ILLUSTRATIVE MASTERPLAN PROVIDED BY PLANNING AND DESIGN GROUP, MAY 2019. ANY AMENDMENTS WILL REQUIRE REVISION AND RECALCULATION OF ATTENUATION FEATURES.
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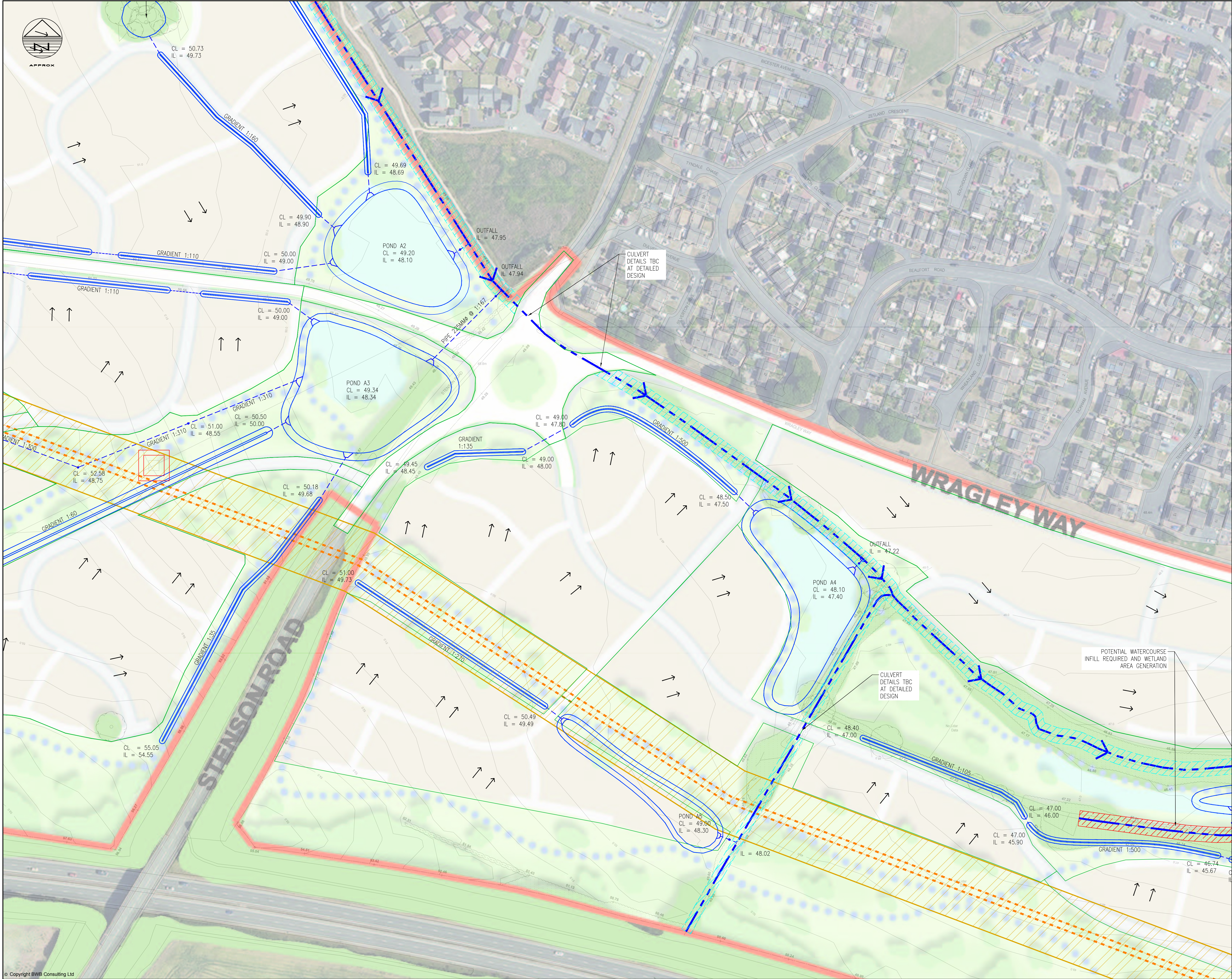
Drawing Title

OUTLINE SURFACE WATER DRAINAGE STRATEGY

Drawn:	J.Green		Reviewed:	R.Ward	
BWB Ref:	NTH2136	Date:	23.05.19	Scale@A1:	1:100

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ATTENUATION POND

SWALE

CATCHMENT BOUNDARIES

GAS MAIN EASEMENT
(APPROXIMATELY 17M FROM MAIN CENTERLINE)

WATERHOUSE EASEMENT (IN LINE WITH LOCAL COUNTY GUIDANCE)

WATERCOURSE REMOVAL/
ALTERATIONS TBC

APPROXIMATE PYLON STANDOFF
TBC

EXISTING WATERCOURSE ROUTE

PROPOSED SW NETWORK

HP GAS MAIN

SURFACE WATER FLOW ROUTE

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Project Title

LAND OFF WRAGLEY WAY

Drawing Title

OUTLINE SURFACE
WATER DRAINAGE
STRATEGY

Drawn: J.Green

Reviewed: R.Ward

BWB Ref: NTH2136

Date: 23.05.19

Scale@A1: 1:1000

Drawing Status

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Status

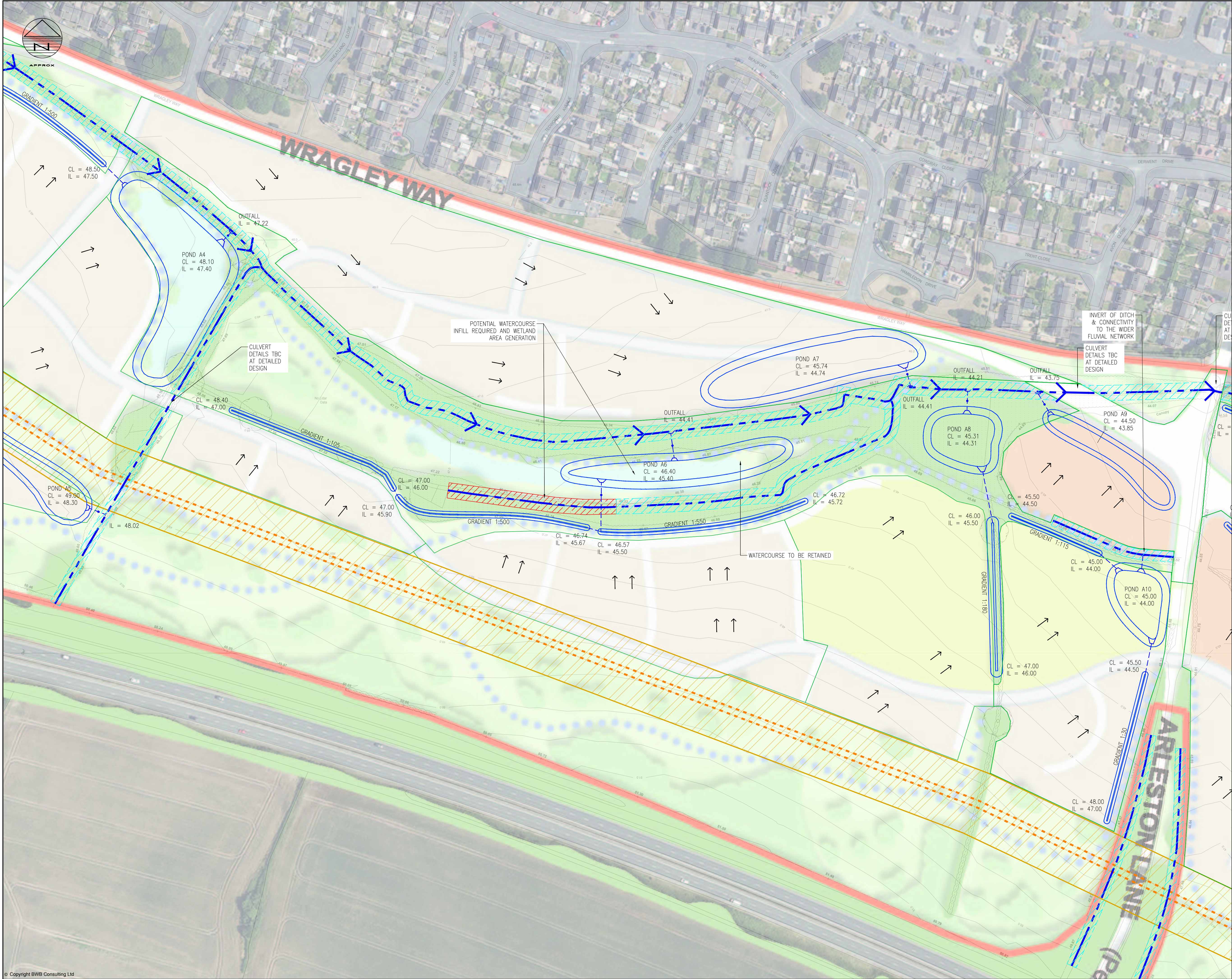
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HP GAS MAIN

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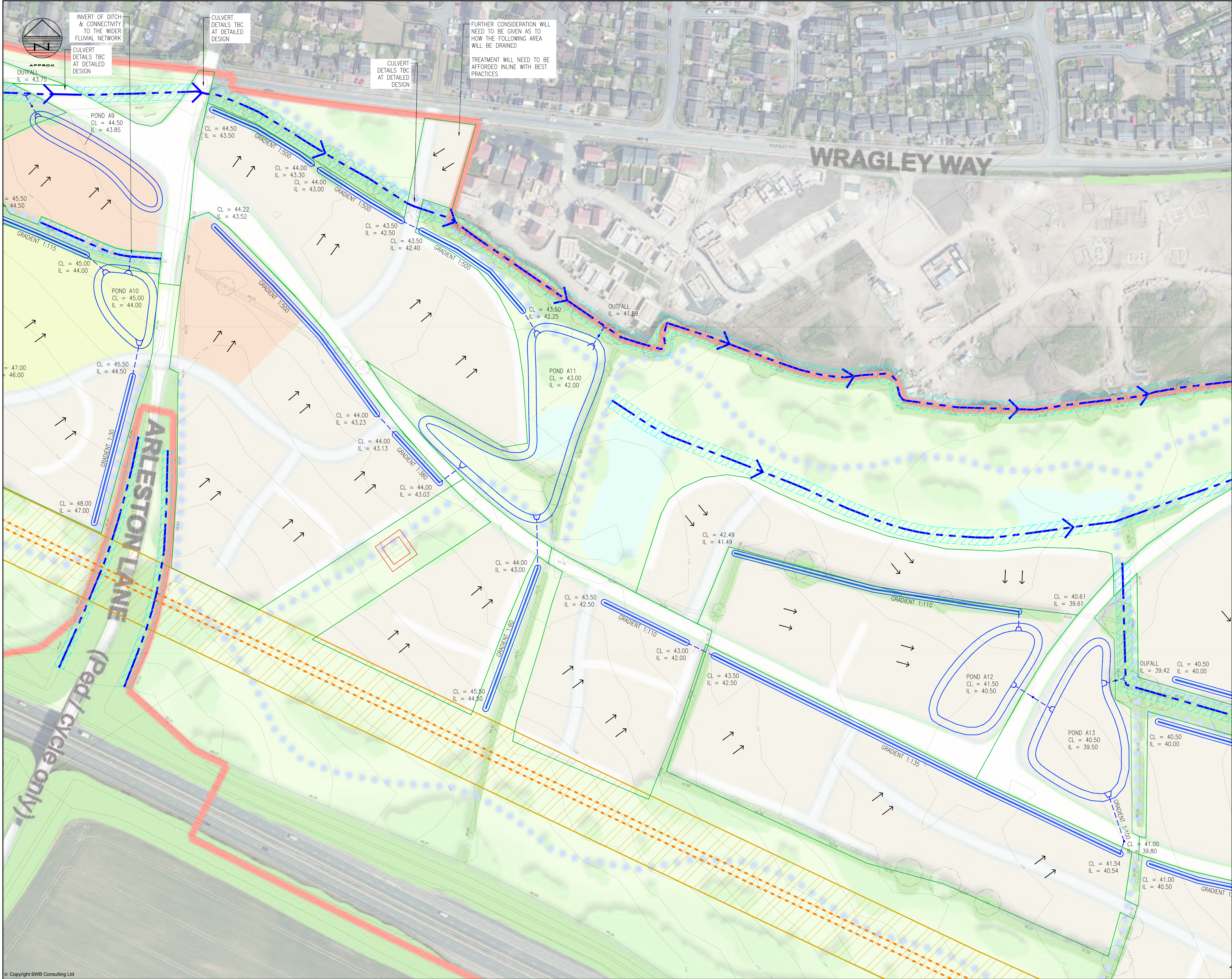
Drawn:	J.Green	Reviewed:	R.Ward
BWB Ref:	NTH2136	Date:	23.05.19
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PROPOSED SW NETWORK

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SURFACE WATER FLOW ROUTE

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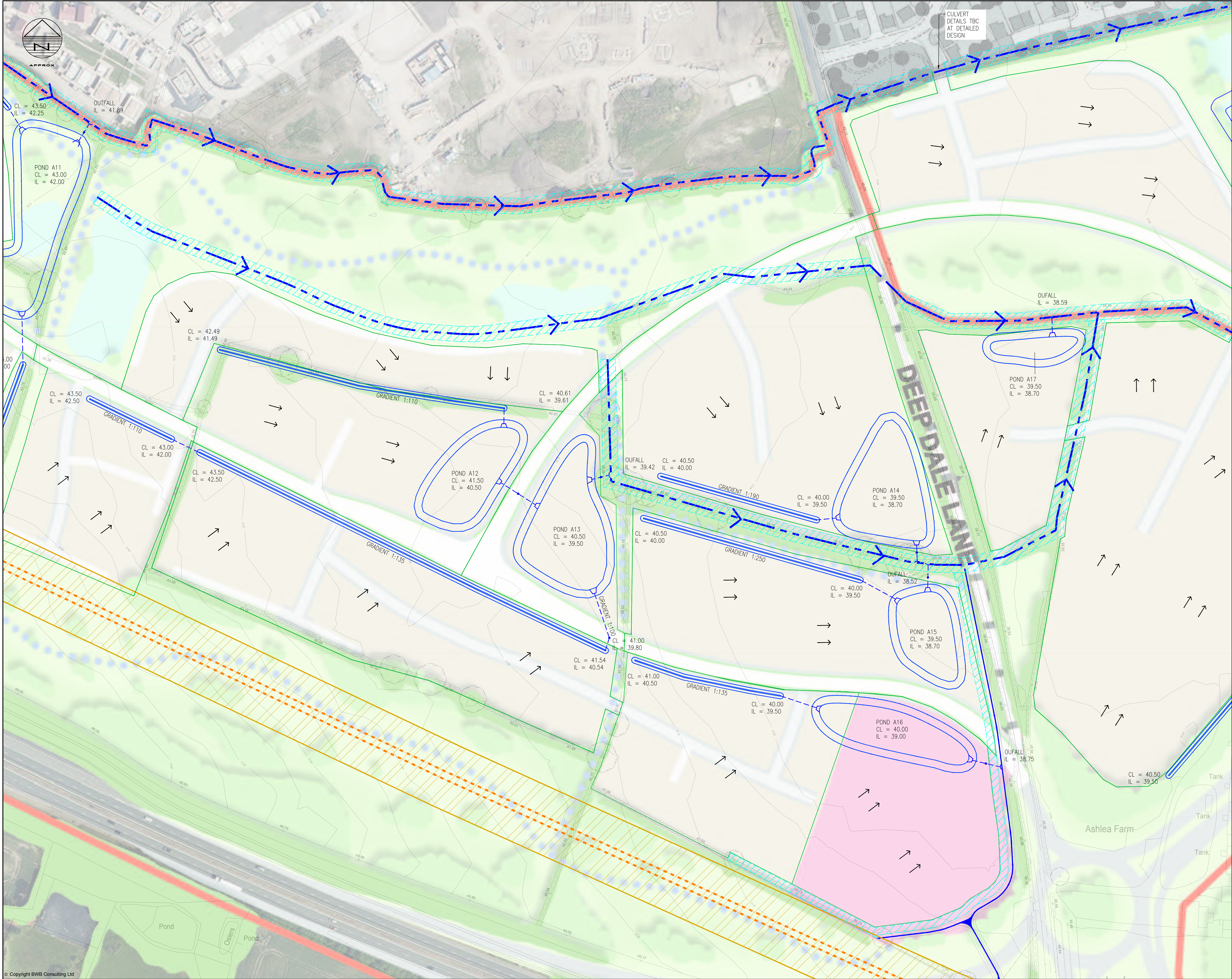
OUTLINE SURFACE WATER DRAINAGE STRATEGY

Drawn:	J.Green	Reviewed:	R.Ward
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Scale@A1:	1:1000		

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EXISTING WATERCOURSE ROUTE

PROPOSED SW NETWORK

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SURFACE WATER FLOW ROUTE

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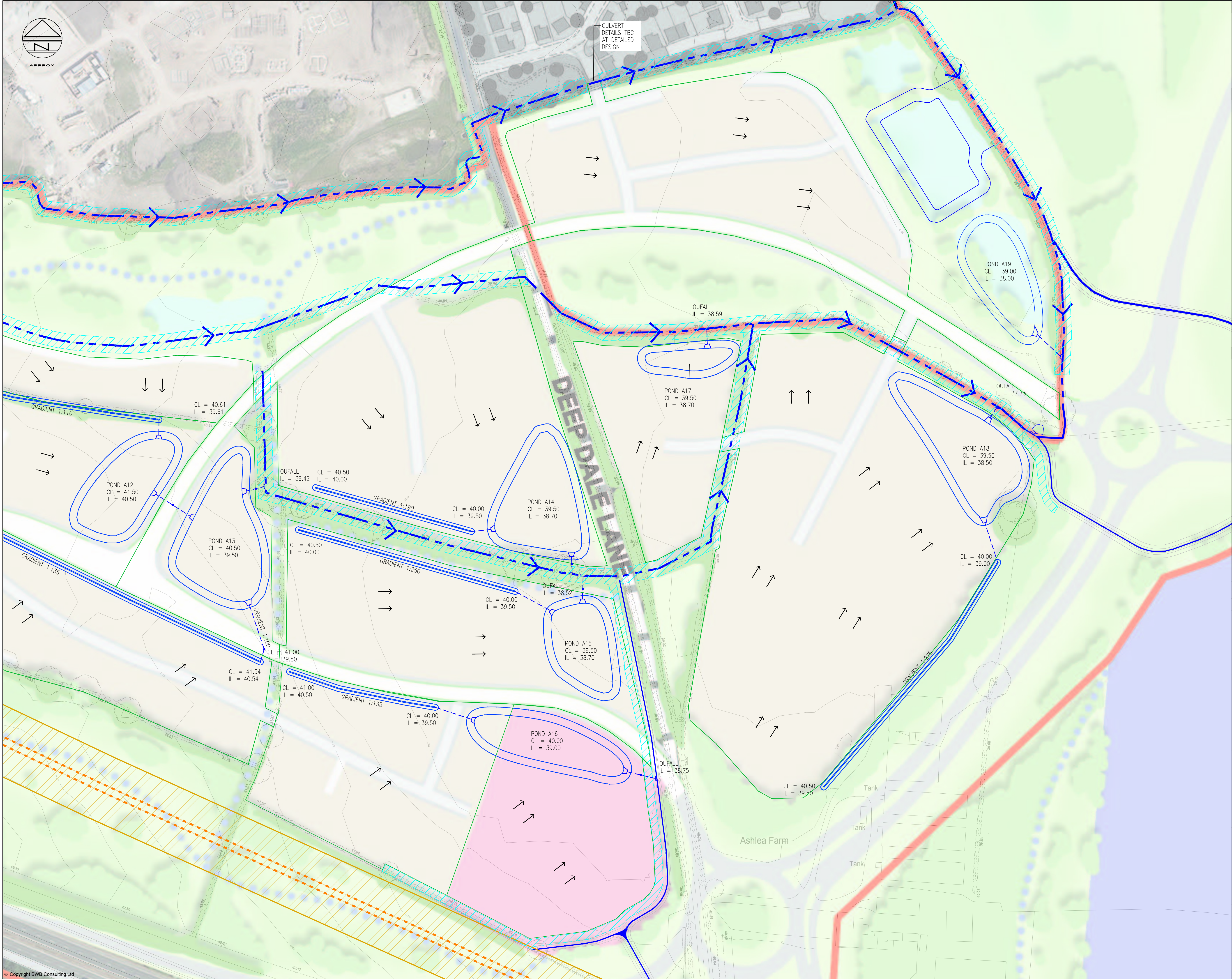
**OUTLINE SURFACE
WATER DRAINAGE
STRATEGY**

Drawn:	J.Green	Reviewed:	R.Ward
BWB Ref:	NTH2136	Date:	23.05.19
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WATERCOURSE REMOVAL/ ALTERATIONS TBC

APPROXIMATE PYLON STANDOFF TBC

EXISTING WATERCOURSE ROUTE

PROPOSED SW NETWORK

HP GAS MAIN

SURFACE WATER FLOW ROUTE

DRAINAGE NOTES

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OUTLINE SURFACE WATER DRAINAGE STRATEGY

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Scale@A1:	1:1000	Status	

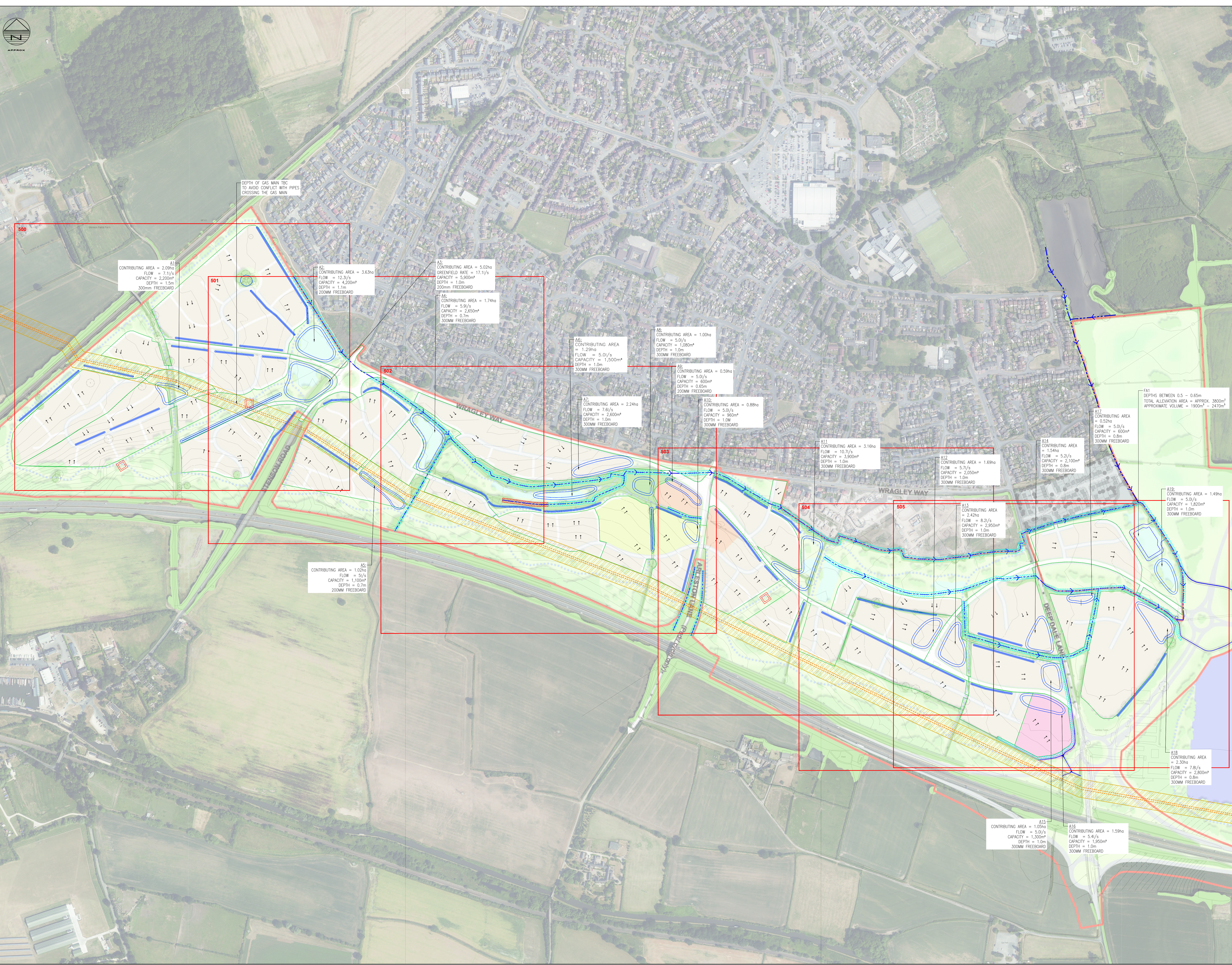
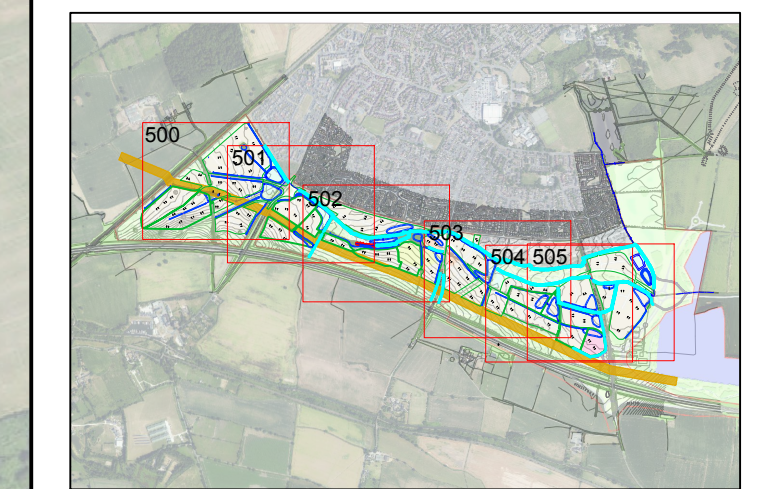
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Key Plan



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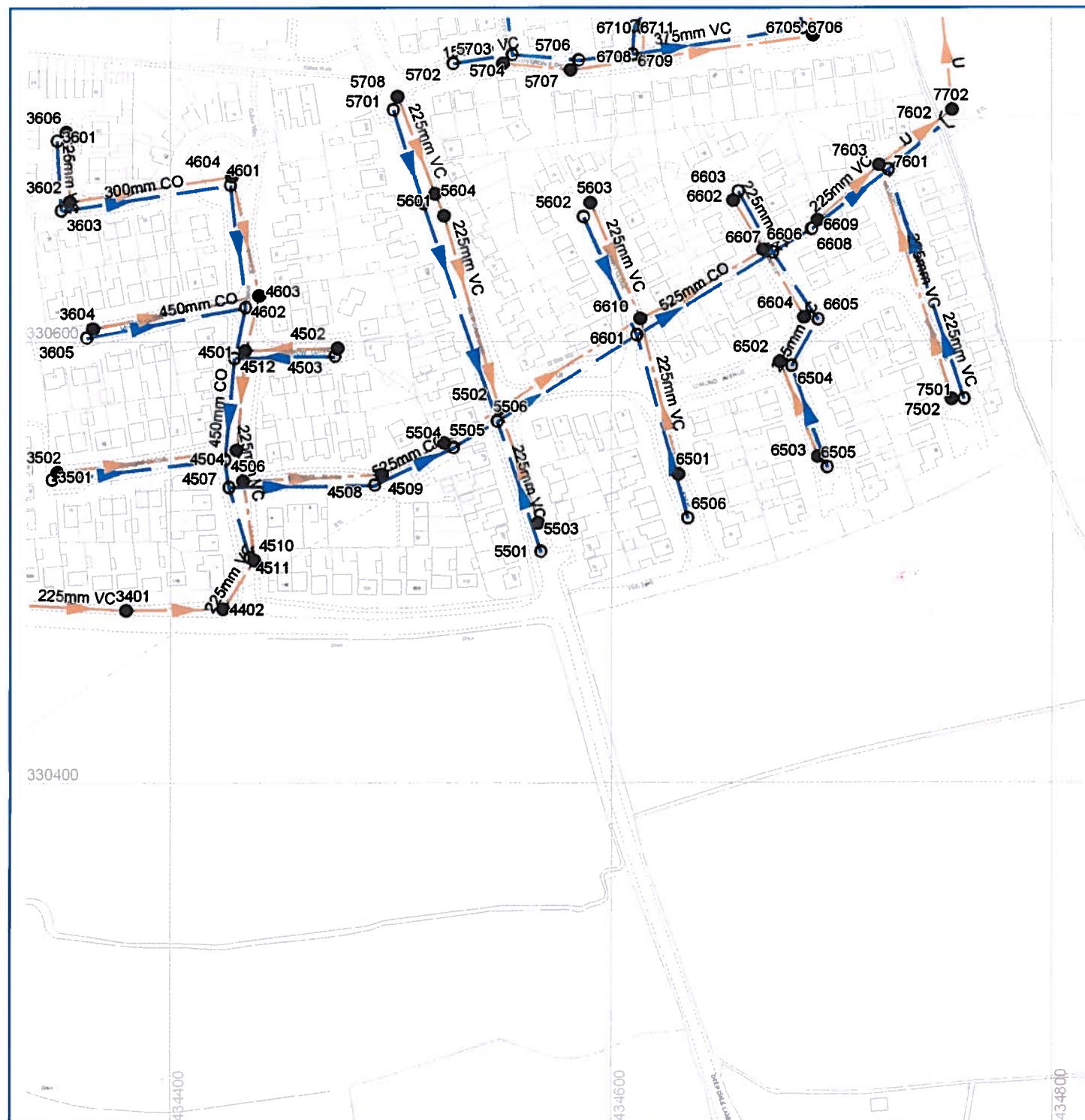
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OUTLINE SURFACE WATER DRAINAGE STRATEGY

Drawn:	J.Green	Reviewed:	R.Ward
BWB Ref:	NTH2136	Date:	23.05.19
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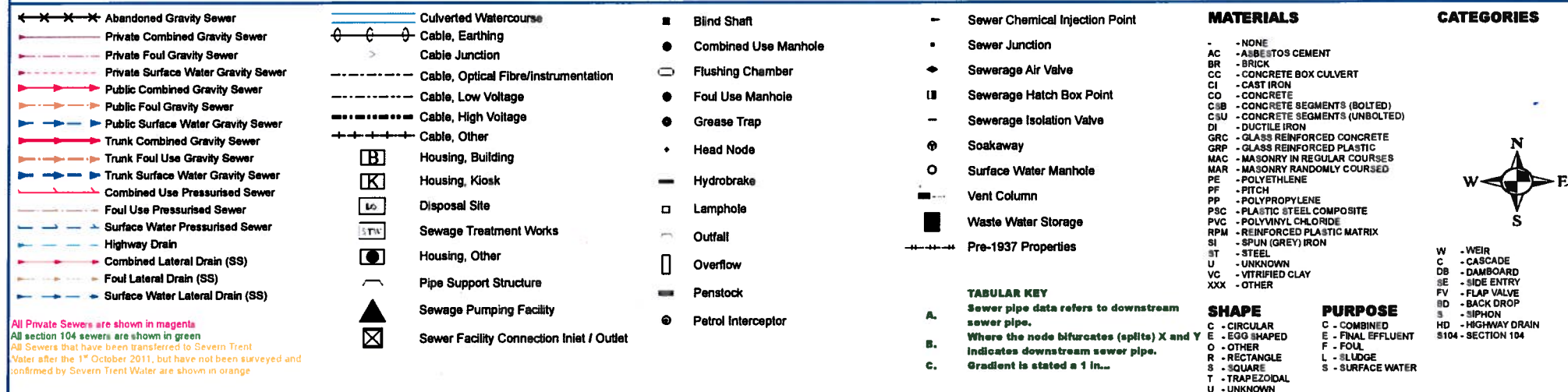
Drawing Status
PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
WRA-BWB-ZZ-XX-DR-CD-506	S2	P1

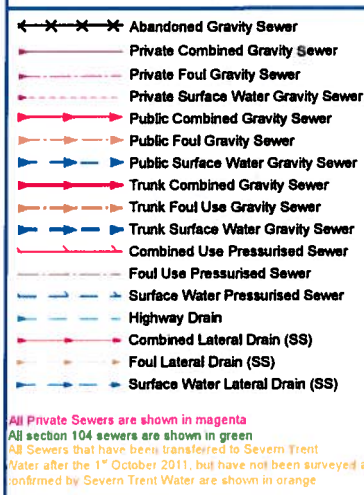
APPENDIX 5: Severn Trent Water DSE & Sewer Records



Sewer Node		Sewer Pipe Data								
REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SK34308501	41.55	40.01	39.48	F	VC	C	225	nil	137.06	2003
SK34308502	40.76	39.51	39.45	F	VC	C	225	nil	380.50	2003
SK34308503	41.22	39.85	39.53	F	VC	C	225	nil	144.50	2003
SK34308504	40.75	39.90	39.85	S	VC	C	225	nil	483.80	2003
SK34308505	41.22	40.20	39.91	S	VC	C	225	nil	167.93	2003
SK34308506	41.66	40.59	40.07	S	VC	C	225	nil	165.63	2003
SK34308601	41.23	40.04	39.62	S	CO	C	525	nil	172.55	2003
SK34308602	40.79	39.42	39.21	F	VC	C	225	nil	69.36	2003
SK34308603	40.79	39.83	39.62	S	VC	C	225	nil	102.24	2003
SK34308604	40.53	39.44	39.16	F	VC	C	225	nil	166.61	2003
SK34308605	40.55	39.82	39.62	S	VC	C	225	nil	234.35	2003
SK34308606	40.68	39.16	39.09	F	VC	C	225	nil	504.50	2003
SK34308607	40.66	39.64	39.43	S	VC	C	525	nil	109.95	2003
SK34308608	40.45	39.43	nil	S	CO	C	525	nil	0.00	2003
SK34308609	40.44	39.07	38.87	F	VC	C	225	nil	167.70	2003
SK34308610	41.30	39.46	39.17	F	VC	C	225	nil	215.77	2003
SK34308705	41.05	38.83	38.46	F	VC	C	225	nil	156.68	2003
SK34308706	41.11	39.62	39.44	S	CO	C	450	nil	319.78	2003
SK34308708	41.20	39.34	38.98	F	VC	C	225	nil	216.06	2003
SK34308709	41.21	39.87	39.64	S	VC	C	375	nil	338.83	2003
SK34308710	41.23	39.58	39.45	F	VC	C	225	nil	107.69	2003
SK34308711	41.20	40.10	40.03	S	VC	C	225	nil	166.29	2003
SK34307501	40.75	39.62	nil	S	VC	C	225	nil	0.00	2003
SK34307502	40.75	39.40	38.85	F	VC	C	225	nil	197.98	2003
SK34307601	40.29	nil	38.98	S	U	U	nil	nil	0.00	2003
SK34307603	40.31	38.84	nil	F	VC	C	225	nil	0.00	2003
SK34307702	nil	nil	nil	F	U	U	nil	nil	0.00	2003



SEVERN TRENT WATER		Sewern Trent Water Limited Asset Data Management PO Box 5344 Coventry CV3 9PT Telephone: 0845 601 6616	
SEWER RECORD (Tabular)			
O/S Map scale:	1:2500	This map is centred upon: O / S Grid reference:	
Date of Issue:	28.02.14	x :	434576
Sheet No.	2 of 2	y :	330496
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ETE
ETE SEGMENT S (BOLTED)
ETE SEGMENT S (UNBOLTED)
E IRON

REINFORCED CONCRETE
REINFORCED PLASTIC
RY IN REGULAR COURSES
RY RANDOMLY COURSED
HLENE

ROPYLENE
C STEEL COMPOSITE
NYL CHLORIDE
RCED PLASTIC MATRIX
GREY) IRON

WN
ED CLAY



W - WEIR
C - CASCADE
DB - DAMBOARD
SE - SIDE ENTRY
FV - FLAP VALVE
BD - BACK DROP
S - SIPHON
HD - HIGHWAY DRAIN
S104 - SECTION 104

PURPOSE

C - COMBINED
E - FINAL EFFLUENT
F - FOUL
L - SLUDGE
S - SURFACE WATER

	Severn Trent Water Limited Asset Data Management PO Box 5344 Coventry CV3 9PT Telephone: 0845 601 6616	
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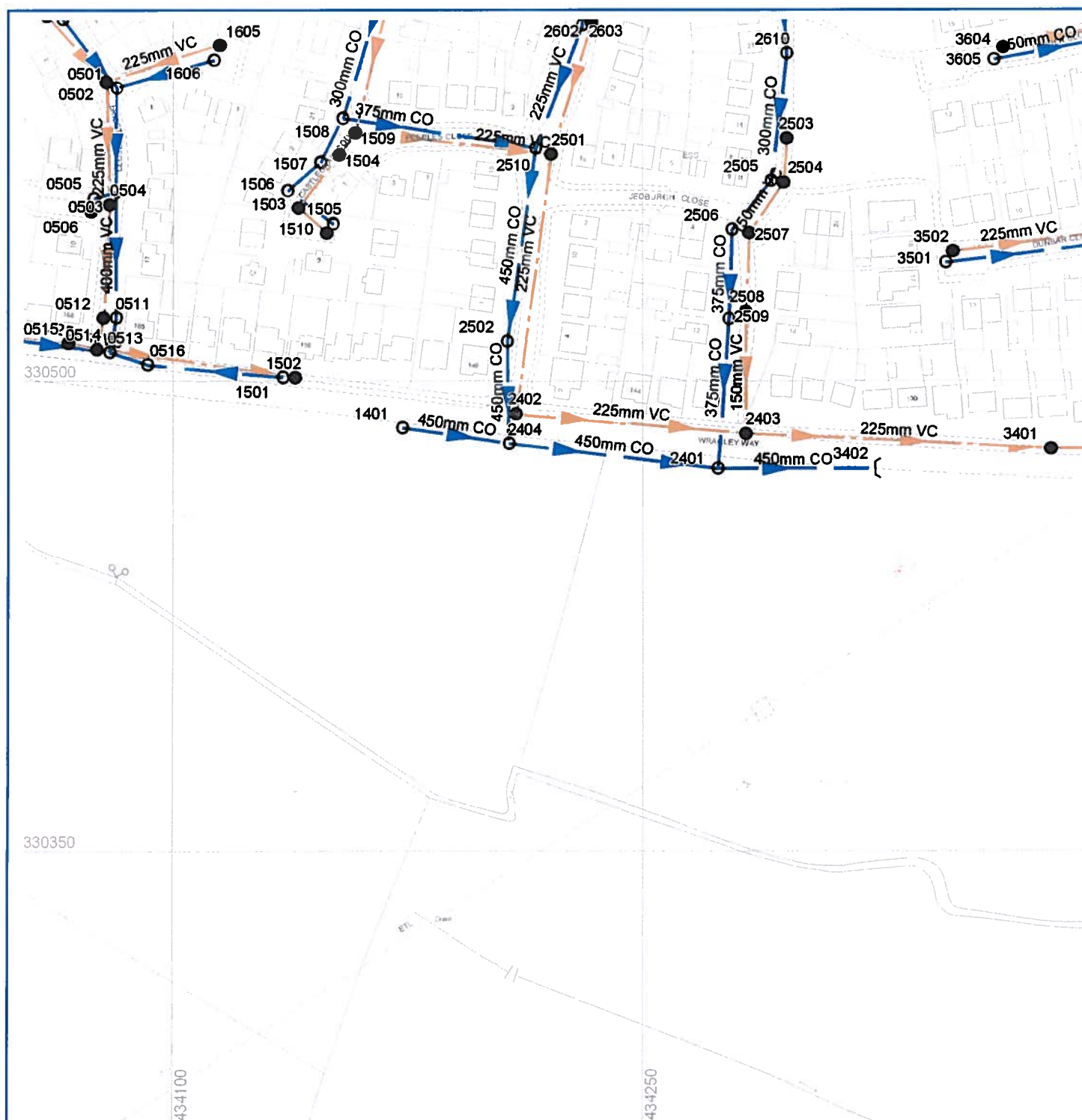
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Sewer Node

Sewer Pipe Data

REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SK34303604	42.82	40.34	40.02	F	VC	C	225	nil	240.56	nil
SK34303605	42.85	40.99	40.55	S	CO	C	450	nil	166.48	1979

- Abandoned Gravity Sewer
- Private Combined Gravity Sewer
- Private Foul Gravity Sewer
- Private Surface Water Gravity Sewer
- Public Combined Gravity Sewer
- Public Foul Gravity Sewer
- Public Surface Water Gravity Sewer
- Trunk Combined Gravity Sewer
- Trunk Foul Use Gravity Sewer
- Trunk Surface Water Gravity Sewer
- Combined Use Pressurised Sewer
- Foul Use Pressurised Sewer
- Surface Water Pressurised Sewer
- Highway Drain
- Combined Lateral Drain (SS)
- Foul Lateral Drain (SS)
- Surface Water Lateral Drain (SS)

- Culverted Watercourse
- Cable, Earthing
- Cable Junction
- Cable, Optical Fibre/Instrumentation
- Cable, Low Voltage
- Cable, High Voltage
- Cable, Other
- Housing, Building
- Housing, Kiosk
- Disposal Site
- Sewage Treatment Works
- Housing, Other
- Pipe Support Structure
- Sewage Pumping Facility
- Sewer Facility Connection Inlet / Outlet

- Blind Shaft
- Combined Use Manhole
- Flushing Chamber
- Foul Use Manhole
- Grease Trap
- Head Node
- Hydrobrake
- Lamphole
- Outfall
- Overflow
- Penstock
- Petrol Interceptor
- Sewer Chemical Injection Point
- Sewer Junction
- Sewerage Air Valve
- Sewerage Hatch Box Point
- Sewerage Isolation Valve
- Soakaway
- Surface Water Manhole
- Vent Column
- Waste Water Storage
- Pre-1937 Properties

TABULAR KEY
Sewer pipe data refers to downstream sewer pipe.
Where the node bifurcates (splits) X and Y indicates downstream sewer pipe.
Gradient is stated as 1 in...

MATERIALS

- NONE
- ASBESTOS CEMENT
- BRICK
- CONCRETE BOX CULVERT
- CAST IRON
- CONCRETE
- CONCRETE SEGMENTS (BOLTED)
- CONCRETE SEGMENTS (UNBOLTED)
- DUCTILE IRON
- GLASS REINFORCED CONCRETE
- GLASS REINFORCED PLASTIC
- MASONRY IN REGULAR COURSES
- MASONRY RANDOMLY COURSED
- POLYETHYLENE
- PITCH
- POLYPROPYLENE
- PLASTIC STEEL COMPOSITE
- POLYVINYL CHLORIDE
- REINFORCED PLASTIC MATRIX
- SPUN (GREY) IRON
- STEEL
- UNKNOWN
- VITRIFIED CLAY
- OTHER

SHAPE

- CIRCULAR
- EGG SHAPED
- OTHER
- RECTANGLE
- SQUARE
- TRAPEZOIDAL
- UNKNOWN

PURPOSE

- COMBINED
- FINAL EFFLUENT
- FLOUL
- SLUDGE
- SURFACE WATER

CATEGORIES



- WEIR
- CASCADE
- DAMBOARD
- HIDE ENTRY
- FLAP VALVE
- BACK DROP
- SIPHON
- HIGHWAY DRAIN
- SECTION 104

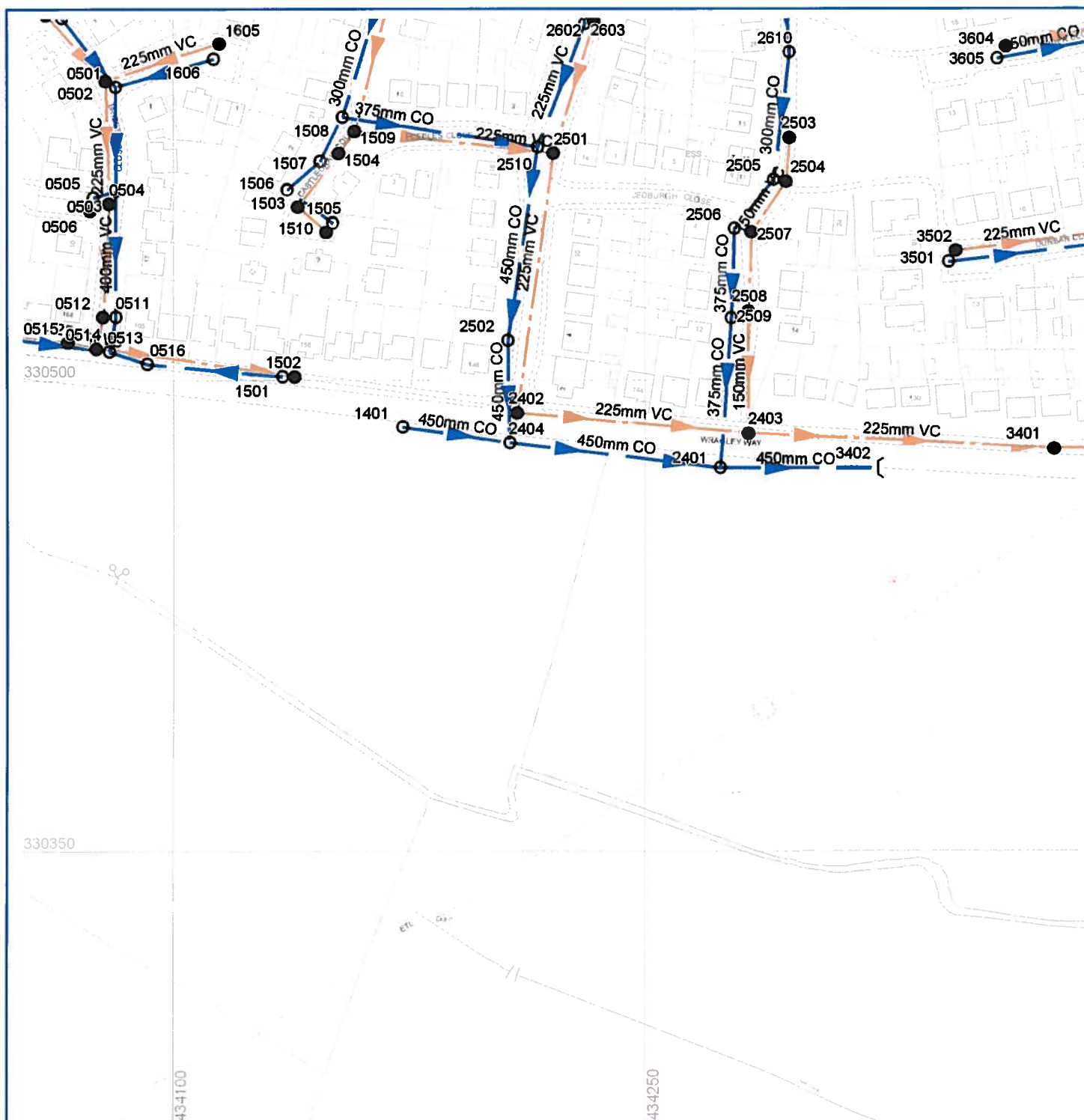


Severn Trent Water Limited
Asset Data Management
PO Box 5344
Coventry
CV3 9FT
Telephone: 0845 601 6616

SEWER RECORD (Tabular)

O/S Map scale: 1:1750
Date of Issue: 28.02.14
Sheet No. 2 of 2
This map is centred upon:
O / S Grid reference:
x : 434222
y : 330439

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Sewer Node		Sewer Pipe Data								
REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SK34300501	45.61	44.04	43.87	S	VC	C	400	nil	194.12	2003
SK34300502	45.59	43.37	43.13	F	VC	C	225	nil	162.54	2003
SK34300503	45.35	43.87	43.68	S	VC	C	400	nil	210.53	2003
SK34300504	45.37	43.12	42.78	F	VC	C	225	nil	108.06	2003
SK34300505	45.37	44.05	44.02	S	VC	C	225	nil	242.67	2003
SK34300506	45.33	43.17	43.13	F	VC	C	225	nil	158.00	2003
SK34300511	44.87	43.66	43.64	S	CO	C	450	nil	559.00	2003
SK34300512	44.87	42.78	42.27	F	VC	C	225	nil	20.00	2003
SK34300513	44.71	43.58	43.51	S	CO	C	450	nil	180.71	2003
SK34300514	44.25	42.13	42.01	F	VC	C	225	nil	530.33	2003
SK34300515	44.72	42.66	42.15	F	VC	C	225	nil	18.08	2003
SK34300609	45.54	44.25	44.07	S	VC	C	400	nil	154.44	2003
SK34301401	43.90	42.53	42.20	S	CO	C	450	nil	104.15	2003
SK34301501	44.57	43.68	43.52	S	VC	C	225	nil	289.94	2003
SK34301503	44.17	42.70	42.59	F	VC	C	225	nil	178.33	2003
SK34301504	44.27	42.55	42.48	F	VC	C	225	nil	122.86	2003
SK34301505	44.24	43.05	43.04	S	VC	C	225	nil	1790.00	nil
SK34301506	44.19	43.01	42.91	S	VC	C	225	nil	138.30	2003
SK34301507	44.26	42.91	42.83	S	VC	C	225	nil	195.63	2003
SK34301508	44.33	42.76	42.43	S	CO	C	375	nil	190.06	2003
SK34301509	44.34	42.35	41.73	F	VC	C	225	nil	102.24	2003
SK34301510	44.25	42.87	42.75	F	VC	C	150	nil	100.33	2003
SK34301605	45.37	43.64	43.39	F	VC	C	225	nil	151.80	2003
SK34301606	45.40	44.34	44.20	S	VC	C	225	nil	230.57	2003
SK34302401	43.17	41.71	41.51	S	CO	C	450	nil	240.00	2003
SK34302402	43.32	41.45	40.94	F	VC	C	225	nil	144.69	2003
SK34302403	43.00	40.91	40.05	F	VC	C	225	nil	111.84	2003
SK34302404	43.64	42.17	41.75	S	CO	C	450	nil	160.67	2003
SK34302501	43.78	41.57	41.46	F	VC	C	225	nil	757.27	2003
SK34302502	43.40	42.26	42.20	S	CO	C	450	nil	541.67	2003
SK34302503	43.22	41.84	41.69	F	VC	C	150	nil	93.60	2003
SK34302504	43.16	41.66	41.57	F	VC	C	150	nil	215.78	2003
SK34302505	43.15	42.05	41.92	S	CO	C	300	nil	153.15	2003
SK34302506	42.99	41.92	41.88	S	CO	C	375	nil	713.00	2003
SK34302507	42.97	41.56	41.31	F	VC	C	150	nil	100.08	2003
SK34302508	42.82	41.31	40.93	F	VC	C	150	nil	102.63	2003
SK34302509	42.81	41.87	41.78	S	CO	C	375	nil	529.22	2003
SK34302510	43.77	42.40	42.28	S	CO	C	450	nil	518.58	2003
SK34302602	43.98	42.39	41.73	F	VC	C	225	nil	66.62	2003
SK34302603	44.00	42.83	42.55	S	VC	C	225	nil	144.10	2003
SK34302610	43.37	42.29	42.06	S	CO	C	300	nil	177.43	2003
SK34303401	42.35	40.03	39.76	F	VC	C	225	nil	163.00	2003
SK34303501	42.87	40.79	40.20	S	VC	C	225	nil	133.08	2003
SK34303502	42.87	40.37	39.70	F	VC	C	225	nil	121.81	2003

Abandoned Gravity Sewer

Private Combined Gravity Sewer

Private Foul Gravity Sewer

Private Surface Water Gravity Sewer

Public Combined Gravity Sewer

Public Foul Gravity Sewer

Public Surface Water Gravity Sewer

Trunk Combined Gravity Sewer

Trunk Foul Use Gravity Sewer

Trunk Surface Water Gravity Sewer

Combined Use Pressurised Sewer

Foul Use Pressurised Sewer

Surface Water Pressurised Sewer

Highway Drain

Combined Lateral Drain (SS)

Foul Lateral Drain (SS)

Surface Water Lateral Drain (SS)

Culverted Watercourse

Cable, Earthing

Cable Junction

Cable, Optical Fibre/Instrumentation

Cable, Low Voltage

Cable, High Voltage

Cable, Other

Housing, Building

Housing, Kiosk

Disposal Site

Sewage Treatment Works

Housing, Other

Pipe Support Structure

Sewage Pumping Facility

Sewer Facility Connection Inlet / Outlet

Blind Shaft

Combined Use Manhole

Flushing Chamber

Foul Use Manhole

Grease Trap

Head Node

Hydrobrake

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Soakaway

Surface Water Manhole

Vent Column

Waste Water Storage

Pre-1937 Properties

TABULAR KEY

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Gradient is stated as 1 in...

MATERIALS

AC - NONE

BR - ASBESTOS CEMENT

CC - BRICK

CI - CONCRETE BOX CULVERT

CO - CAST IRON

CSB - CONCRETE SEGMENTS (BOLTED)

CSU - CONCRETE SEGMENTS (UNBOLTED)

DI - DUCTILE IRON

GRC - GLASS REINFORCED CONCRETE

GRP - GLASS REINFORCED PLASTIC

MAC - MASONRY IN REGULAR COURSES

MAR - MASONRY RANDOMLY COURSED

PE - POLYETHYLENE

PF - PITCH

PP - POLYPROPYLENE

PSC - PLASTIC STEEL COMPOSITE

PVC - POLYVINYL CHLORIDE

RPM - REINFORCED PLASTIC MATRIX

SI - SPUN (GREY) IRON

ST - STEEL

U - UNKNOWN

VC - VITRIFIED CLAY

XXX - OTHER

SHAPE

C - CIRCULAR

E - EGG SHAPED

O - OTHER

R - RECTANGLE

S - SQUARE

T - TRAPEZOIDAL

U - UNKNOWN

PURPOSE

C - COMBINED

E - FINAL EFFLUENT

F - FOUL

L - SLUDGE

S - SURFACE WATER

SEVERN

TRENT

WATER

Sewern Trent Water Limited

Asset Data Management

PO Box 5344

Coventry

CV3 9FT

Telephone: 0845 601 6616

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Sheet No. 1 of 2

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BWB CONSULTING

03 MAR 2014

RECEIVED

BWB Consulting
Livery Place
35, Livery Street
Colmore Business Park
Birmingham
B3 2PB

BWB CONSULTING

03 MAR 2014

RECEIVED

F.A.O: Carmen Jaimez

28th February 2014

Dear Sirs,

Land off Wragley Way, Derby
Proposed 2000 dwellings (434293,330422)

I refer to your recent Development Enquiry Request in respect of the above site. Please find a copy of the sewer records and 'Additional Guidance Notes' enclosed for your information.

Sewer Crossing

A 450mm dia public surface water sewer appears to be located in the north of the site parallel with Wragley Way. This sewer will require an easement of 10m, 5m each side within which no buildings shall be erected.

Foul Water Drainage

Due to the size of this development and downstream sewer flooding issues, a sewer capacity assessment (SCA) will need to be commissioned to understand the effects this development will have on the public sewers and the various pumping stations and overflows further downstream.

The initial sewer modelling will be funded by the developer. However, any further mitigation modelling and any public sewerage system improvements will be funded by Severn Trent within a reasonable timescale. Sewer modelling will also identify a discharge rate that can be currently accepted to allow a limited

SEVERN
TRENT
WATER

Severn Trent Water

Severn Trent Water Ltd
Leicester Water Centre
Gorse Hill
Anstey
Leicester
LE7 7GU

Tel: 0116 234 3834

Fax: 0116 234 3035

www.stwater.co.uk

net.dev.east@severntrent.co.uk

Contact: Keith Baker

Direct line: 0116 234 3786

Mobile no: 07889 631417

Your ref:

Our ref: WT29675 / 8136144

number of houses for a first phase, i.e whether the 130 can be accepted, until the improvements can be provided. The public foul sewers are between 1.87m and 2.32m deep to invert along Wragley Way, as the site may slope slightly to the south towards the watercourse there may be some part of the development where a pumped discharge may be required, again a pump rate would be determined by the SCA modelling.

A connection point for the first phase can be into any of the public foul manholes in Wragley Way, subject to suitable levels for a gravity connection and which part of the site is to be developed first. For the whole site, a different connection point may be suggested by the sewer modelling report.

Surface Water Drainage

Under the terms of Section H of the Building Regulations 2000, the disposal of surface water by means of soakaways should be considered as the primary method. If this is not practical and no watercourse is available as an alternative, the use of sewerage should be considered. In addition, other sustainable drainage methods should also be explored before a discharge to the public sewerage system is considered.

If these are found to be unsuitable, satisfactory evidence will need to be submitted. The evidence should be either percolation test results or a statement from the SI consultant (extract or a supplementary letter).

Subject to the above, the site area is bordered by a watercourse and crossed by drainage ditches, therefore I expect that the site will drain by gravity into the surrounding natural drainage systems subject to agreement of discharge rates with the Environment Agency. Some part of the site in the north along Wraggley Way may be able to gravitate to the 450mm dia public surface water sewer or the open ditch this sewer discharges to along Wragley Way. This would be limited to a green field run-off rate for that particular area, subject to agreement with this office, once that area is known.

Any flows generated by the site in excess of the permitted discharge rate will have to be attenuated within the development site.

For any new connection(s) into the public sewer network or the reuse of an existing sewer connection(s), you will need to apply

under Section 106 Water Industry Act 1991 as amended by the Water Act 2003. Our New Connections Team currently processes Section 106 applications, please contact them on 0800 707 6600 for an application pack and guidance notes (or visit www.stwater.co.uk). For the avoidance of doubt, it is suggested that you quote the reference number above. Applications to make such connections should be made separately from any application for adoption of the related sewers under Section 104 Water Industry Act 1991 as amended by the Water Act 2003.

I must inform you that this evaluation is only valid for 6 months from the date of this letter. Please quote the reference number above, in all future correspondence.

Yours faithfully,



WF Walton
Asset Protection Manager - East
Waste Water

Additional Guidance Notes

If you experience difficulty in the provision of off-site sewers to serve your proposed development, an application for requisition sewers under Section 98 Water Act 2003 may be appropriate on request to this office.

If there are existing public sewers within the curtilage of the development site that may affect the proposed development, the option to divert them under Section 185 Water Act 2003 may be available. All costs incurred would lay with the Applicant.

All potentially adoptable sewers must be designed and constructed in accordance with the guidelines in Sewers for Adoption (6th Edition), after 1st May 2006. A Severn Trent Water Addendum for Foul Sewage Pumping Stations will be available at www.wrcplc.co.uk/sfa.

If the sewers are to be offered for adoption or if the development works could affect the public sewerage system, the Developer should approach Severn Trent Water Ltd to discuss their proposals in detail. This is to ensure the Developer is aware of the Company's requirements which could affect the development design and/or programme.

In cases where the complexity of both the existing receiving sewerage system and the proposed additional sewerage necessitates the construction of a suitable computer model, Severn Trent Water can offer this service. Enquiries should be addressed to James Arkesden in our Infrastructure Strategy Team who can be contacted on 07583 894202 (Wed – Fri only) or email to: sewer.capacity@severntrent.co.uk.

Severn Trent Water has no knowledge of any specific land drainage issues involving this site. The Developer is to contact and seek approval of The Environment Agency, Local Authority etc. regarding any means of surface water disposal to the land drainage system, required attenuation, discharge consent etc.

All enquiries with respect to the supply of sewer records only should be directed to Severn Trent Water Limited, Asset Data Management, PO Box 5344, Coventry. CV3 9FT (Tel. 0845 601 6616).

Asset Protection
Waste Water East

SUPPLEMENTARY GUIDANCE NOTES

In 2006 the Government issued national advice in the form of "Planning Policy Statement 25: Development and Flood Risk" that seeks to reduce the impact of development on surface water runoff. This advice is generally followed by Local Authorities through both the Building Regulations (Approved Document H) and the imposition of appropriate planning conditions. Severn Trent welcomes this advice and supports such planning conditions that impose flow restrictions. It is considered that in accordance with current guidance disposal of storm runoff from the development should be dealt with as follows:

1. By soakage into the site's subsoil, subject to suitable ground soakage capacity and any contamination present. If ground soakage proves inadequate, evidence should be submitted to Severn Trent Water. The evidence should be either percolation test results or a statement from the SI consultant (extract from report or a supplementary letter) stating that soakaways would be ineffective. **A connection to public sewerage (existing or adoptable) would then be considered reasonable with flows as:**
2. Brown field development site: If storm runoff from the existing development is connected to the public sewerage system, then peak storm flows from the proposed development up to that generated from the previous connected impermeable area may be connected to the network subject to the details of the existing storm connection arrangements being submitted to Severn Trent Water.

For existing storm connections to the public foul sewerage system, any new storm connection to the public storm sewerage system (if available) should be limited to 5 litres/sec/ha (option A) OR a peak flow to be determined by the Company from its developer-funded hydraulic modelling of the public storm sewerage system (option B). The developer may choose either option. Existing flows should be assessed as the lower of $Q=2.78 \times 50 \times A_{\text{imp}}$ l/s (A_{imp} ha) and the unsurcharged capacity of the outfall pipe(s).

In addition to this restriction, for Brownfield developments, the Company would also suggest a reduction in surface water flow to the public sewerage systems of 20%. It should be noted that the Company would like to see any flow attenuation based on a 30 year critical duration storm design in accordance with 'Sewers for Adoption' current edition.

3. Green field development site: If the site is a green field development i.e. not involving any demolition of buildings or paved areas connected to the public sewerage system, then the storm runoff from the proposed development may be connected to the public sewerage system subject to peak storm flows (30 year design storm) being limited to a green field runoff of 5 litres/sec/ha (subject to a minimum of 5 litres/sec), applied to the gross area of the site, subject to sufficient capacity in the network.



BETTER SOLUTIONS, INTELLIGENTLY ENGINEERED