

Mintondale Developments Ltd

Land North of Radstone Fields

Brackley

Northamptonshire

Flood Risk Assessment &

Drainage Strategy

October 2020

| | |
|----------------|-----------------|
| AUTHOR: | JS |
| CHECKED: | JLW |
| APPROVED: | JS |
| REPORT REF: | FRA109/FRA revA |
| STATUS: | FINAL |

CONTENTS

| | Page Number |
|--|--------------------|
| 1.0 INTRODUCTION | 1 |
| 2.0 PLANNING POLICY | 2 |
| 3.0 EXISTING SITE | 4 |
| 4.0 POTENTIAL SOURCES OF FLOODING | 6 |
| 5.0 PROPOSED DEVELOPMENT | 9 |
| 6.0 VULNERABILITY & COMPATIBILITY | 15 |
| 7.0 ASSESSMENT OF FLOOD IMPACT | 16 |
| 8.0 CONCLUSIONS & RECOMMENDATIONS | 18 |

APPENDICES

| | |
|-------------------|---|
| Appendix A | Site Location Plan |
| Appendix B | Topographical Survey (Interlocks Surveys Ltd) |
| Appendix C | Pre-Planning Assessment Report (Anglian Water) |
| Appendix D | Plan Illustrating Relief Drain Route |
| Appendix E | Proposed Development Masterplan (Savills Urban Design Studio) |
| Appendix F | QBAR & Preliminary Attenuation Calculations |

1.0 INTRODUCTION

- 1.1 This Flood Risk Assessment (FRA) has been produced by Armstrong Stokes & Clayton on behalf of Mintondale Developments Ltd in support of the proposed development of land to the north of Radstone Fields, Brackley, Northamptonshire.
- 1.2 This FRA has been prepared in accordance with the National Planning Policy Framework (NPPF) and the accompanying Planning Practice Guidance (PPG), and in consultation with the Environment Agency, Anglian Water and South Northamptonshire Council, via the West Northamptonshire Strategic Flood Risk Assessment (SFRA).

2.0 PLANNING POLICY

National

- 2.1 The NPPF and PPG provide national planning guidance on the management of flood risk in respect to new development.
- 2.2 Paragraph 155 of the NPPF document states *'Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.'*
- 2.3 For the purposes of applying the NPPF, PPG states *'flood risk is a combination of the probability and the potential consequences of flooding from all sources – including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources'.*
- 2.4 For the purposes of applying the NPPF, PPG states *'areas at risk from all sources of flooding are included. For fluvial (river) and sea flooding, this is principally land within Flood Zones 2 and 3. It can also include an area within Flood Zone 1 which the Environment Agency has notified the local planning authority as having critical drainage problems'.*
- 2.5 PPG states that the key objectives of a site specific FRA is to establish.
- *whether a proposed development is likely to be affected by current or future flooding from any source;*
 - *whether it will increase flood risk elsewhere;*
 - *whether the measures proposed to deal with these effects and risks are appropriate;*
 - *the evidence for the local planning authority to apply (if necessary) the Sequential Test, and;*

- *whether the development will be safe and pass the Exception Test, if applicable.*

2.6 PPG also refers to a FRA being appropriate to the scale, nature and location of the development and be credible and fit for purpose. A site specific FRA should always be proportionate to the degree of flood risk and make optimum use of information already available, including information in a SFRA for the area, and the interactive flood risk maps available on the Environment Agency's web site.

Local

2.7 The administrative area of South Northamptonshire Council is covered by the joint West Northamptonshire Level 1 SFRA, dated December 2017 and March 2019. These documents provide further, more local guidance in respect of flood risk. This FRA has been prepared with reference to the SFRA.

3.0 EXISTING SITE

General

- 3.1 The application site has a total gross area of approx. 29.87 ha and lies to the north of the current Radstone Fields development, and to the east of Halse Road, Brackley. The proposed developable area of the residential element equates to 12.86 ha, with sports pitches, recreational areas, open space and land reserved for biodiversity making up the remaining area of the total site. An OS based location plan identifying the application site is included within **Appendix A**.
- 3.2 The site is bound to the north and east by agricultural land, with a Solar Farm situated further north and Radstone Road situated further east. Halse Road abuts the western boundary. The Radstone Fields residential development abuts the southern boundary of the site.
- 3.3 The site is classified as Greenfield, consisting of agricultural land comprised of a series of field parcels, each bounded by hedgerow. A Public Bridleway, known as The Worlidge, runs through the site, to the north of the proposed residential element. A further Public Right of Way runs along the western boundary of the northern field parcel adjacent to the location of the proposed sports pitches.
- 3.4 Whilst it is evident that there are a number of small channels running along field boundaries within the site, there are at least three unnamed minor watercourses within the vicinity, with two of them abutting the site. The two that adjoin the site are situated to the south and north-east edges of the site. The watercourse to the south is situated where the site abuts the existing Radstone Fields development. The watercourse to the north-east runs from The Worlidge, and flows in an easterly direction, towards Radstone Road and beyond.

Levels

- 3.5 A topographical survey of the site, relative to OSBM, has been carried out. A copy of the survey drawing is included within **Appendix B**.

- 3.6 The survey confirms that the site generally falls from north to south. The highest contour level noted on the survey is circa. 153.50m AOD along the northern boundary, with the lowest level noted as being circa. 137.50m AOD situated towards the southern boundary.

Drainage

- 3.7 A Pre-Planning Assessment report has been prepared by Anglian Water for the application site. It confirms that there are no public sewers within or adjacent to the site. A copy of the Pre-Planning Assessment report is included within **Appendix C**. The report states that foul drainage from this development site will fall within the catchment of Brackley (New) Water Recycling Centre (WRC), which currently does not have sufficient capacity to treat flows that would be generated by this development proposal. Anglian Water, are however, obliged in accordance with the Water Industry Act 1991 to accept foul flows from this site, and would therefore take the necessary steps to ensure that there is sufficient treatment capacity should the site obtain a planning consent.
- 3.8 Whilst the site is Greenfield, and thus there is little positive drainage systems associated with the current site to take into consideration, there has been a small surface water relief drain installed within the south-western field parcel. This was installed approx. 6 years previous, with a purpose to drain a small pond located close to Halse Road, and which in heavy rainfall events flooded the adjacent carriageway. The drain was constructed to take excess flows away from Halse Road to the existing watercourse that runs along the southern boundary of the site. Attached within **Appendix D** is a copy of a plan illustrating the size and location of the relief drain.
- 3.9 As the site is Greenfield, an assessment of the Greenfield run-off for the residential element of the scheme, and which falls within southern catchment as highlighted within paragraph 3.4 of this report, has been undertaken using the Micro Drainage software suite, adopting the ICP SUDS method. The results confirm an average (QBAR) run-off rate to the receiving watercourse to the South (12.86 ha) is 56.5 l/s. A copy of the QBAR results are included within **Appendix F**.

4.0 POTENTIAL SOURCES OF FLOODING

Fluvial / Tidal Flooding

- 4.1 The nearest potential source of fluvial / tidal flooding is represented by the unnamed watercourses located to the south, north-east and north-west of the site. The watercourses to the south and north-west discharge to the River Great Ouse, with the watercourse to the north-east, situated close to The Worlidge, discharging to the Radstone Brook, which in turn outfalls to the River Great Ouse. The unnamed watercourses and Radstone Brook are classified as 'ordinary watercourses'. The River Great Ouse, as it passes to the east of Brackley, has a 'Main River' classification.
- 4.2 An extract of the Environment Agency's on-line flood mapping is shown in Figure 1 below. The dark blue areas represent Flood Zone 3, land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year. The light blue areas represent Flood Zone 2, land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%) in any year. All remaining areas are classified as Flood Zone 1, land assessed as having a less than 1 in 1000 annual probability of river or sea flooding (<0.1%) in any year.
- 4.3 The site location is indicated on the flood mapping extract in Figure 1, confirming that it lies within Flood Zone 1.

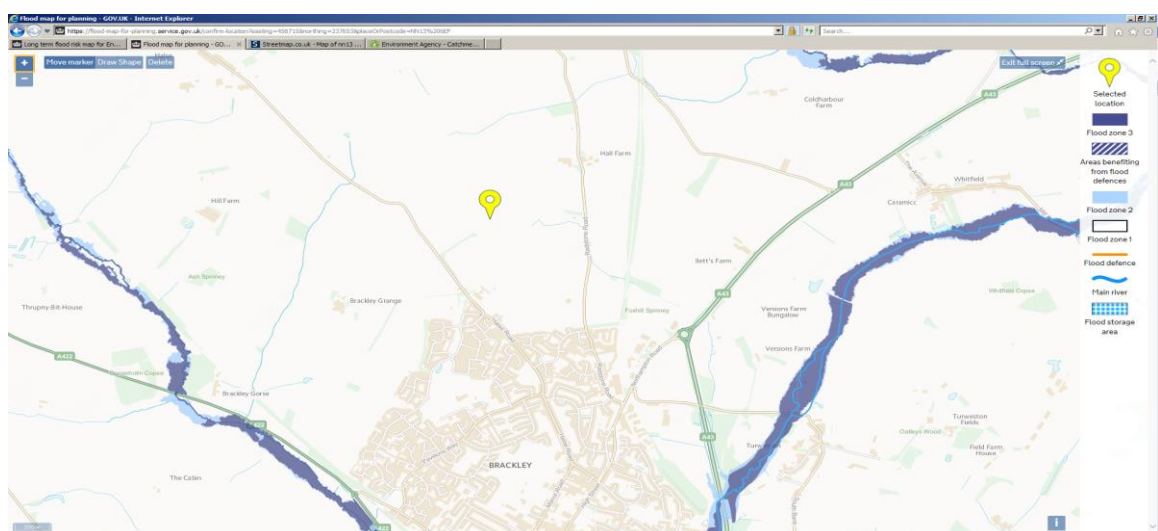


Figure 1 – Environment Agency Floodplain Mapping Extract

- 4.4 As the site lies within Flood Zone 1, site specific modelled flood level data has not been sourced from the Environment Agency.

Groundwater

- 4.5 Groundwater flooding is highly variable and dependant on localised ground conditions.
- 4.6 The SFRA contains no information on groundwater flooding. We are not aware of any records or anecdotal evidence to suggest that the site or surrounding area is particularly susceptible to groundwater flooding.
- 4.7 The site does not lie within a groundwater Source Protection Zone (SPZ).

Overland Flows / Surface Water

- 4.8 Other than that associated with the channels of the local unnamed watercourses, the Environment Agency on-line surface water flood mapping and the SFRA confirm that the majority of the site is not susceptible to surface water flooding, with only a low level associated with the channels of the watercourses.
- 4.9 We are not aware of any evidence to suggest that the site is prone to flooding from excess overland flows or that the site has ever been subject to flooding via this source.

Existing Sewers

- 4.10 The SFRA contains no specific information on sewer flooding. We are not aware of any records or anecdotal evidence to suggest that the site or surrounding area is particularly susceptible to flooding from the public sewer network.
- 4.11 We are not aware of any flooding problems affecting the site associated with any nearby existing private drainage systems.

Reservoirs, Canals & Other Artificial Sources

- 4.12 There are no artificial sources identified within the vicinity that would pose a flood risk to the site.

5.0 PROPOSED DEVELOPMENT

General

- 5.1 It is proposed to develop the site to accommodate circa 450 residential dwellings with associated access roads, parking and open spaces. In addition, sports pitches, recreational land and biodiversity areas are to be promoted, situated to the northern portion of the site.
- 5.2 The proposed development masterplan layout, prepared by Savills Urban Design Studio, is included within **Appendix E**.

Levels

- 5.3 The proposed finished development levels have yet to be finalised, however, it is expected that they will generally reflect the existing prevailing topography.

Foul Drainage

- 5.4 Based on a proposed residential development of circa 450 residential dwellings @ 4000 l/unit/day, the peak foul discharge from the residential element of the development will be approx. 21.0 l/s.
- 5.5 Anglian Water has confirmed within their Pre-Planning Assessment Report and subsequent correspondence that insufficient capacity currently exists within the WRC to treat this level of foul flow. In addition, it is likely that a 225mm diameter sewer will be required to facilitate a gravity discharge from this development, with the nearest public sewer of equivalent diameter to accept such a connection at Manhole 0503, located at the junction of Humphries Drive / Falcon Way / Nightingale Close, situated less than 1.0km to the south. However, whilst this is currently regarded as a suitable connection point by the water authority, they confirm there is currently insufficient capacity within the network to accommodate the flows generated by the proposed development. Figures 2 and 3 below highlight the possible connection point.



Figure 2 – Foul Connection Point



Figure 3 – Foul Connection Point

5.6 Within Anglian Water's report they have suggested that they should undertake a further assessment to establish where capacity needs to be provided within the network, along with the best point of connection.

- 5.7 We understand that the applicant has negotiated a right of connection to a 150mm diameter sewer within the adjoining Radstone Road residential development. However, with consideration of the run-off to be generated by the development, any connection to this sewer would result in a requirement for on-site attenuation, as a 150mm diameter sewer, and the downstream network, will not have sufficient capacity to accept a free discharge generated by the development proposals. In addition, and in the short term, depending on the timing of Anglian Water upgrades, there may also be a requirement to include for on-site attenuation whilst the public sewer network is upgraded sufficiently to accommodate a free flow from this site.
- 5.8 Depending on the phasing of the development, it may be that an initial phase of development could discharge to the 150mm diameter sewer; however this would depend on the plot numbers proposed, measured against available capacity within the existing sewer and downstream network.
- 5.9 As it is apparent that further negotiations are required with the water authority, and that they ultimately need to undertake a detailed assessment of their network capacity when considering the whole development proposals, it serves little purpose, at this juncture, in estimating the potential attenuation required, if ultimately any is necessary. Anglian Water are obliged in accordance with the Water Industry Act 1991 to accept foul flows from this development subject to it gaining a planning permission, and thus, initially it is recommended that further negotiations are undertaken with the water authority to ascertain timelines for network upgrades, acceptable discharge rates and likely connection points. This has been acknowledged by the water authority within their report and subsequent correspondence.
- 5.10 Assessing the topography of the site and adjoining land, and depending on the final location of the connection to the public sewer network, the residential element would appear to drain via gravity towards the existing network. However, at detailed design stage a full assessment of the outfall route will be necessary to ensure it can negotiate existing utilities and other infrastructure that may obstruct a gravity outfall.

- 5.11 It is anticipated that the main on-site foul drainage network that will ultimately serve the development proposals, will be offered to Anglian Water for adoption under Section 104 of the Water Industry Act 1991.
- 5.12 A connection to the public sewer network will be undertaken in accordance with a Section 106 of the Water Industry Act 1991

Surface Water Drainage

- 5.13 A sustainable surface water drainage strategy that does not increase discharge rates and therefore does not increase the risk of flooding to other areas should be provided in accordance with the NPPF and the SFRA.
- 5.14 It is understood that the applicant has negotiated a right of connection to a 300mm diameter sewer within the adjoining Radstone Road residential development. However, with consideration of the run-off to be generated by the development, any connection to this sewer would result in a requirement for on-site attenuation. It is also unlikely that this sewer, or the downstream network, will have sufficient capacity to accept the rates close to or equivalent of the Greenfield run-off. In addition, in accordance with CIRIA guidance, if infiltration SuDS (Sustainable Drainage System) is not available, the next option for surface water disposal that should be explored, in preference to a discharge to a sewer, is an outfall to a watercourse, at a rate that does not exceed pre-developed flows.
- 5.15 The SFRA states that the general geology of the area may be suitable for the use of infiltration SuDS techniques, subject to on-site percolation testing. It also suggests the use of attenuation based systems as an alternative. As an example, infiltration SuDS may include the use of soakaways, infiltration basins, swales, filter trenches and permeable paving.
- 5.16 To support the use of SuDS, the recently constructed Radstone Fields Development does, for large parts of the site, utilise infiltration SuDS.
- 5.17 For the purpose of this report, and as a geotechnical assessment of the site's formation has not been made available, and thus no specific soil infiltration data,

an attenuation based surface water strategy is proposed at this stage, with a restricted discharge to the relevant unnamed watercourses.

- 5.18 With consideration of discharge rates, and to not overload the existing downstream watercourse, the post development run-off from the residential element will be equivalent to the pre-developed Greenfield run-off rate highlighted within paragraph 3.9 of this report, reduced to an equivalent percentage of the post development impermeable area from the catchment area.
- 5.19 With respect to the proposed attenuation, open features are always preferable to below ground structures as they offer wider ecological and biodiversity benefits. In this instance, the development layout has sufficient area to permit the inclusion of open balancing ponds.
- 5.20 Preliminary attenuation calculations have been undertaken using the Micro Drainage software suite to assess the likely maximum size of a pond, and to confirm that sufficient space is allocated within the development proposals. A summary of the balancing pond design criteria is as follows:

Watercourse to the South (12.86 ha)

- Contributing Imp. Area – 8.4 ha (65% of Developable site area)
- Design Event – 1 in 100 year (plus a 40% allowance for climate change)
- Max. Discharge – 36.7 l/s (65% of Greenfield Run-off)
- Max. Overall Depth – 1.5m (1.2m effective)
- Bank Slopes – 1 in 4

- 5.21 A copy of the calculation outputs is included within **Appendix F**. In summary, storage volume of 5,986m³ of attenuation is required and this could be accommodated within a balancing pond with a maximum plan area of approx. 7,208m². The indicative development layout offers sufficient allowance to accommodate the pond size required, however at detailed design stage it may be that a series of smaller ponds and supporting swales will be introduced to accommodate the volume of attenuation required.

- 5.22 Whilst for the purpose of this report, and prior to porosity testing, proprietary infiltration SuDS has been discounted they should not be totally dismissed. If at detailed design stage some permeability is available within the natural formation, infiltration SuDS may be promoted. This could include attenuation ponds becoming infiltration basins, possibly supported by a controlled outfall to the watercourse, and the use of traditional soakaways to drain surface water run-off from domestic roof areas.
- 5.23 In addition, permeable paving for the construction of driveways and private parking areas should be included at the detailed design stage. Even where ground conditions are not entirely suitable for infiltration SuDS, permeable paving can be used as a valuable initial treatment train and may also reduce the extent of the on-site attenuation required.
- 5.24 Consideration should also be given to the incorporation of water butts on individual rainwater pipes, with overflows draining to the surface water network. Whilst the incorporation of water butts will not reduce the design criteria of the receiving system, their inclusion will delay the time of entry and provide the facility for some surface water run-off to be stored and used for irrigation.
- 5.25 In terms of other SuDS techniques, it is considered that green roofs will not be suitable for use on residential properties with standard pitched or hip type roofs.
- 5.26 Whilst the site does not lie within a groundwater SPZ, the proposed surface water drainage system should be designed in accordance with all relevant Environment Agency Pollution Prevention Guidance (PPG).
- 5.27 It is expected that the main on-site surface water drainage network will be offered to Anglian Water for adoption under Section 104 of the Water Industry Act 1991. Anglian Water will also consider the adoption of the open balancing pond. Should the pond not be adopted for any reason, then it will be necessary for the maintenance responsibility to be transferred in perpetuity to an appropriate estate management company.

6.0 VULNERABILITY & COMPATIBILITY

General

- 6.1 In accordance with Table 2: Flood Risk Vulnerability Classification, contained within the PPG, residential usage (Class C3) and sports facility (Class D2) is classified as 'more vulnerable' and 'less vulnerable' development respectively.
- 6.2 More vulnerable and less vulnerable development uses are both appropriate for location within Flood Zone 1.

Sequential Test

- 6.3 Paragraph 158 of the NPPF states *'The aim of the Sequential Test is to steer new development to areas with the lowest risk of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The SFRA will provide the basis for applying this test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding.'*
- 6.4 In this instance, the site is considered to be sequentially acceptable, as the proposed development will be located within Flood Zone 1.

Exception Test

- 6.5 In accordance with Table 3: Flood risk vulnerability and flood zone 'compatibility', contained within the PPG, the Exception Test is not required in this instance.
- 6.6 Whilst the Exception Test is not required, it should be noted that this FRA demonstrates that, in accordance with paragraphs 160 and 161 of the NPPF, the proposed development will be safe for its lifetime, taking account the vulnerability of its users. It also demonstrates that there will be no increase in flood risk to other areas.

7.0 ASSESSMENT OF FLOOD IMPACT

Fluvial/Tidal Flooding

- 7.1 Based on the current Environment Agency indicative flood mapping, the application site is located within Flood Zone 1. Thus the proposed development can be considered to be at the lowest probability of fluvial flooding (<1%).
- 7.2 We are not aware of any historical records or anecdotal evidence to suggest that the site has been affected by flooding via this source.

Groundwater

- 7.3 No specific information relating to groundwater levels on the site is available; however, there is no evidence to suggest that the site is susceptible to groundwater flooding.
- 7.4 In the absence of any historical records or anecdotal evidence to suggest otherwise, the risk of groundwater flooding to the proposed development is therefore considered to be low.

Overland Flows / Surface Water

- 7.5 We are not aware of any records or anecdotal evidence to suggest that the development will be subject to flooding from overland / surface water flows.
- 7.6 The overall risk of overland / surface water flooding to the proposed development is therefore considered to be low.

Existing Sewers

- 7.7 We are not aware of any records or anecdotal evidence to suggest that the development will be subject to flooding resulting from deficiencies with the existing public or any private drainage networks.

- 7.8 The risk of flooding to the proposed development from this source is therefore considered to be low.

Proposed Drainage

- 7.9 There will clearly be an increase in peak foul discharge in the post development scenario. On the basis that Anglian Water has confirmed that sufficient capacity will be available within the existing network as it comes on stream or that on-site attenuation, possibly in a temporary situation, is provided whilst off-site mitigation works are being undertaken, there will be no increase in flood risk to this site or other areas via this source.
- 7.10 An attenuation based surface water drainage system restricting the maximum positive surface discharge from the development to the rate highlighted within paragraph 5.20 of this report, will ensure no increase in the risk of flooding to the development or other areas via this source in lower order rainfall events, and a reduction in flood risk in more extreme events.

Reservoirs, Canals & Other Artificial Sources

- 7.11 No potential artificial sources of flooding have been identified within the vicinity of the site.

8.0 CONCLUSIONS & RECOMMENDATIONS

General

- 8.1 With consideration of all the information available, including that contained within the SFRA, the risk of flooding to the proposed development from all sources is considered to be low.

Mitigation Measures

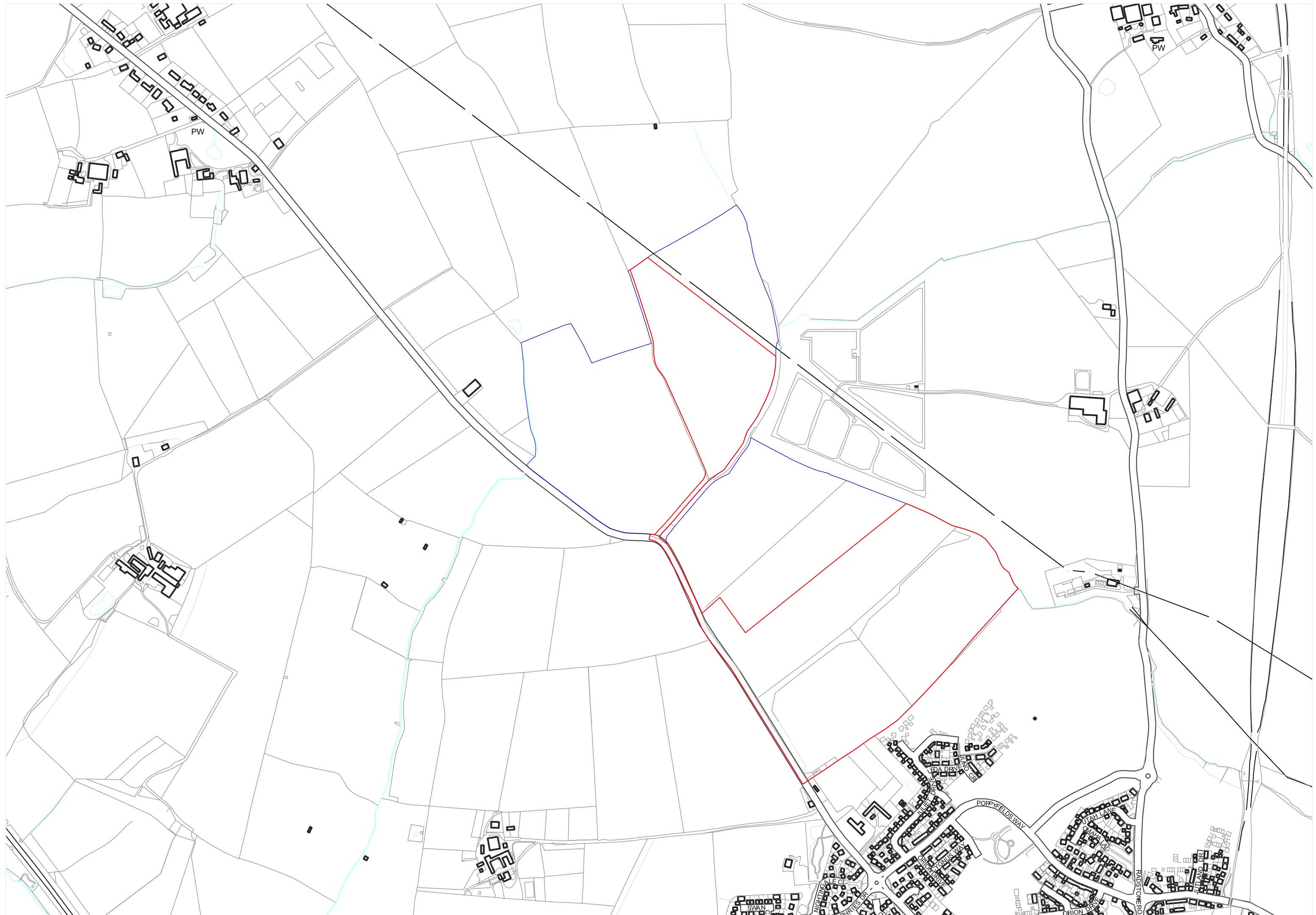
- 8.2 As the proposed development will be restricted to Flood Zone 1, it will not displace floodwater in the 1 in 100 year event. No floodwater storage mitigation measures are therefore proposed.
- 8.3 With an agreement on a suitable connection / outfall point, and the upgrading of the existing foul sewer network and water treatment facilities by the water authority, will ensure there is no risk of flooding from the foul sewer proposals.
- 8.4 The implementation of an attenuation based sustainable surface water drainage strategy, as outlined within Section 5 of this report, will ensure that there is no increase in flood risk to surrounding areas resulting from the disposal of surface water run-off in the post development scenario during lower order rainfall events and a reduction in flood risk in more extreme events.
- 8.5 A safe dry route of access / egress will be available from the proposed development.

Residual Flood Risk

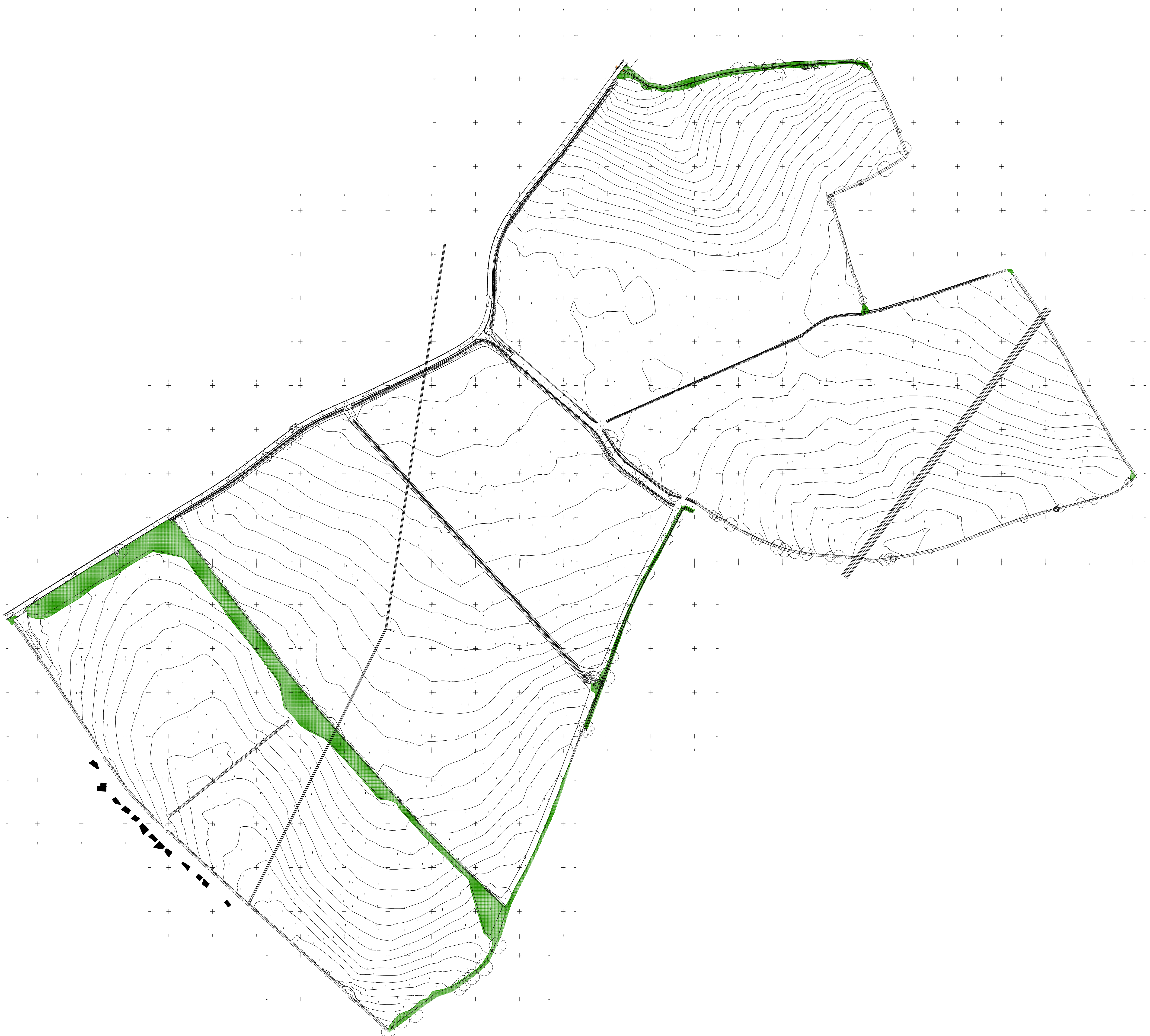
- 8.6 Whilst flood risk can never be entirely eliminated, it is considered that the residual flood risk to the development from all sources is low.
- 8.7 There will be no increase in the residual flood risk to other areas as a result of the development proposals.

APPENDICES

APPENDIX A



APPENDIX B


[illegible]

This survey has been prepared with a scaling accuracy for a plot at a scale of 1:200. All tree heights and spreads are approximate. We have tried to identify tree types, however if tree spreads are critical specialist arborists should be consulted.

Drainage pipe slots have been mistreated from the surface. Crumbler access has not been gained for safety reasons, therefore slots should be regarded as approximate.

Some details may have been omitted due to parked vehicles.

Notes.
Coordinates related to OS National Grid from ST01 by GPS. (No scale factor added).
Levels related to GPS.

|  | | | | | | | |
|---|---------------------|----------|---------|----------|----------|----------|--|
| INDICATIVE ONLY | | | | | | | |
| Rev | Details of Revision | | | | Drawn | Date | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Survived | Drawn | Date | Checked | Date | Approved | Date | |
| AS | AS | 18/08/17 | RGT | 22/08/17 | RGT | 22/08/17 | |

**INTERLOCKS
SURVEYS**

T: 01926 330123
F: 01926 330120
E: info@interlocksurveys.co.uk

Interlocks Surveys Limited
St. Andrews House
Radford Square
Leamington Spa
Warwickshire
CV31 1TF

Client.
FRAMPTONS
ORIEL HOUSE
42 NORTH BAH
BANBURY
OXFORDSHIRE, OX16 0TH

TOPOGRAPHICAL SURVEY
RADSTONE FIELDS EXTENSION
BRACKLEY
NN13 6DY

Dwg No. **170676** Sheet **1 of 28**

Scale 1:2000 A0 Sheet Rev. -

APPENDIX C

From: Rhodes Mark <mRhodes@anglianwater.co.uk>
Sent: 09 November 2020 11:57
To: jonbullock@armstrongstokesclayton.co.uk
Subject: PPE-0105595 - Radstone Fields

Hello Jon,

Further to our telephone conversation this morning, there is an alternative 225mm foul sewer that may be more convenient to serve as the connection point for your site.

Manhole 0503 located in Humphries Drive/Falcon Way at NGR SP5803238564.





As per our previous response, we have assessed the impact of connecting the foul flows from the planned development to this point and unfortunately there is insufficient capacity in this sewer to accommodate your site. Consequently, we must consider an alternative foul water drainage strategy. An alternative strategy may involve connecting to a different point on the network or introducing some control on the flow discharged from the development. Anglian Water will reimburse reasonable costs incurred in connecting to the recommended connection point, over and above those required to connect to the nearest point of connection. In order to define a feasible alternative foul water drainage strategy we will need to understand your onsite drainage design in greater detail.

I'll for arrange with you Pre-Planning Report to be revised to reflect the above connection point as your preferred point of connection.

Kind Regards



Mark Rhodes

Pre-Development Senior Engineer (West)
Telephone: 07980756440

Anglian Water Services Limited

Thorpe Wood House, Thorpe Wood, Peterborough,
Cambridgeshire, PE3 6WT



Pre-Planning Assessment Report

Radstone Fields

InFlow Reference: PPE-0105595

Assessment Type: Water & Used Water

Report published: 26/10/2020



Thank you for submitting a pre-planning enquiry.

This has been produced for Armstrong Stokes & Clayton Limited Civil & Structural Engineering Consultants.

Your reference number is **PPE-0105595**.

This report can be submitted as a drainage strategy for the development should it seek planning permission.

If you have any questions upon receipt of this report, you can submit a further question via InFlow. Alternatively, please contact the Planning & Capacity team on **0345 60 66 087**, Option 1 or email planningliaison@anglianwater.co.uk

Section 1 - Proposed development

The response within this report has been based on the following information which was submitted as part of your application:

| List of planned developments | |
|------------------------------|--------------|
| Type of development | No. Of units |
| Dwellings | 450 |

The anticipated residential build rate is:

| Year | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 | Y7 | Y8 | Y9 |
|------------|----|-----|-----|-----|----|----|----|----|----|
| Build rate | 80 | 120 | 120 | 130 | 0 | 0 | 0 | 0 | 0 |

Development type: Greenfield
Planning application status: Unknown
Site grid reference number: SP5813139179

The comments contained within this report relate to the public water mains and sewers indicated on our records.

Your attention is drawn to the disclaimer in the useful information section of this report.

Section 2 - Assets affected

Our records indicate that we have the following types of assets within or overlapping the boundary of your development site as listed in the table below.

Additionally, it is highly recommended that you carry out a thorough investigation of your proposed working area to establish whether any unmapped public or private sewers and lateral drains are in existence. We are unable to permit development either over or within the easement strip without our prior consent. The extent of the easement is provided in the table below. Please be aware that the existing water mains/public sewers should be located in highway or open space and not in private gardens. This is to ensure available access for any future maintenance and repair and this should be taken into consideration when planning your site layout.

| Water and Used water easement information | | |
|---|----------------|---------------------------------------|
| Asset type | Pipe size (mm) | Total easement required (m) |
| Water mains | 299 | 6.00 m either side of the centre line |
| Water mains | 295 | 6.00 m either side of the centre line |
| Water mains | 146 | 4.50 m either side of the centre line |
| Water mains | 154 | 6.00 m either side of the centre line |
| Water mains | 252 | 6.00 m either side of the centre line |

If it is not possible to avoid our assets then these may need to be diverted in accordance with Section 185 of the Water Industry Act (1991). You will need to make a formal application if you would like a diversion to be considered.

Due to the private sewer transfer in October 2011 many newly adopted public used water assets and their history are not indicated on our records. You also need to be aware that your development site may contain private water mains, drains or other assets not shown on our records. These are private assets and not the responsibility of Anglian Water but that of the landowner.

Section 3 - Water supply

In examining the available capacity for your development site we assess the capacity and costs for two categories of water main. These are:

Strategic

These are the offsite potable water mains which deliver water within an area to a large number of development sites often across a number of towns. The strategic provision of these water mains enables us to provide of the cheapest solution across a large geographical area.

Local reinforcement

These are localised reinforcement mains to enable us to provide water to your development site. On most sites we also have two categories of water mains the Spine Mains and Housing Estate Mains (HEMs). To support your budgeting arrangements we have also examined the estimated cost for delivering the onsite water mains needed for a site of your size.

Water supply network

Your site will benefit from the strategic water main(s) as listed below. This strategic scheme has been designed to cater for the predicted growth in this area. In addition, there is also insufficient capacity in the localised network to supply your site and therefore offsite local reinforcements are needed. Details of the necessary upgrades can be found in the water infrastructure section of this report and the cost of these works are included in the infrastructure charge. If you wish to proceed with the development then you will need to complete an application for a new supply.

This is recommended to be done at the earliest opportunity as it could take a minimum of 18 months to install any offsite reinforcement works. The connection point for the site will be from the existing water main in Halse Road .

The development should be connected to the 280mm HPPE main in Halse Road with a 225mm HPPE SDR17 connection and pipework.

The offsite works will be required at between 50-100 properties which in relation to the developers build schedule is after year 1 (80 properties).

Connection point(s)

| Connection Point | Address | National Grid Reference (NGR) |
|------------------|------------|-------------------------------|
| CP-3370 | Halse Road | SP5794338978 |

Water infrastructure and costs

In order to supply your site, the following upgrades are required:

| Strategic Water Mains | Based on |
|-----------------------|----------|
| Brownfield | 7.529 |

| Estimated Local reinforcement Mains | Based on |
|-------------------------------------|---|
| Thorpe Lodge to Marston St Lawrence | To restore pressures in the existing Radstone Fields development areas will require 2.3km of 355mm HPPE reinforcement from the outlet of meter GRT2WM at Thorpe Lodge WR. Start grid ref SP5221944292, end grid ref SP5329042254. |
| Radstone Fields local WB | The site has a high point estimated from contours and spot heights of 153m AOD, and the elevation of the PoC is estimated at 149m AOD. To ensure 20m onsite pressures at all times, the site will require a local water booster. The WB will require a lift of 6m at a peak flow of 9.845 l/s. This will be Site Specific. Based on maintaining 20m at the high point AOD |

Your development site will be required to pay an **infrastructure charge** for each new property connecting to the public sewer that benefits from Full planning permission.

You will be required to pay an infrastructure charge upon connection for each new plot on your development site. The infrastructure charge are types of charges set out in Section 146(2) of the Water Industry Act 1991

The charge should be paid by anyone who wishes to build or develop a property and is payable upon request of connection.

Payment of the infrastructure charge must be made before premises are connected to the public sewer.

| Infrastructure charge for water | |
|---------------------------------|----------|
| Anglian Water supply | £ 340.00 |

The **infrastructure discount** is a new element, introduced to reflect the changes in Ofwat's charging rules from April 2020.

The discount is £400.00 for each connection to the water supply network in the Anglian Water area.

Due to the changes in the charging rules, any discount must now be applied to the infrastructure charge rather than the requisition charge. This has provided us the opportunity to offer the discount (via the infrastructure charge) not just to water main requisitioners, but to those seeking water connections too.

Infrastructure charges are raised on a standard basis of one charge per new connection (one for water and one for sewerage). However, if the new connection is to non-household premises, the Infrastructure charges is calculated according to the number and type of water fittings in the premises. This is called the "relevant multiplier" method of calculating the charge.

Details of the relevant multiplier for each fitting can be found at our [website](#).

The Water Infrastructure charge for your dwellings is:

| Infrastructure charge | Number of units | Total |
|-----------------------|-----------------|-------------|
| £ 340.00 | 450 | £ 153000.00 |

The Infrastructure discount for your dwellings is:

| Infrastructure discount | Number of units | Total |
|-------------------------|-----------------|--------------|
| -£ 400.00 | 450 | -£ 180000.00 |

The estimated cost for the onsite water main for your development is:

| Onsite water main | £ |
|----------------------------|--------------|
| Estimated cost of delivery | £ 270,000.00 |

Please note, a detailed cost breakdown will be provided on receipt of a formal application for a new water main.

Alternatively, you may wish to have the onsite main delivered by a Self-lay Provider under terms set out in a self-lay agreement.

For more information on water mains and self-lay of water mains, please visit our [website](#)

Section 4 - Water recycling services

In examining the used water system we assess the ability for your site to connect to the public sewerage network without causing a detriment to the operation of the system. We also assess the receiving water recycling centre and determine whether the water recycling centre can cope with the increased flow and effluent quality arising from your development.

Water recycling centre

The foul drainage from this development is in the catchment of Brackley (New) Water Recycling Centre, which currently does not have capacity to treat the flows from your development site. Anglian Water are obligated to accept the foul flows from your development with the benefit of planning consent and would therefore take the necessary steps to ensure that there is sufficient treatment capacity should the planning authority grant planning permission.

Used water network

Our assessment has been based on development flows connecting to the nearest accessible foul water sewer of the same size or greater pipe diameter to that required to drain the site. The infrastructure to convey foul water flows to the receiving sewerage network is assumed to be the responsibility of the developer. Conveyance to the connection point is considered as Onsite Work and includes all work carried out upstream from the point of connection, including making the connection to our existing network. This connection point has been determined in reference to the calculated discharge flow and on this basis, a 225mm internal diameter pipe is required to drain the development site. The nearest network connection point that meets this criteria is at manhole 5904 at SP5855837952, located in Halse Road. Anglian Water has assessed the impact of connecting the foul flows from the planned development to this point and unfortunately there is insufficient capacity in this sewer to accommodate your site. Consequently, we must consider an alternative foul water drainage strategy. An alternative strategy may involve connecting to a different point on the network or introducing some control on the flow discharged from the development. Anglian Water will reimburse reasonable costs incurred in connecting to the recommended connection point, over and above those required to connect to the nearest point of connection. In order to define a feasible alternative foul water drainage strategy we will need to understand your onsite drainage design in greater detail. Therefore, we would like to arrange a meeting to examine the available options and establish an effective strategy. Mark Rhodes, our Pre-Development Senior Engineer for this area and will be responsible for evaluating the foul water drainage strategy. We'd grateful if you could advise Mark of your availability for a meeting and a convenient venue or alternatively a conference call can be arranged if this is more convenient. For your reference, Mark can be contacted at 07980 756440 or mrhodes@anglianwater.co.uk Please note that Anglian Water will request a suitably worded condition at planning application stage to ensure this strategy is implemented to mitigate the risk of flooding.

It is assumed that the developer will provide the necessary infrastructure to convey flows from the site to the network. Consequently, this report does not include any costs for the conveyance of flows.

Surface water disposal

You indicated on the Pre-Planning Application form that a connection to the public surface water sewer network is not required. A new surface water sewer can be used as a mechanism to discharge surface water to a watercourse or as part of a Suds scheme where appropriate. Subject to the sewer being designed in accordance with the current version of Sewers For Adoption, the sewer can be put forward for adoption by Anglian Water under Section 104 of the Water Industry Act 1991. If the outfall is to a watercourse, the applicant will be required to obtain consent to discharge via the appropriate body. Therefore a capacity assessment has not been made on the public surface water network. However, should this situation change and you wish to have a surface water connection assessment on the local network, then we will provide this free of charge if requested within 12 months of this report and you are able to provide the relevant evidence that your original strategy was unviable.

As you may be aware, Anglian Water will consider the adoption of SuDs provided that they meet the criteria outline in our SuDs adoption manual. This can be found on our [website](#). We will adopt features located in public open space that are designed and constructed, in conjunction with the Local Authority and Lead Local Flood Authority (LLFA), to the criteria within our SuDs adoption manual. Specifically, developers must be able to demonstrate:

1. Effective upstream source control,
2. Effective exceedance design, and
3. Effective maintenance schedule demonstrating that the assets can be maintained both now and in the future with adequate access.

If you wish to look at the adoption of any SuDs then an expression of interest form can be found on our [website](#)

As the proposed method of surface water disposal is not relevant to Anglian Water; we suggest that you contact the relevant Local Authority, Lead Local Flood Authority, the Environment Agency or the Internal Drainage Board, as appropriate.

Trade Effluent

We note that you do not have any trade effluent requirements. Should this be required in the future you will need our written formal consent. This is in accordance with Section 118 of the Water Industry Act (1991).

Used Water Budget Costs

Your development site will be required to pay an infrastructure charge for each new property connecting to the public sewer that benefits from Full planning permission.

You will be required to pay an infrastructure charge upon connection for each new plot on your development site. The infrastructure charge are types of charges set out in Section 146(2) of the Water Industry Act 1991

The charge should be paid by anyone who wishes to build or develop a property and is payable upon request of connection.

Payment of the infrastructure charge must be made before premises are connected to the public sewer.

| | |
|--|-----------------|
| Infrastructure charge for water recycling: | £ 570.00 |
|--|-----------------|

The Water Recycling Infrastructure charge for your dwellings is:

| Infrastructure charge | Number of units | Total |
|-----------------------|-----------------|----------|
| £ 570.00 | 450 | £ 256500 |

Infrastructure charges are raised on a standard basis of one charge per new connection (one for water and one for sewerage). However, if the new connection is to non- household premises, the fixed element is calculated according to the number and type of water fittings in the premises. This is called the "relevant multiplier" method of calculating the charge.

Details of the relevant multiplier for each fitting can be found at our [website](#).

It has been assumed that the onsite used water network will be provided under Section 104 of the Water Industry Act

It is recommended that you also budget for connection costs.

Please note that we offer alternative types of connections depending on your needs and these costs are available at our [website](#).

Section 5 - Map of Proposed Connection Points

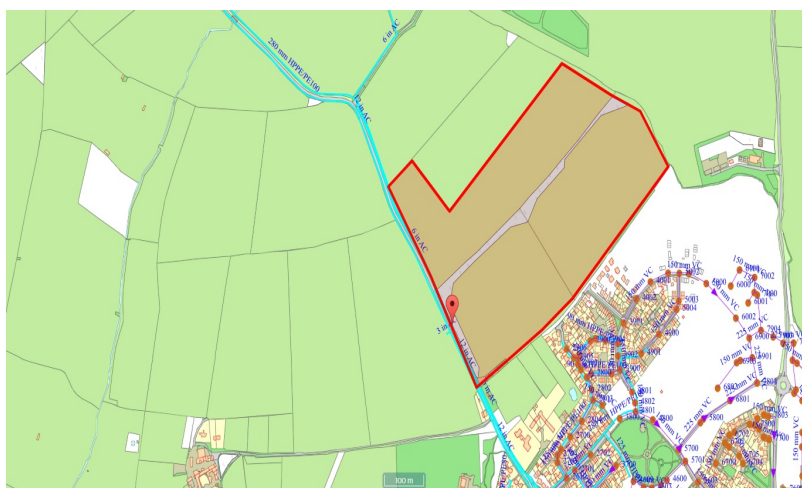


Figure 1: Showing your water point of connection

Section 6 - Useful information

Water Industry Act – Key water sections

Section 41:

This provides you with the right to requisition a new water main for domestic purposes to connect your site to the public water network.

Section 45:

This provides you with the right to have a connection for domestic purposes from a building or part of a building to the public water main.

Section 51A - E:

This provides you with the right to provide the water main or service connection yourself and for us to vest them into our company.

Section 55:

This applies where you request a supply of water for non-domestic purposes.

Section 185:

This provides you with the right to make a reasonable request to have a public water main, sewer or public lateral drain removed or altered, at your expense.

Details on how you can make a formal application for a new water main, new connection or diversion are available on from our Development Services team on **0345 60 66 087** or via our [website](#)

If you have any other queries on the rights to requisition or connect your housing to the public water and sewerage infrastructure then please contact our Development Services team at:

Anglian Water
PO Box 495
Huntingdon
PE29 6YY

Telephone: 0345 60 66 087

Email: developmentsservices@anglianwater.co.uk

Water pressure and flow rate

The water pressure and consistency that we must meet for your site is laid out in the Water Industry Act (1991). This states that we must supply a flow rate of 9 litres per minute at a pressure of 10 metres of head to the external stop tap. If your water pressure requirements exceed this then you will need to provide and maintain any booster requirements to the development site.

Self-lay of water mains

A list of accredited self-lay provider organisations can be found on the Lloyds Registrar [website](#)

Water Industry Act – Key used water sections

Section 98:

This provides you with the right to requisition a new public sewer. The new public sewer can be constructed by Anglian Water on your behalf. Alternatively, you can construct the sewer yourself under section 30 of the Anglian Water Authority Act 1977.

Section 102:

This provides you with the right to have an existing sewerage asset vested by us. It is your responsibility to bring the infrastructure to an adoptable condition ahead of the asset being vested.

Section 104:

This provides you with the right to have a design technically vetted and an agreement reached that will see us adopt your assets following their satisfactory construction and connection to the public sewer.

Section 106:

This provides you with the right to have your constructed sewer connected to the public sewer.

Section 185

This provides you with the right to have a public sewerage asset diverted.

Details on how to make a formal application for a new sewer, new connection or diversion are available on our [website](#) or via our Development Services team on **0345 60 66 087**.

Sustainable drainage systems

Many existing urban drainage systems can cause problems of flooding, pollution or damage to the environment and are not resilient to climate change in the long term. .

Our preferred method of surface water disposal is through the use of Sustainable Drainage Systems or SuDS.

SuDS are a range of techniques that aim to mimic the way surface water drains in natural systems within urban areas. For more information on SuDS, please visit our [website](#)

We recommend that you contact the Local Authority and Lead Local Flood Authority (LLFA) for your site to discuss your application.

Private sewer transfers

Sewers and lateral drains connected to the public sewer on the 1 July 2011 transferred into Water Company ownership on the 1 October 2011. This follows the implementation of the Floods and Water Management Act (FWMA). This included sewers and lateral drains that were subject to an existing Section 104 Adoption Agreement and those that were not. There were exemptions and the main non-transferable assets were as follows:

Surface water sewers and lateral drains that do not discharge to the public sewer, e.g. those that discharged to a watercourse.

Foul sewers and lateral drains that discharged to a privately owned sewage treatment/collection facility.

Pumping stations and rising mains will transfer between 1 October 2011 and 1 October 2016.

The implementation of Section 42 of the FWMA will ensure that future private sewers will not be created. It is anticipated that all new sewer applications will need to have an approved section 104 application ahead of a section 106 connection.

It is anticipated that all new sewer applications will need to have an approved Section 104 application ahead of a Section 106 connection

Encroachment

Anglian Water operates a risk based approach to development encroaching close to our used water infrastructure. We assess the issue of encroachment if you are planning to build within 400 metres of a water recycling centre or, within 15 metres to 100 metres of a pumping station. We have more information available on our [website](#)

Locating our assets

Maps detailing the location of our water and used water infrastructure including both underground assets and above ground assets such as pumping stations and recycling centres are available from [digdat](#)

All requests from members of the public or non-statutory bodies for maps showing the location of our assets will be subject to an appropriate administrative charge.

We have more information on our [website](#)

Charging arrangements

Our charging arrangements and summary for this year's water and used water connection and infrastructure charges can be found on our [website](#)

Section 7 - Disclaimer

The information provided in this report is based on data currently held by Anglian Water Services Limited ('Anglian Water') or provided by a third party. Accordingly, the information in this report is provided with no guarantee of accuracy, timeliness, completeness and is without indemnity or warranty of any kind (express or implied).

This report should not be considered in isolation and does not nullify the need for the enquirer to make additional appropriate searches, inspections and enquiries. Anglian Water supports the plan led approach to sustainable development that is set out in the National Planning Policy Framework ('NPPF') and any infrastructure needs identified in this report must be considered in the context of current, adopted and/or emerging local plans. Where local plans are absent, silent or have expired these needs should be considered against the definition of sustainability holistically as set out in the NPPF.

Whilst the information in this report is based on the presumption that proposed development obtains planning permission, nothing in this report confirms that planning permission will be granted or that Anglian Water will be bound to carry out the works/proposals contained within this report.

No liability whatsoever, including liability for negligence is accepted by Anglian Water or its partners, employees or agents, for any error or omission, or for the results obtained from the use of this report and/or its content. Furthermore, in no event will any of those parties be liable to the applicant or any third party for any decision made or action taken as a result of reliance on this report.

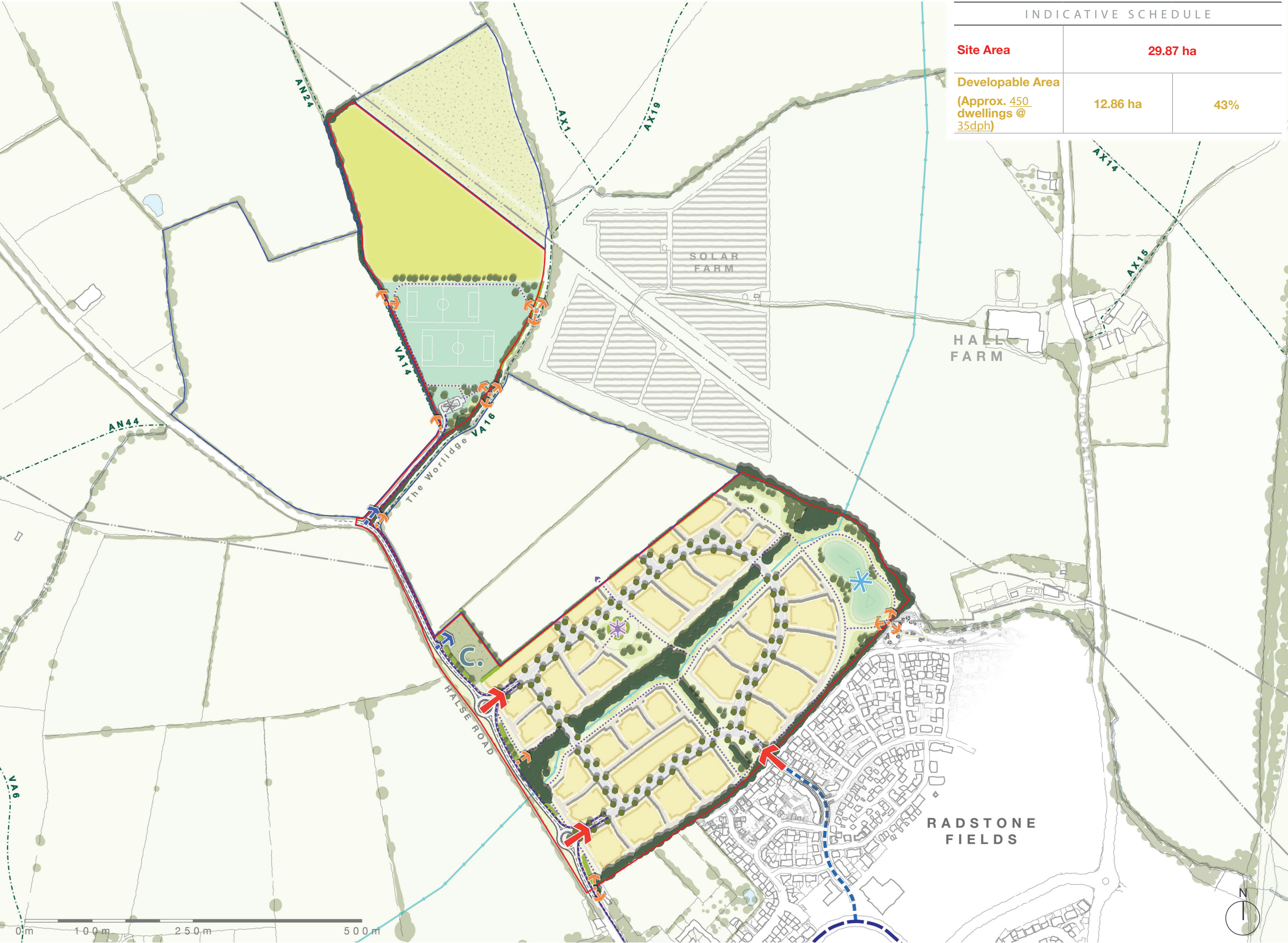
This report is valid for the date printed and the enquirer is advised to resubmit their request for an up to date report should there be a delay in submitting any subsequent application for water supply/sewer connection(s).

APPENDIX D



| FINAL PLAN OF PRE & POST CONSTRUCTION DRAINAGE | | | | | |
|--|--|----------|----------|------------|--------|
| FOR | Helmdon Blackpit Power Ltd C/o Material Change Ltd Watering Farm, Creeting St Mary Ipswich, Suffolk, IP6 8ND | | | | |
| WORK AT | Helmdon Blackpit AD Plant, Gas Supply Main | | | | |
| O.S. SHEET No. | SP5839-5939 | | | | |
| FIELD No. | Plot 8 & 9 | | | | |
| OWNER | F & M Humphrey | | | | |
| PARISH & COUNTY | Brackley, Northamptonshire | | | | |
| REPRODUCED FROM ORDNANCE SURVEY MAP WITH THE PERMISSION OF THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE CROWN COPYRIGHT RESERVED | | | | | |
| SCALE: 1: 2500 | | | | | |
| DETAILS (METRIC) | | | | | |
| KEY | PIPE DIA. | TYPE | LENGTH | PERM. FILL | DEPTH |
| | 225mm | Twinwall | 186m | - | 1300mm |
| | 150mm | Clay | Existing | Drains | |
| Route of Gas Main | | | | | |
| Existing Drains | | | | | |
| Junction | Size, Type, Depth, Stone | | | | |
| | No existing drains connected into new installed 225mm twinwall drain | | | | |
| CERTIFIED AS A TRUE RECORD OF FIELD DRAINAGE | | | | | |
| SIGNED | M.C. | | | | |
| DATE | 3rd February 2016 | | | | |
| MILES DRAINAGE LIMITED | | | | | |
| Great Ashfield, Bury St Edmunds, Suffolk | | | | | |

APPENDIX E



| INDICATIVE SCHEDULE | | |
|---|----------|-----|
| Site Area | 29.87 ha | |
| Developable Area (Approx. 450 dwellings @ 35dph) | 12.86 ha | 43% |

- Site Boundary
- Retained Land
- Proposed Residential Development
- Proposed Residential Frontages
- Proposed Primary Vehicular Access Points
- Proposed Secondary Vehicular Access Points
- Existing Medium Pressure Gas Main
- Existing Bus Route through Radstone Fields
- Proposed Bus Route Extension through Radstone Fields
- Existing Public Rights of Way
- Proposed Pedestrian Connections
- Proposed Footpath Along Halse Road
- Indicative Footpath / Cycle Network
- Proposed Primary Road / Bus Loop
- Existing Vegetation
- Proposed Open Space
- Call Option Recreation Land
- Land Reserved for Biodiversity Net Gain
- Formal Sports / Recreational Land
- Proposed Location of Cemetery / Allotments
- Proposed Car Park for associated Formal Sports / Recreational Land
- Proposed Children's Play Area
- Proposed Location of Attenuation Basins


Land North of Radstone Fields, Brackley

Mintondale Developments

Reproduced from the Ordnance Survey Map with the permission of the Controller of H.M. Stationery Office Crown copyright licence number 100024244 Savills (UK) Ltd. Published for the purposes of identification only and although believed to be correct accuracy is not guaranteed. Box:UK Urban Design Projects:Mintondale - N Brackley:B) Drawings:INDD:462784_INDD01_Drawing Sheets 06/11/20 © Copyright Savills (UK) Ltd.

| | | | |
|-------------|------------|------------|-------------------------|
| drawing no. | LB01 | drawing | Illustrative Masterplan |
| revision | I | scale | Refer to scale bar |
| drawn by | CJM | checked by | AR |
| date | 06/11/2020 | job no. | 462784 |

APPENDIX F

| | | |
|--|---|---|
| Armstrong Stokes & Clayton Ltd | | Page 1 |
| Regus House, Herald Way Pegasus Business Park Castle Donington, Derbyshir... | Southern Watercourse Radstone Fields Extension Brackley |  |
| Date 30/10/2020 File | Designed by JS Checked by | |
| Micro Drainage Source Control 2017.1.2 | | |

ICP SUDS Mean Annual Flood


Input


| | | | |
|-----------------------|--------|---------------|----------|
| Return Period (years) | 2 | Soil | 0.450 |
| Area (ha) | 12.860 | Urban | 0.000 |
| SAAR (mm) | 700 | Region Number | Region 4 |


Results l/s

| | |
|------------|-------|
| QBAR Rural | 56.5 |
| QBAR Urban | 56.5 |
| Q2 years | 50.6 |
| Q1 year | 46.9 |
| Q30 years | 110.7 |
| Q100 years | 145.2 |

©1982-2017 XP Solutions

| | | | | | |
|--|---------------------|---|-----------------------------|-----------------------|---|
| Armstrong Stokes & Clayton Ltd | | | | | Page 1 |
| Regus House, Herald Way Pegasus Business Park Castle Donington, Derbyshir... | | Southern Watercourse Radstone Fields Brackley | | |  |
| Date 29/07/2019 File WATERCOURSE TO THE SOUT... | | Designed by JS Checked by | | | |
| Micro Drainage | | Source Control 2017.1.2 | | | |
| <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 | 139.012 | 0.512 | 36.7 | 2139.7 | O K |
| 30 min Summer | 139.147 | 0.647 | 36.7 | 2800.5 | O K |
| 60 min Summer | 139.276 | 0.776 | 36.7 | 3473.4 | O K |
| 120 min Summer | 139.395 | 0.895 | 36.7 | 4130.7 | O K |
| 180 min Summer | 139.456 | 0.956 | 36.7 | 4478.8 | O K |
| 240 min Summer | 139.493 | 0.993 | 36.7 | 4692.5 | O K |
| 360 min Summer | 139.537 | 1.037 | 36.7 | 4955.4 | O K |
| 480 min Summer | 139.562 | 1.062 | 36.7 | 5107.0 | O K |
| 600 min Summer | 139.576 | 1.076 | 36.7 | 5190.3 | O K |
| 720 min Summer | 139.582 | 1.082 | 36.7 | 5229.7 | O K |
| 960 min Summer | 139.582 | 1.082 | 36.7 | 5224.9 | O K |
| 1440 min Summer | 139.559 | 1.059 | 36.7 | 5085.9 | O K |
| 2160 min Summer | 139.520 | 1.020 | 36.7 | 4850.9 | O K |
| 2880 min Summer | 139.478 | 0.978 | 36.7 | 4604.3 | O K |
| 4320 min Summer | 139.389 | 0.889 | 36.7 | 4093.5 | O K |
| 5760 min Summer | 139.291 | 0.791 | 36.7 | 3554.8 | O K |
| 7200 min Summer | 139.201 | 0.701 | 36.7 | 3079.9 | O K |
| 8640 min Summer | 139.119 | 0.619 | 36.7 | 2661.3 | O K |
| 10080 min Summer | 139.044 | 0.544 | 36.7 | 2293.5 | O K |
| 15 min Winter | 139.066 | 0.566 | 36.7 | 2400.4 | O K |
| 30 min Winter | 139.213 | 0.713 | 36.7 | 3142.7 | O K |
| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) | |
| 15 min Summer | 138.153 | 0.0 | 1919.5 | 26 | |
| 30 min Summer | 90.705 | 0.0 | 2490.2 | 41 | |
| 60 min Summer | 56.713 | 0.0 | 3428.4 | 70 | |
| 120 min Summer | 34.246 | 0.0 | 4128.2 | 130 | |
| 180 min Summer | 25.149 | 0.0 | 4527.3 | 190 | |
| 240 min Summer | 20.078 | 0.0 | 4796.1 | 248 | |
| 360 min Summer | 14.585 | 0.0 | 5165.4 | 368 | |
| 480 min Summer | 11.622 | 0.0 | 5404.3 | 486 | |
| 600 min Summer | 9.738 | 0.0 | 5544.1 | 604 | |
| 720 min Summer | 8.424 | 0.0 | 5596.5 | 724 | |
| 960 min Summer | 6.697 | 0.0 | 5508.5 | 960 | |
| 1440 min Summer | 4.839 | 0.0 | 5226.6 | 1226 | |
| 2160 min Summer | 3.490 | 0.0 | 7789.3 | 1600 | |
| 2880 min Summer | 2.766 | 0.0 | 8200.2 | 1996 | |
| 4320 min Summer | 1.989 | 0.0 | 8718.5 | 2820 | |
| 5760 min Summer | 1.573 | 0.0 | 9473.4 | 3592 | |
| 7200 min Summer | 1.311 | 0.0 | 9858.0 | 4336 | |
| 8640 min Summer | 1.129 | 0.0 | 10168.9 | 5104 | |
| 10080 min Summer | 0.994 | 0.0 | 10409.6 | 5760 | |
| 15 min Winter | 138.153 | 0.0 | 2147.4 | 26 | |
| 30 min Winter | 90.705 | 0.0 | 2739.1 | 41 | |
| ©1982-2017 XP Solutions | | | | | |

| | | | | | |
|--|---------------------|---|-----------------------------|-----------------------|---|
| Armstrong Stokes & Clayton Ltd | | | | | Page 2 |
| Regus House, Herald Way Pegasus Business Park Castle Donington, Derbyshir... | | Southern Watercourse Radstone Fields Brackley | | |  |
| Date 29/07/2019 File WATERCOURSE TO THE SOUT... | | Designed by JS Checked by | | | |
| Micro Drainage | | Source Control 2017.1.2 | | | |
| <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 | 139.354 | 0.854 | 36.7 | 3902.0 | O K |
| 120 min Winter | 139.484 | 0.984 | 36.7 | 4643.8 | O K |
| 180 min Winter | 139.551 | 1.051 | 36.7 | 5039.5 | O K |
| 240 min Winter | 139.591 | 1.091 | 36.7 | 5285.9 | O K |
| 360 min Winter | 139.642 | 1.142 | 36.7 | 5596.3 | O K |
| 480 min Winter | 139.671 | 1.171 | 36.7 | 5782.5 | O K |
| 600 min Winter | 139.688 | 1.188 | 36.7 | 5892.8 | O K |
| 720 min Winter | 139.698 | 1.198 | 36.7 | 5954.4 | O K |
| 960 min Winter | 139.703 | 1.203 | 36.7 | 5985.6 | O K |
| 1440 min Winter | 139.682 | 1.182 | 36.7 | 5852.9 | O K |
| 2160 min Winter | 139.632 | 1.132 | 36.7 | 5535.9 | O K |
| 2880 min Winter | 139.579 | 1.079 | 36.7 | 5208.1 | O K |
| 4320 min Winter | 139.459 | 0.959 | 36.7 | 4496.2 | O K |
| 5760 min Winter | 139.318 | 0.818 | 36.7 | 3700.8 | O K |
| 7200 min Winter | 139.179 | 0.679 | 36.7 | 2963.4 | O K |
| 8640 min Winter | 139.054 | 0.554 | 36.7 | 2344.9 | O K |
| 10080 min Winter | 138.948 | 0.448 | 36.7 | 1840.4 | O K |
| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) | |
| 60 min Winter | 56.713 | 0.0 | 3836.8 | 70 | |
| 120 min Winter | 34.246 | 0.0 | 4602.5 | 128 | |
| 180 min Winter | 25.149 | 0.0 | 5028.5 | 186 | |
| 240 min Winter | 20.078 | 0.0 | 5302.9 | 244 | |
| 360 min Winter | 14.585 | 0.0 | 5635.4 | 360 | |
| 480 min Winter | 11.622 | 0.0 | 5766.8 | 476 | |
| 600 min Winter | 9.738 | 0.0 | 5748.4 | 592 | |
| 720 min Winter | 8.424 | 0.0 | 5695.3 | 706 | |
| 960 min Winter | 6.697 | 0.0 | 5579.3 | 932 | |
| 1440 min Winter | 4.839 | 0.0 | 5347.0 | 1356 | |
| 2160 min Winter | 3.490 | 0.0 | 8711.1 | 1692 | |
| 2880 min Winter | 2.766 | 0.0 | 9156.5 | 2160 | |
| 4320 min Winter | 1.989 | 0.0 | 9590.7 | 3072 | |
| 5760 min Winter | 1.573 | 0.0 | 10612.7 | 3920 | |
| 7200 min Winter | 1.311 | 0.0 | 11046.7 | 4680 | |
| 8640 min Winter | 1.129 | 0.0 | 11398.8 | 5360 | |
| 10080 min Winter | 0.994 | 0.0 | 11677.5 | 5968 | |
| ©1982-2017 XP Solutions | | | | | |

| | | |
|--|---|---|
| Armstrong Stokes & Clayton Ltd | | Page 4 |
| Regus House, Herald Way Pegasus Business Park Castle Donington, Derbyshir... | Southern Watercourse Radstone Fields Brackley |  |
| Date 29/07/2019 File WATERCOURSE TO THE SOUT... | Designed by JS Checked by | |
| Micro Drainage Source Control 2017.1.2 | | |

Model Details

Storage is Online Cover Level (m) 140.000

Tank or Pond Structure

Invert Level (m) 138.500

| Depth (m) | Area (m ²) | Depth (m) | Area (m ²) | Depth (m) | Area (m ²) | Depth (m) | Area (m ²) |
|-----------|------------------------|-----------|------------------------|-----------|------------------------|-----------|------------------------|
| 0.000 | 3643.4 | 0.700 | 5178.4 | 1.400 | 6943.5 | 2.100 | 7207.6 |
| 0.100 | 3847.0 | 0.800 | 5416.0 | 1.500 | 7207.6 | 2.200 | 7207.6 |
| 0.200 | 4058.2 | 0.900 | 5657.4 | 1.600 | 7207.6 | 2.300 | 7207.6 |
| 0.300 | 4273.2 | 1.000 | 5906.3 | 1.700 | 7207.6 | 2.400 | 7207.6 |
| 0.400 | 4492.0 | 1.100 | 6159.0 | 1.800 | 7207.6 | 2.500 | 7207.6 |
| 0.500 | 4714.5 | 1.200 | 6415.5 | 1.900 | 7207.6 | | |
| 0.600 | 4944.6 | 1.300 | 6679.5 | 2.000 | 7207.6 | | |

Hydro-Brake® Optimum Outflow Control

| | |
|-----------------------------------|----------------------------|
| Unit Reference | MD-SHE-0256-3670-1200-3670 |
| Design Head (m) | 1.200 |
| Design Flow (l/s) | 36.7 |
| Flush-Flo™ | Calculated |
| Objective | Minimise upstream storage |
| Application | Surface |
| Sump Available | Yes |
| Diameter (mm) | 256 |
| Invert Level (m) | 138.500 |
| Minimum Outlet Pipe Diameter (mm) | 300 |
| Suggested Manhole Diameter (mm) | 1800 |

| Control Points | Head (m) | Flow (l/s) |
|---------------------------|----------|------------|
| Design Point (Calculated) | 1.200 | 36.7 |
| Flush-Flo™ | 0.428 | 36.7 |
| Kick-Flo® | 0.876 | 31.6 |
| Mean Flow over Head Range | - | 30.7 |

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 | 8.2 | 1.200 | 36.7 | 3.000 | 57.1 | 7.000 | 86.1 |
| 0.200 | 26.3 | 1.400 | 39.5 | 3.500 | 61.5 | 7.500 | 89.1 |
| 0.300 | 35.9 | 1.600 | 42.1 | 4.000 | 65.6 | 8.000 | 91.9 |
| 0.400 | 36.7 | 1.800 | 44.6 | 4.500 | 69.5 | 8.500 | 94.7 |
| 0.500 | 36.5 | 2.000 | 46.9 | 5.000 | 73.1 | 9.000 | 97.4 |
| 0.600 | 36.0 | 2.200 | 49.1 | 5.500 | 76.6 | 9.500 | 100.0 |
| 0.800 | 33.7 | 2.400 | 51.2 | 6.000 | 79.9 | | |
| 1.000 | 33.6 | 2.600 | 53.3 | 6.500 | 83.1 | | |

©1982-2017 XP Solutions