BETTS HYDRO
CONSULTING ENGINEERS

FOX'S BANK
HALSNEAD GARDEN VILLAGE
WHISTON

FLOOD RISK ASSESSMENT AND DRAINAGE MANAGEMENT STRATEGY

For

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APRIL 2020

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WHISTON

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EXECUTIVE SUMMARY

This Flood Risk Assessment and Drainage Management Strategy was prepared to support a full planning application for the construction of a residential led development known as the Halsnead Garden Village on land adjacent to Fox's Bank Lane in Whiston. This document is submitted on behalf of:

- Taylor Wimpey UK - Limited Gate House, Turnpike Road, High Wycombe, Buckinghamshire, HP12 3NR (Buyer);
- Gino Frederick Fantin & Dawn Sara Fantin - of Cherry Tree Farm, Fox's Bank Lane, Whiston L35 3SS and Catherine Sarah Jane Griffin - of Moss House, Whixall, Whitchurch, Shropshire SY13 2PG (Seller);
- Mrs K Mullin - Of Halsnead Farm, Fox's Bank Lane, Whiston L35 3SU (Seller);
- Reynard Land Whiston Limited - Reynard House, Altrincham Road, Wilmslow, Cheshire SK9 5ND (Promoter); and
- Evo Living Limited – 17, St Ann's Square, Manchester M2 7PW (Promoter).

The applicant is hereafter referred to as "Taylor Wimpey".

Flood Risk

The site lies solely within Flood Zone 1 based on the Environment Agency Flood Map for Planning and overall covers 16.204ha, Residential development is classified as 'more vulnerable' within the Planning Practice Guidance which supports the National Planning Policy Framework. The Planning Practice Guidance confirms that 'more vulnerable' development is appropriate to be located within Flood Zone 1, providing there is no increase in flood risk elsewhere due to the proposals

This report has reviewed all sources of flood risk both to and resulting from the proposed development site. Consultations with the Environment Agency, United Utilities, and Knowsley Metropolitan Borough Council have been undertaken and did not identify any historical incidents of flooding to the site. The nearest watercourse is Whiston Brook located approximately 100m south-east of site, which is considered 'Main River' by the Environment Agency. Whiston Brook flows south and connects into Foxes Bank Brook which ultimately outfalls into Logwood Mill Brook located approximately 1.5km south-west from site. The fluvial/pluvial flood risk to site from these sources is 'very low'.

The primary flood risk is from surface water flooding, this risk varies across site from 'very low' to 'high' and is closely associated with the existing topography and the drainage features onsite. The risk associated with surface water flooding will be inherently reduced as part of the proposals following the implementation of the mitigation measures proposed including sustainable surface water management infrastructure.

Drainage Strategy

In accordance with national and local planning policy, surface water management is required to be considered for development of this nature and scale. Surface water discharge options have therefore been assessed in accordance with the sustainable drainage hierarchy, which is; discharge to ground, to a watercourse and finally to the public sewer network. Based on the cohesive ground conditions by the online datasets and observed on the walkover, infiltration is not likely to offer a viable drainage solution. Soakaway Testing to BRE365 is still recommended evidence that discharge to ground will not be a viable solution in accordance with the Local Planning Authority's requirements.

Assuming infiltration is unlikely to offer a site wide drainage solution for the site, this assessment has considered the alternatives in accordance with the hierarchy. The next method in the approach should be to discharge surface water run-off to a watercourse, and at present the site currently drains to the neighbouring Main Rover network via onsite ponds and offsite connections. There are two existing outfalls to the watercourse network, which have been investigated to confirm condition and routing. The proposals are to discharge to the watercourse using one of these existing connections, the other will continue to convey flows from the onsite pond network and no changes would be proposed.

Detailed design will need to refine this strategy and confirm whether a full gravity is feasible. Initial design works have been completed to confirm in principle a gravity system can be achieved on the site. Consents will be required from the Environment Agency for any works effecting the Main River network (Whiston Brook) and further discussion with the Lead Local Flood Authority will also be required to agree the proposed discharge rates. Any offsite works also will need to be discussed and agreed with the relevant parties (Highways Authority) during detailed design.

In accordance with the SuDS Manual (CIRIA 753) and the Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015) all sites should endeavour to achieve as close to pre-development greenfield rates as is viable. The proposals are therefore to restrict surface water run-off from site to mimic a pre-development greenfield situation, the pre-development greenfield rate (QBar) is calculated to be 69.7l/s. Detailed design needs to confirm whether the available capacity in the existing offsite conveyance connection to the watercourse is sufficient to cater for this rate.

The proposed onsite surface water drainage system will need to be sized to contain the 1 in 30yr return period event below ground with overland run-off from storm events up to and including the 1 in 100yr return period event with a 40% allowance for climate change being contained onsite. It would be beneficial to implement SuDS features including permeable surfaces, bio-filtration, and ponds, to assist with this requirement. It is proposed that attenuation areas (pond(s)/basin(s)) be provided onsite to assist with this requirement, although this will need to be considered further during detailed design.

The drainage strategy proposed for this development will be reviewed at the time when the future phases of the Halsnead Garden Village project come forward, to ensure that enough capacity in the conveyance and attenuation features has been allowed for. Full assessments will need to take place to support these additional phases of development in due course, however it is important to note at this stage that an holistic and comprehensive surface water management regime will be required to ensure that the proposals do not result in any increase in surface water flooding to the neighbouring areas.

This Flood Risk Assessment and Drainage Management Strategy has been prepared in consultation with the relevant interested parties and incorporates their comments where possible. The report is commensurate with the scale and nature of the development proposals and in summary, the development can be considered appropriate in accordance with the Planning Practice Guidance.

CONTENTS

Document Tracking Sheet iii

EXECUTIVE SUMMARY v

Figures & Tables viii

Specialist Software ix

Abbreviations & Acronyms ix

1.0 INTRODUCTION 11

1.1 Planning Policy Context 11

1.2 Site Context 11

1.3 Consultation 11

2.0 EXISTING SITE LOCATION 12

2.1 Location 12

2.2 Existing and Historical Land Use 12

2.3 Topography 12

3.0 DEVELOPMENT PROPOSALS 13

3.1 Nature of the development 13

4.0 SOURCES OF FLOOD RISK 14

4.1 Fluvial Flood Risk 14

Safe Access and Egress 14

4.2 Tidal Flood Risk 15

4.3 Flood Risk Vulnerability Classification and Flood Zone Compatibility 15

4.4 Surface Water Flood Risk 15

Pluvial (Overland run-off) Flood Risk 16

Sewer Flood Risk 16

4.5 Groundwater Flood Risk 17

4.6 Artificial Sources of Flood Risk 17

Reservoirs 17

Canals 17

4.7 Historical and Anecdotal Flooding Information 18

4.8 Flood Risk Mitigation Measures & Residual Risks 18

Mitigation Measures 18

Residual Risks 19

5.0 SURFACE WATER MANAGEMENT 20

5.1 Pre-Development Surface Water Run-off 20

5.2 Post Development Surface Water Run-Off 20

5.3 Sustainable Drainage Systems (SuDS) 20

5.4 Methods of Surface Water Management 21

5.5 Discharge via Infiltration 21
5.6 Discharge to Watercourse 22
5.7 Discharge to Public Sewer Network 24
5.8 Climate Change 25

6.0 FOUL WATER MANAGEMENT 26

7.0 SUMMARY AND CONCLUSIONS 27

8.0 RECOMMENDATIONS 29

BIBLIOGRAPHY & REFERENCES 30
Web-based References 30

Figures & Tables

Figure 1: Aerial Photograph of site (Bing Maps, 2019) 12
Figure 2: Proposed Planning Proposals (Taylor Wimpey, 2019) 13
Figure 3: Fluvial/Tidal Flood Zone Map for Planning Extract (GOV.UK, 2019) 14
Figure 4: Surface Water Flood Map Extract (GOV.UK, 2019) 15
Table 1: Pre-Development Surface Water Run-Off Rates (Betts Hydro, 2019) 20
Table 2: Post-Development Un-Restricted Run-Off Rates (Betts Hydro, 2019) 20
Figure 5: SuDS Photographs (SusDrain, 2012) 21
Figure 6: Existing Drainage Situation Plan extract (Betts Hydro, 2019) 22
Figure 7: Preliminary Proposed Drainage Strategy Plan extract (Betts Hydro, 2019) 23
Table 3: Estimated Stormwater Storage Requirements (Betts Hydro, 2019) 24
Table 4: Change to Extreme Rainfall Intensity (Environment Agency, 2016) 25

APPENDIX A: NPPF EXTRACTS .....
APPENDIX B: EA INFORMATION & CORRESPONDENCE .....
APPENDIX C: UU CORRESPONDENCE .....
APPENDIX D: LPA/LLFA CORRESPONDENCE .....
APPENDIX E: LOCATION PLAN .....
APPENDIX F: TOPOGRAPHIC SURVEY .....
APPENDIX G: PROPOSED PLANNING LAYOUT .....
APPENDIX H: PFRA/SFRA PLANNING EXTRACTS .....
APPENDIX I: SURFACE WATER RUN-OFF CALCULATIONS .....
APPENDIX J: IMPERMEABLE AREAS PLANS .....
APPENDIX K: PRELIMINARY DRAINAGE PLANS .....
APPENDIX L: STORMWATER STORAGE ESTIMATES .....

APPENDIX M: OVERLAND FLOOD FLOW ROUTING PLANS .....
APPENDIX N: TYPICAL SUDS DETAILS .....
APPENDIX O: NOTES AND LIMITATIONS .....

Specialist Software

- MicroDrainage WinDES (v.14.1) – Calculation of Greenfield run-off rates IH124/ICP-SUDS, Greenfield run-off volumes, rates of rainfall and stormwater storage estimates.

Abbreviations & Acronyms

AEP	Annual Exceedance Probability
BGL	Below Ground Level
BGS	British Geological Survey
CC	Climate Change
CSAI	Cranfield Soil and Agrifood Institute
EA	Environment Agency
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
mAOD	metres Above Ordnance Datum
NGR	National Grid Reference
NPPF	National Planning Policy Framework
NSRI	National Soil Resources Institute
OS	Ordnance Survey
PFRA	Preliminary Flood Risk Assessment
PPG	Planning Practice Guidance
QSE	Quick Storage Estimate
QBAR	Mean Annual Flood
SfA	Sewers for Adoption
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
TWL	Top Water Level
UU	United Utilities

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1.0 INTRODUCTION

1.1 Planning Policy Context

1.1.1 All forms of flooding and their impact on the natural and built environment are material planning considerations. The National Planning Policy Framework (NPPF) sets out the Government's objectives for the planning system, along with how planning should facilitate and promote sustainable patterns of development, avoiding flood risk and accommodating the impacts of climate change. Government policy with respect to development in flood risk areas is contained within the NPPF and the supporting Planning Practice Guidance (PPG) (refer to extracts in **Appendix A**).

1.1.2 A Flood Risk Assessment and Drainage Management Strategy (FRA&DMS) has been completed in accordance with NPPF/PPG to review all sources of flood risk both to and from the proposed development. The report also considers the most appropriate drainage options including the implementation of Sustainable Drainage Systems (SuDS) in line with current climate change guidance.

1.1.3 The proposals are solely 'residential' in nature and are classified as 'more vulnerable' in Table 2 (Flood Risk Vulnerability Classification) within the Planning Practice Guidance. The PPG confirms that this type of land-use is appropriate for Flood Zone 1, providing there is no increase in flood risk elsewhere due to the proposals.

1.2 Site Context

1.2.1 This Flood Risk Assessment and Drainage Management Strategy was prepared to support a full planning application for a residential development on land off Fox's Bank Lane in Halsnead near Whiston. The proposals will be complete with access, car parking, external works and lighting, landscaping, boundary walls and fencing, external services and drainage. This document is submitted on behalf of:

- Taylor Wimpey UK - Limited Gate House, Turnpike Road, High Wycombe, Buckinghamshire, HP12 3NR (Buyer);
- Gino Frederick Fantin & Dawn Sara Fantin - of Cherry Tree Farm, Fox's Bank Lane, Whiston L35 3SS and Catherine Sarah Jane Griffin - of Moss House, Whixall, Whitchurch, Shropshire SY13 2PG (Seller);
- Mrs K Mullin - Of Halsnead Farm, Fox's Bank Lane, Whiston L35 3SU (Seller);
- Reynard Land Whiston Limited - Reynard House, Altrincham Road, Wilmslow, Cheshire SK9 5ND (Promoter); and
- Evo Living Limited – 17, St Ann's Square, Manchester M2 7PW (Promoter).

The applicant is hereafter referred to as "Taylor Wimpey".

1.3 Consultation

1.3.1 The preparation of this report has been undertaken in consultation with the Environment Agency (EA), United Utilities (UU) and Knowsley Metropolitan Borough Council (KMBC). Consultation responses can be seen in **Appendix B, C** and **D** respectively. The NPPF advises that KMBC as the Local Planning Authority (LPA) should consult with the EA who will provide advice and guidance on flood issues at a strategic level and in relation to planning applications.

2.0 EXISTING SITE LOCATION

2.1 Location

2.1.1 The proposed development site is located off Fox's Bank Lane in Whiston. The Ordnance Survey National Grid Reference (OS NGR) for the site is E: 347671, N: 389955 and the nearest postcode is L35 3RA. The total site covers 16.204ha and is edged in red in Figure 1 (see location plan in **Appendix E**).

2.1.2 The site is bounded to the north by agricultural land, with Fox's Bank Lane directly adjacent to the east. To the east of Fox's Bank Lane lies agricultural land with Whiston Brook beyond, the Blundells Hill Golf Course is further east as illustrated in **Figure 1**. To the south lies the M62 and to the west of site lies Halsnead Holiday Park. At present there are existing bodies of water within the site as illustrated below, including a series of pond features and land drainage ditches.

Figure 1: Aerial Photograph of site (Bing Maps, 2020)

2.2 Existing and Historical Land Use

2.2.1 At present the development site is used mostly for agricultural purposes and is undeveloped, part of the site currently has impermeable areas associated with the existing farm building. There are existing pond features located within the development site which assist with the natural drainage of the site, no other historical uses have been identified as part of this assessment.

2.3 Topography

2.3.1 A site walkover was carried out by Betts in March 2017, the topography varies through the site. Ground levels currently range from 47.93mAOD in the western corner down to 35.90mAOD in the south- eastern corner, as illustrated within **Figure 1.** Woodland is currently present in the centre of site therefore; detailed levels information was not available for this area. A full topographical survey has been carried out and is included in **Appendix F**.

3.0 DEVELOPMENT PROPOSALS

3.1 Nature of the development

3.1.1 This assessment is to support a full planning application for the demolition of existing farm buildings and erection of 337 residential dwellings together with new vehicular access, SUDs ponds, landscaping and other associated. The planning proposals are in **Figure 2** (**Appendix G**) and will be complete with access, parking, external works and lighting, landscaping, boundary walls and fencing, external services and drainage.

Figure 2: Proposed Planning Proposals (Taylor Wimpey, 2020)

3.1.2 The total site covers 16.204ha, however the development area excludes those areas that will remain undeveloped or be maintained as Public Open Space (POS) this area, equates to 13.772ha. At present the site is 99% permeable and based on layout shown above, the impermeable areas of the site are estimated to increase to 55% of the development area (equating to 7.575ha).

3.1.3 National and local planning policy identifies that Sustainable Drainage Systems (SuDS) should be incorporated into new development. The planning proposals show there is scope to incorporate some SuDS features within the proposed open space/amenity areas on the site such as pond/swales. Detailed design will be required to confirm the specific types of SuDS, subject to ground investigations and detailed levels review.

4.0 SOURCES OF FLOOD RISK

4.1 Fluvial Flood Risk

4.1.1 Information relating to flood risk at the site has been obtained from the Environment Agency and from the Gov.uk website. An extract of the EA's Flood Zone Map for Planning is shown in **Figure 3**, which illustrates the site is located wholly within Flood Zone 1. Flood Zone 1 is an area considered to be at little or no flood risk from rivers and/or the sea (as defined by the EA).

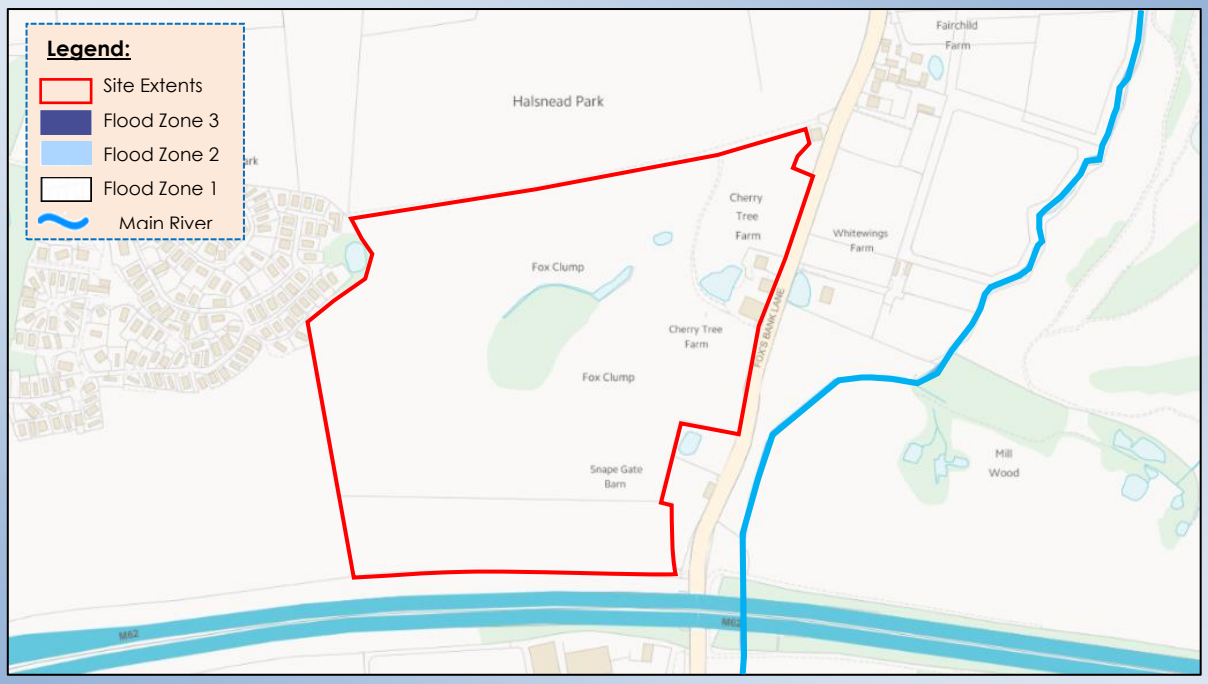

Figure 3: Fluvial/Tidal Flood Zone Map for Planning Extract (GOV.UK, 2020)

4.1.2 The nearest watercourse to the site is Whiston Brook located approximately 32m east of site and is considered 'Main River' by the Environment Agency. Whiston Brook flows south and connects into Foxes Bank Brook which ultimately outfalls into Logwood Mill Brook located approximately 1.5km south-west from site. The flood risk from Whiston Brook is 'very low' due to the proximity from site and the surrounding topographic levels being lower than the development site, as represented in the Governments long-term flood risk mapping (see **Appendix B**).

4.1.3 Review of the available mapping data also indicates the presence of a series of pond features onsite and within the vicinity. These pond-like features are assumed to assist with natural land drainage and therefore due to their nature and size, the flood risk to site is 'low'. Consultation with the EA and LLFA has not identified any associated flood risk from these features.

Safe Access and Egress

4.1.4 The proposed access road for the site will be via Fox's Bank Lane located adjacent to the eastern site boundary. This road is shown, on the EA's Flood Zone Map for Planning, to also be located within Flood Zone 1. Safe access and egress will be maintained via the new proposed access road from Foxes Bank Lane, as flood risk is 'very low'.

4.2 Tidal Flood Risk

4.2.1 The Mersey Estuary is located 10km to the south of the site and the Formby Coastline is located 15km to the west of site. Due to the surrounding topography and the proximity from site, the flood risk associated with these tidal sources is very low. This is supported by the EAs Fluvial/Tidal Flood Zone Map for Planning which shows the site being in Flood Zone 1 (**Figure 3** previously).

4.3 Flood Risk Vulnerability Classification and Flood Zone Compatibility

4.3.1 The proposals are 'residential' in nature and as such is classified as 'more vulnerable' in Table 2: Flood Risk Vulnerability Classification, within the PPG. Table 3: Flood Risk Vulnerability and Flood Zone 'Compatibility', within the PPG confirms that this type of land use is appropriate for Flood Zone 1, providing there is no increase in flood risk elsewhere due to the proposals.

4.4 Surface Water Flood Risk

4.4.1 Surface water flooding occurs when rainwater is unable to drain away through the normal drainage systems or soak into the ground but lies on or flows over the ground instead. The risk associated with surface water run-off is indicated by the long-term flood mapping (extract shown in **Figure 4**).

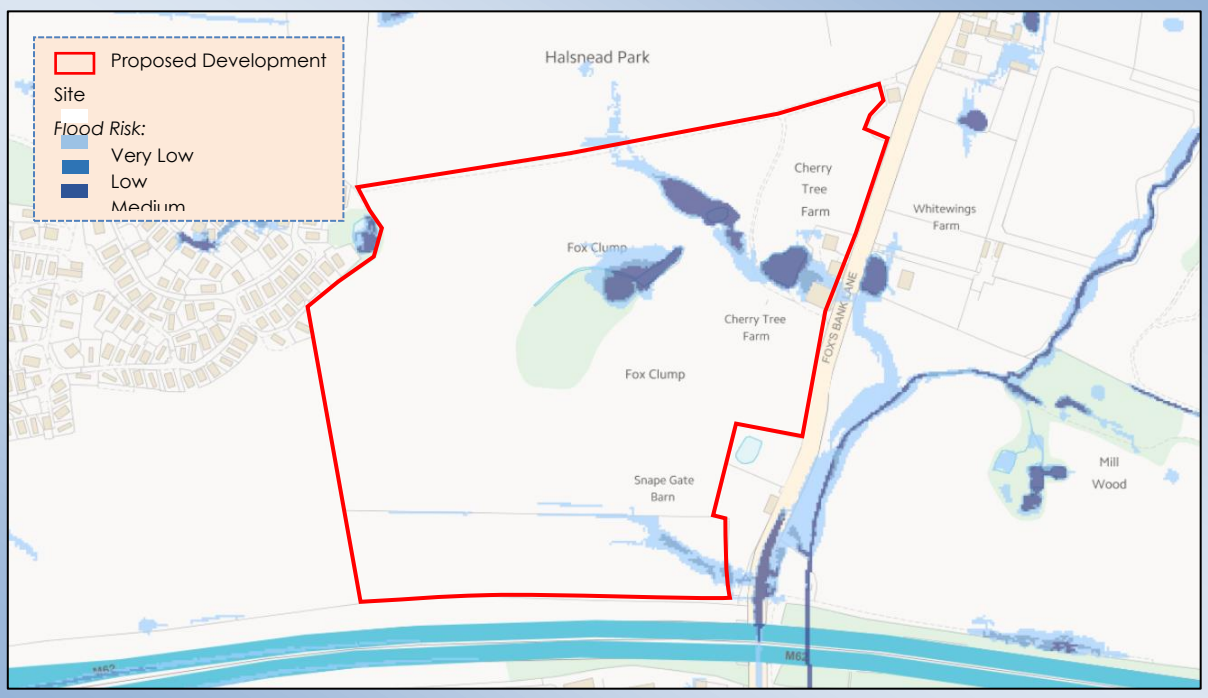

Figure 4: Surface Water Flood Map Extract (GOV.UK, 2020)

4.4.2 As indicated in **Figure 4** the overall site is predominantly at 'very low' to 'low' flood risk from surface water sources, there are however some areas onsite shown to be at higher flood risk. Review of the existing topographic survey (**Appendix F**) suggest these higher surface water flood risk areas are associated with the naturally low-lying areas onsite or existing pond areas. These low-lying areas are neighboured by elevated land and

therefore, would be more susceptible to ponding in the extreme storm events when land drainage is at capacity and unable to convey flows away as it would do naturally at present.

4.4.3 The areas onsite at highest risk of surface water flooding are also associated with existing pond features. These features will account for the higher surface water risks due to the inherent build-up of water in these areas during periods of heavy rainfall due to the existing topography.

4.4.4 The risk to the proposals from surface water will be reduced, post-development through the design and implementation of a sustainable surface water drainage regime. Furthermore, any existing pond features will be maintained and included in the proposals. The proposals will therefore adopt an intra-sequential approach and located the more vulnerable residential dwellings in the lesser flood risk areas. In order to further mitigate for any residual risks, it is advised that (following any re-grade of the site) the Finished Floor Levels of the proposed properties, are raised above the external levels to allow for safe overland flow routes through the development site.

Pluvial (Overland run-off) Flood Risk

4.4.5 Intense rainfall that is unable to soak into the ground or enter drainage systems can run-off land and result in flooding. Local topography and the land-use can have a strong influence on the direction and depth of flow. The site is neighboured by undeveloped areas to the north and west, topographically the levels in the area generally fall towards the watercourse network to the east of site. There could be potential for pluvial flows across site in the extreme storm events when natural drainage systems are exceeded. Interception methods can be implemented onsite to cater for any associated flows.

4.4.6 The volume and rate of overland flow from land can be exacerbated if development increases the percentage of impermeable area. Any overland flows generated by the development must therefore be carefully controlled, safe avenues directing overland flow away from adjacent development is advised. Any existing overland flow onto site will need to be catered for within the development.

Sewer Flood Risk

4.4.7 In urban areas, rainwater is frequently drained into surface water sewers or sewers containing both surface and waste water known as 'combined sewers'. Foul water flooding often occurs in areas prone to overland flow and can result when the sewer is overwhelmed by heavy rainfall and will continue until the water drains away.

4.4.8 United Utilities sewer records identify there to be limited public sewer infrastructure within the vicinity of the site. The nearest public surface water sewer is located approximately 635m to the north-west and the nearest public foul water sewer is located approximately 570m to the north of site. We have contacted UU regarding the possibility of sewer flooding near the site, they have confirmed there are no recorded historical sewer flooding issues within the vicinity of the site, refer to **Appendix C**.

4.5 Groundwater Flood Risk

4.5.1 High groundwater levels are usually the key source of groundwater flooding, which occurs when excess water emerges at the grounds surface (or within manmade underground structures such as basements). Groundwater flooding is often more insistent than surface water flooding and would typically last for weeks/months rather than days meaning the result to property is often more severe.

4.5.2 In general terms groundwater flooding can occur from three main sources:

- If groundwater levels are naturally close to the surface, then this can present a flood risk during times of intense rainfall. No groundwater flood risk has been identified during review of the Knowsley Metropolitan Borough Council's Strategic Flood Risk Assessment (SFRA).
- Seepage and percolation occur where embankments above ground level hold water. In these cases, water travels through the embankment material and emerges on the opposite side of the embankment. At present there are no reported problems with groundwater flooding.
- Groundwater recovery/rebound occurs where the water table has been artificially depressed by abstraction. When the abstraction stops, the water table makes a recovery to its original level. There is the potential for groundwater flooding in low lying areas where groundwater levels have been depressed below their pre-pumping conditions, where these were at or close to ground level. As with the seepage scenario the likelihood of flooding from this source is low.

4.5.3 The EA mapping data for groundwater shows that the site is underlain by a Principle Bedrock Aquifer and Secondary (undifferentiated) superficial deposits (**Appendix B**). No historical groundwater flooding of the site has been identified during consultation with interested parties. Irrespective, it is advised that external levels fall away from the properties (where feasible) to minimise the flood risk from a variety of sources. By keeping the finished floor levels elevated relative to the externals, this should help create an overland flow route, in the event of a groundwater related flood event.

4.6 Artificial Sources of Flood Risk

4.6.1 National policy states that an FRA should consider the potential risks from a variety of other flood sources including artificial sources (such as risks from reservoirs and canals).

Reservoirs

4.6.2 The EA recognises reservoirs as bodies of water over 25,000cu.m and the long-term flood mapping is included in **Appendix B** which shows the extents of flooding associated with reservoirs does not impact upon the proposed development site.

4.6.3 There are several small bodies of water (less than 25,000cu.m) onsite and within the vicinity, these existing pond features are assumed to be used for land drainage and due to their scale, the associated flood risk is minimal.

Canals

4.6.4 The closest canal to the site is the St Helens Canal located approximately 6km north-east, due to its proximity from site the risk of flooding associated with canals is therefore considered to be 'low'.

4.6.5 Irrespective, it is advised that external levels fall away from the property (where feasible) to minimise the flood risk from a variety of sources. By keeping the finished floor levels elevated relative to the externals, this should help create an overland flood flow route in the event of a breach or any other source of flooding that could lead to overland flows including reservoir or canal flooding.

4.7 Historical and Anecdotal Flooding Information

4.7.1 An internet-based search for flooding events did not identify any historical flooding to the immediate site, however, it did highlight previous flooding to the wider Knowsley area approximately 4.5km from site. Review of the Knowsley Metropolitan Borough Council (KMBC) Preliminary Flood Risk Assessment (PFRA) and KMBC Strategic Flood Risk Assessment (SFRA) also did not highlight any historic flooding pertinent to this FRA (some general mapping data has been included in **Appendix H**).

4.7.2 Consultations have also been undertaken with the EA, UU and KMBC (see **Appendix B, C and D** respectively), which failed to identify any historical flooding directly to the site or the surrounding area.

4.8 Flood Risk Mitigation Measures & Residual Risks

4.8.1 The site is located within Flood Zone 1 and considered to be at little risk of fluvial/tidal flooding. To observe a conservative approach, mitigation measures have been proposed below to safeguard the development with regards to other potential residual sources of flood risk; and to consider the uncertainties of climate change in accordance with Planning Policy.

Mitigation Measures

4.8.2 For 'more vulnerable' development located within Flood Zone 1; it is typical to set the Finished Floor Levels (FFL) of residential dwellings a minimum of 150mm above the external ground levels (where practical). By ensuring the FFLs are raised sufficiently above the external levels (following any re-grade) this should mitigate any risk of flooding from a variety of sources, including groundwater and surface water run-off risks at the site.

4.8.3 Any overland flows generated by the development must be carefully controlled. Safe avenues directing overland flow way from any existing and proposed buildings is advised. Any incoming flows onto site should also be catered for, by allowance for continued conveyance through the development site.

4.8.4 To minimise the flood risk to the neighbouring properties it is recommended that the surface water run-off generated by the proposals be managed effectively with the peak rates of run-off being restricted to the pre-development situation (with betterment where required).

4.8.5 The proposed onsite surface water drainage system will need to be sized to contain the 1 in 30yr return period event below ground, with exceedance from storm events up to and including the 1 in 100yr return period storm event with a 40% allowance for climate change being contained onsite.

4.8.6 As with any drainage system blockages within either the foul or surface water system have the potential to cause flooding or disruption. It is important that should any drainage systems not be offered for adoption to either United Utilities or Knowsley Metropolitan Borough Council (depending on nature of asset involved) then an appropriate maintenance regime should be scheduled with a suitably qualified management company for these private drainage systems.

Residual Risks

4.8.7 If an extreme rainfall event exceeds the design criteria for the drainage system it is likely that there will be some overland flows that are unable to enter the system, it is important that these potential overland flows are catered for within the proposed development in the event that the capacity of the drainage system is exceeded.

5.0 SURFACE WATER MANAGEMENT

5.1 Pre-Development Surface Water Run-off

5.1.1 The total site covers approximately 16.204ha, however the proposed development area excludes areas which will remain undeveloped and covers a smaller portion approximately 13.772ha. At present the site is mostly undeveloped and less than 5% impermeable. Most of the undeveloped areas on the site naturally drain to the watercourse via existing surface water conveyance or natural infiltration over time.

5.1.2 It is not clear at this time where the existing impermeable areas of the site drain and given the small amount of impermeable areas the proposals will be to consider the entire development area as permeable for the purpose of calculating run-off rates and volumes. The peak rates and volumes of run-off generated by the development area have been calculated for the storm events below using the FEH catchment data, details of which are included in **Table 1** (full details **Appendix I**).

Site Area	Run-Off Rates				Run-Off Volumes	
	1 In 1 Year	1 In 30 Year	1 In 100 Year	QBar	1 In 1 Year	1 In 100 Year
13.772ha	60.7l/s	118.6l/s	145.1l/s	69.7l/s	1382.8cu.m	4293.6cu.m

Table 1: Pre-Development Surface Water Run-Off Rates (Betts Hydro, 2019)

5.2 Post Development Surface Water Run-Off

5.2.1 At present the planning proposals show the development area to cover 13.772ha. Based on the planning layout we have estimated that the post-development impermeable areas will cover approximately 55% of the development area (which equates to 7.575ha).

Site Area	Run-Off Rates		
	1 In 1 Yr.	1 In 30 Yr.	1 In 100 Yr. +CC
7.575ha	337.9l/s	605.7l/s	1130.0l/s

Table 2: Post-Development Un-Restricted Run-Off Rates (Betts Hydro, 2019)

5.2.2 The unrestricted post-development run-off rates have been detailed in **Table 2**. The proposals however will be to restrict the rate of discharge from the development to mimic the pre-development greenfield situation (quoted in **Table 1** previously). Betterment in the form of permeable surfaces will also be considered as part of detailed design where feasible to reduce surface water run-off rates.

5.3 Sustainable Drainage Systems (SuDS)

5.3.1 Sustainable Drainage Systems (SuDS) can address the four core sustainability objectives; water quantity, water quality, amenity and biodiversity. In accordance with the NPPF, SuDS should be specified wherever possible to manage surface water run-off generated onsite. With the appropriate systems, all core objectives can be satisfied, in turn reducing the burden downstream on both watercourses and sewerage systems.

5.3.2 Where possible, peak surface water discharge rates to watercourses and sewers should be appropriately managed and where possible reduced. Preference should always

be given to SuDS over the traditional methods within green spaces (POS) areas, where SuDS features can be implemented. The photographs in **Figure 5** illustrate similar residential schemes which have utilised SuDS as part of the surface water regime.

Figure 5: SuDS Photographs (SusDrain, 2012)

5.3.3 Given the indicative layout there may be the opportunity to incorporate methods such as swales and balancing pond(s) to provide a degree of treatment before flows are carried to a watercourse. Should the ground conditions onsite prove favourable, it would also be recommended that permeable paving, swales or tree pits be utilised in non-adopted areas where at all feasible; if infiltration is not feasible then the permeable paving should be lined, with a positive connection into the main drainage for the site.

5.3.4 Promoting SuDS to deal with surface water at the source, will limit the required attenuation and in turn reduce the volume of surface water in the nearby watercourse and sewer infrastructure. There may be the potential to utilise SuDS features for conveyance/attenuation of surface water flows within the proposed drainage strategy, opposed to the traditional below ground storage methods. Detailed design should confirm whether this site would be suitable for incorporation of SuDS following more detailed analysis of levels, ground conditions and attenuation requirements.

5.4 Methods of Surface Water Management

5.4.1 At present the proposed development area covers is 13.772ha and the proposed impermeable area will cover approximately 55% of the development area (equating to 7.575ha). There are three methods that have been reviewed for the management and discharge of surface water. These may be applied individually or collectively to form a complete strategy and should be applied in the order of priority listed below:

- Discharge via infiltration
- Discharge to watercourse
- Discharge to public sewerage system

5.5 Discharge via Infiltration

5.5.1 Any impermeable areas that can drain to soakaway or an alternative method of infiltration would significantly improve the sustainability of any surface water systems.

The online published datasets have therefore been reviewed to determine the underlying ground strata. The British Geology Survey (BGS) mapping data indicates that the underlying bedrock geology consists of *Kinnerton Sandstone Formation and the superficial deposits are Devensian Tills.* The Cranfield Soil and AgriFood Institute (CSAI), Soilscapes viewer identifies the soils across the site to be slowly permeable, seasonally wet, and slightly acid but base-rich loamy and clayey soils.

5.5.2 Based on the ground conditions identified by the online published datasets above, it can be considered that infiltration is not likely to provide a viable surface water drainage solution for the entire proposals, in terms of infiltration characteristics. As infiltration rates vary on a site by site basis, in accordance with LPA's and UU's requirements, Soakaway Testing to BRE365 is recommended to evidence that discharge to ground will not be a viable solution for the site.

5.6 Discharge to Watercourse

5.6.1 Assuming infiltration is not feasible at the site, this assessment has considered the alternatives for managing surface water run-off in accordance with the sustainable drainage hierarchy. The next method should be to discharge to a watercourse. The nearest watercourse to the site is Whiston Brook located approximately 32m east of the site and is considered 'Main River' by the Environment Agency. Whiston Brook flows south and connects into Fox's Bank Brook, ultimately outfalling into Logwood Mill Brook.

Figure 6: Existing Drainage Situation Plan extract (Betts Hydro, 2019)

5.6.2 Detailed drainage investigation has been undertaken by the client to ascertain how the existing land and ponds located onsite currently drain. The existing run-off generated by the site ultimately outfalls to Whiston Brook utilising two existing outfalls

(shown within **Figure 6** as A and B) for conveyance. An existing Drainage Plan has been drafted to illustrate the existing routing however, this is confirmed on the more detailed CCTV survey illustration (**Appendix K**).

5.6.3 Given the nature of the development, the proposals are to discharge surface water run-off generated by the development to the watercourse network utilising one of these existing connections for conveyance and connection as illustrated in the preliminary proposed plan in **Figure 7**. The existing connection from the onsite pond features will be maintained to cater for these natural areas which will remain as they currently exist within the development proposals. Detailed design will need to confirm feasibility of the drainage strategy proposed following a full review of levels; however, a preliminary drainage layout has been produced to illustrate the deliverability of the surface water drainage solution (see drawings in **Appendix K**).

5.6.4 Consents will be required from the Environment Agency for any works effecting the Main River network (Whiston Brook) and further discussion with the Lead Local Flood Authority (KMBC) will also be required to agree the proposed discharge rates. Early discussion is recommended with all parties, to confirm acceptance of the strategy and identify if there are any additional constraints. Any offsite works will need to be discussed with the relevant parties (Highways Authority) during detailed design.

Figure 7: Preliminary Proposed Drainage Strategy Plan extract (Betts Hydro, 2020)

5.6.5 In accordance with the SuDS Manual (CIRIA 753) and the Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015) all sites should endeavour to achieve as close to pre-development greenfield rates as is viable. The proposals are therefore to restrict surface water run-off from site to mimic a pre-development greenfield situation, the pre-development greenfield rate (QBar) is calculated to be

69.7l/s using the FEH statistical method and FEH catchment data (see summary in **Appendix I**).

5.6.6 Detailed design needs to confirm whether the available capacity in the existing offsite conveyance connection to the watercourse is sufficient to cater for this rate of discharge. If this capacity is lower than the proposed rate of discharge, then the existing connection would need to be increased to allow sufficient capacity or a new connection constructed that is appropriately sized, following further discussion with all relevant parties.

5.6.7 Restricting the rate of discharge from site will generate a stormwater storage requirement in the extreme storm events. The stormwater storage figures quoted in **Table 3** (**Appendix L**) are estimates only for the development area and the detailed drainage design will determine with accuracy the stormwater storage requirements.

Impermeable Area (7.575ha)	1 In 1 Year	1 In 30 Year	1 In 100 Year + 40% CC
Restricted Run-Off Rate	69.7l/s	69.7l/s	69.7l/s
Estimated Stormwater Storage Volume	649cu.m-1125cu.m	1690cu.m-2391cu.m	3802cu.m-5129cu.m

Table 3: Estimated Stormwater Storage Requirements (Betts Hydro, 2019)

5.6.8 In accordance with policy it would be beneficial to implement SuDS features including permeable surfaces and bio-filtration where at all feasible (subject to ground investigation and a detailed level review). If designed appropriately SuDS features such as pond(s)/basin(s) and swales could also aid in the attenuation and conveyance requirements for the proposals providing added benefits in terms of water quality. This would also ensure conformance with the guidance in the KMBC Sustainable Drainage and Surface Water Management guidance document (**Appendix H**).

5.6.9 Detailed design will confirm the full surface water management details and use of SuDS, although based on the initial design work already prepared it is feasible to get a gravity surface water regime to work for the scheme and the proposals will be to utilise SuDS basins in the low points of the site to assist with the surface water attenuation requirements, this conforms with both local and national planning guidance.

5.6.10 It should also be noted that the development proposals form part of a wider development opportunity for further residential development. It's understood that future residential led development proposals will come forward in due course to both the north and to the south-west of this site area, as part of the wider Halsnead Garden Village scheme. The drainage strategy proposed to cater for this development parcel will be reviewed at the time when the future phases come forward to ensure that enough capacity in the conveyance and attenuation features has been allowed for to cater for the additional development.

5.6.11 The attenuation ponds proposed on the Preliminary Drainage Layout have capacity for potential expansion in the future to provide attenuation associated with these additional development phases, should this be required and subject to a suitable equalisation process. Full assessments will need to take place to support these

additional phased of development in due course, however it is important to note at this stage that an holistic and comprehensive surface water management regime will be required to ensure that the proposals do not result in any increase in surface water flooding to the neighbouring areas.

5.7 Discharge to Public Sewer Network

5.7.1 Should infiltration and discharge to the watercourse network not offer feasible solutions, then the alternative would be to discharge to the nearest public surface water sewer. UU have identified the nearest public surface water sewer is located approximately 635m to the north-west of site; as illustrated in **Figure 7**. This may offer an alternative should all other options in the hierarchy not be feasible, consents for works to the public sewer network will be required from UU and early discussion will be needed to identify any additional constraints and preferred point(s) for connection.

5.8 Climate Change

5.8.1 There are indications that the climate in the UK is changing significantly and current expert opinion indicates the likelihood that future climate change would produce more frequent short duration and high intensity rainfall events with the addition of more frequent periods of long duration rainfall. An increase in flood water levels means that future flooding events will occur more frequently and will have a greater impact. Considering the future uncertainties Climate Change should be accounted for within the design of all new developments. The recently published Environment Agency document '*Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities*' supersedes Defra's policy statement on Flood Risk and Coastal Erosion Risk Management (2009) and should be used for future proposals.

5.8.2 Climate change factors have been considered and any increase in the level of flood risk (to the site) from climate change is likely to be related to the increase in rainfall intensity and duration and its impact upon the surface water drainage system. In accordance with the updated Climate Change projections providing estimated changes to rainfall intensity (**Table 4**) and based on the design life of the development (100yrs) the "total potential change figures for the 2080's" has been utilised for surface water drainage calculations.

PROJECTIONS	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE 2080'S
Upper End Estimate	40%
Central Change Factor	20%

Table 4: Change to Extreme Rainfall Intensity Compared to 1961-1990 Baseline (Environment Agency, 2016)

6.0 FOUL WATER MANAGEMENT

6.1 Review of the UU sewer records identify there to be limited public sewer infrastructure within the vicinity of the site (refer to sewer records within **Appendix C**). The nearest system is a public foul water sewer is located approximately 570m to the north of site within Lickers Lane. No existing foul water connections from the site are currently present, therefore new connection(s) will be required to cater for the development.

6.2 The proposals are to connect foul water flows generated by site into the nearest foul water sewer (within Lickers Lane) located 570m north of site. The exact point of connection will be subject to early discussions with UU. Detailed design will be required to confirm feasibility of the strategy based on the topographic levels following further detailed investigation.

6.3 Based on the proposals for the construction of 337no. residential units the approximate peak foul water flows generated by the development will be 15.6l/s. This figure is calculated based on 4000 litres per dwelling per 24 hours; the guidance contained within Sewers for Adoption (SfA).

6.4 Consents and relevant agreements will be required from UU prior to commencement of works. Early consultation with UU is recommended to identify any additional constraints and their preferred point(s) of connection. Offsite works will be required for a connection to the public sewer network and any offsite routing will also need to be considered in terms of consents with the relevant asset owners (Highways Authority and third party land owners).

7.0 SUMMARY AND CONCLUSIONS

7.1 This Flood Risk Assessment and Drainage Management Strategy was prepared to support a full planning application for the construction of a residential led development known as the Fox's Bank, Halsnead Garden Village site in Whiston.

Flood Risk

7.2 The site lies solely within Flood Zone 1 based on the Environment Agency Flood Map for Planning and overall covers 16.204ha, Residential development is classified as 'more vulnerable' within the Planning Practice Guidance which supports the National Planning Policy Framework. The Planning Practice Guidance confirms that 'more vulnerable' development is appropriate to be located within Flood Zone 1, providing there is no increase in flood risk elsewhere due to the proposals

7.3 This report has reviewed all sources of flood risk both to and resulting from the proposed development site. Consultations with the Environment Agency, United Utilities, and Knowsley Metropolitan Borough Council have been undertaken and did not identify any historical incidents of flooding to the site. The nearest watercourse is Whiston Brook located approximately 100m south-east of site, which is considered 'Main River' by the Environment Agency. Whiston Brook flows south and connects into Foxes Bank Brook which ultimately outfalls into Logwood Mill Brook located approximately 1.5km south-west from site. The fluvial/pluvial flood risk to site from these sources is 'very low'.

7.4 The primary flood risk is from surface water flooding; this risk varies across site from 'very low' to 'high' and is closely associated with the existing topography and the drainage features onsite. The risk associated with surface water flooding will be inherently reduced as part of the proposals following the implementation of the mitigation measures proposed including sustainable surface water management infrastructure.

Drainage Strategy

7.5 In accordance with national and local planning policy, surface water management is required to be considered for development of this nature and scale. Surface water discharge options have therefore been assessed in accordance with the sustainable drainage hierarchy, which is; discharge to ground, to a watercourse and finally to the public sewer network.

7.6 Based on the cohesive ground conditions by the online datasets and observed on the walkover, infiltration is not likely to offer a viable drainage solution. Soakaway Testing to BRE365 is still recommended evidence that discharge to ground will not be a viable solution in accordance with the Local Planning Authority's requirements. Assuming infiltration is unlikely to offer a site wide drainage solution for the site, this assessment has considered the alternatives in accordance with the hierarchy.

7.7 The next method in the approach should be to discharge surface water run-off to a watercourse, and at present the site currently drains to the neighbouring Main Rover network via onsite ponds and offsite connections. There are two existing outfalls to the watercourse network, which have been investigated to confirm condition and routing. The proposals are to discharge to the watercourse using one of these existing

connections, the other will continue to convey flows from the onsite pond network and no changes would be proposed.

7.8 Detailed design will need to refine this strategy and confirm whether a full gravity is feasible. Initial design works have been completed to confirm in principle a gravity system can be achieved on the site. Consents will be required from the Environment Agency for any works effecting the Main River network (Whiston Brook) and further discussion with the Lead Local Flood Authority will also be required to agree the proposed discharge rates. Any offsite works also will need to be discussed and agreed with the relevant parties (Highways Authority) during detailed design.

7.9 In accordance with the SuDS Manual (CIRIA 753) and the Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015) all sites should endeavour to achieve as close to pre-development greenfield rates as is viable. The proposals are therefore to restrict surface water run-off from site to mimic a pre-development greenfield situation, the pre-development greenfield rate (QBar) is calculated to be 69.7l/. Detailed design needs to confirm whether the available capacity in the existing offsite conveyance connection to the watercourse is enough to cater for this rate.

7.10 Restricting the rate of discharge from the site will generate a storage requirement during extreme storm events. The proposed onsite surface water drainage system will need to be sized to contain the 1 in 30yr return period event below ground with overland run-off from storm events up to and including the 1 in 100yr return period event with a 40% allowance for climate change being contained onsite. It is proposed that attenuation areas (pond(s)/basin(s)) be provided onsite to assist with this requirement, although this will need to be considered further during detailed design.

7.12 The drainage strategy proposed for this development will be reviewed at the time when the future phases of the Halsnead Garden Village project come forward, to ensure that enough capacity in the conveyance and attenuation features has been allowed for. Full assessments will need to take place to support these additional phases of development in due course, however it is important to note at this stage that an holistic and comprehensive surface water management regime will be required to ensure that the proposals do not result in any increase in surface water flooding to the neighbouring areas.

7.12 This Flood Risk Assessment and Drainage Management Strategy has been prepared in consultation with the relevant interested parties and incorporates their comments where possible. The report is commensurate with the scale and nature of the development proposals and in summary, the development can be considered appropriate in accordance with the Planning Practice Guidance.

8.0 RECOMMENDATIONS

8.1 For 'more vulnerable' development located within Flood Zone 1; it is typical to set the Finished Floor Levels (FFL) of residential dwellings a minimum of 150mm above the existing ground levels (where practical). By ensuring the FFLs are raised sufficiently above the external levels (following any re-grade) this should mitigate any risk of flooding from a variety of sources, including groundwater and surface water run-off risks at the site.

8.2 To minimise the flood risk to the neighbouring property and proposed dwellings it is proposed that the surface water run-off generated by the proposals be managed effectively with the peak rates of run-off being restricted in accordance with the NPPF and Non-Technical Standards for SuDS.

8.3 In accordance with LPA's and UU requirements, Soakaway Testing to BRE365 may be required to be undertaken to evidence that discharge to ground will not be a viable solution, this can be via a standard condition (prior to commencement of work).

8.4 It is understood that the existing run-off generated onsite ultimately outfalls to Whiston Brook utilising two existing outfalls for conveyance. The proposals are to discharge surface water run-off generated at the site to the watercourse utilising the existing connections for conveyance and connection where feasible. If further investigation identifies that the existing systems are not suitable then a new connection(s) to Whiston Brook will be required, subject to consents.

8.5 Detailed design will need to confirm feasibility of a full gravity solution following a full review of levels. Initial design works have been completed to confirm in principle a gravity system can be achieved on the site. Consents will be required from the Environment for any works to/effecting the Main River network (Whiston Brook) and further discussion with the LLFA will also be required to agree the proposed discharge rates. Any new offsite works will need to be discussed and agreed with the relevant parties (Highways Authority) during detailed design process.

8.6 If the capacity in the existing offsite connections is lower than the existing pre-development greenfield rate of run-off, then the existing connection would need to be increased to allow sufficient capacity to cater for the proposed discharge rate or the proposed rate of discharge reduced to accommodate the existing capacity.

8.7 Consideration is recommended into the stormwater attenuation requirements due to restricting the surface water discharge from the site. The proposed onsite surface water drainage system will need to be sized to contain the 30yr return period event wholly below ground with run-off from storm events up to and including the 1 in 100yr return period storm event with a 40% allowance for climate change being contained onsite.

8.8 It is important that should any drainage systems not be offered for adoption to either the Water Company or the Local Authority then an appropriate maintenance regime should be scheduled with a suitably qualified management company for these private drainage systems.

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APPENDIX A: NPPF EXTRACTS

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14. Meeting the challenge of climate change, flooding and coastal change

148. The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.

Planning for climate change

149. Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures[48]. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure.

150. New development should be planned for in ways that:

    a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and

    b) can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.

151. To help increase the use and supply of renewable and low carbon energy and heat, plans should:

    a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);

    b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and

    c) identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

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[48] In line with the objectives and provisions of the Climate Change Act 2008.

152. Local planning authorities should support community-led initiatives for renewable and low carbon energy, including developments outside areas identified in local plans or other strategic policies that are being taken forward through neighbourhood planning.

153. In determining planning applications, local planning authorities should expect new development to:

a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and

b) take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

154. When determining planning applications for renewable and low carbon development, local planning authorities should:

a) not require applicants to demonstrate the overall need for renewable or low carbon energy, and recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and

b) approve the application if its impacts are (or can be made) acceptable[49]. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.

Planning and flood risk

155. 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.

156. Strategic policies should be informed by a strategic flood risk assessment, and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards.

157. All plans should apply a sequential, risk-based approach to the location of development – taking into account the current and future impacts of climate change

[49] Except for applications for the repowering of existing wind turbines, a proposed wind energy development involving one or more turbines should not be considered acceptable unless it is in an area identified as suitable for wind energy development in the development plan; and, following consultation, it can be demonstrated that the planning impacts identified by the affected local community have been fully addressed and the proposal has their backing.

– so as to avoid, where possible, flood risk to people and property. They should do this, and manage any residual risk, by:

a) applying the sequential test and then, if necessary, the exception test as set out below;

b) safeguarding land from development that is required, or likely to be required, for current or future flood management;

c) using opportunities provided by new development to reduce the causes and impacts of flooding (where appropriate through the use of natural flood management techniques); and

d) where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to relocate development, including housing, to more sustainable locations.

158. 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 strategic flood risk assessment 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.

159. If it is not possible for development to be located in zones with a lower risk of flooding (taking into account wider sustainable development objectives), the exception test may have to be applied. The need for the exception test will depend on the potential vulnerability of the site and of the development proposed, in line with the Flood Risk Vulnerability Classification set out in national planning guidance.

160. The application of the exception test should be informed by a strategic or site-specific flood risk assessment, depending on whether it is being applied during plan production or at the application stage. For the exception test to be passed it should be demonstrated that:

a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and

b) the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

161. Both elements of the exception test should be satisfied for development to be allocated or permitted.

162. Where planning applications come forward on sites allocated in the development plan through the sequential test, applicants need not apply the sequential test again. However, the exception test may need to be reapplied if relevant aspects of the proposal had not been considered when the test was applied at the plan-making stage, or if more recent information about existing or potential flood risk should be taken into account.

163. When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment[50]. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;

b) the development is appropriately flood resistant and resilient;

c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;

d) any residual risk can be safely managed; and

e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

164. Applications for some minor development and changes of use[51] should not be subject to the sequential or exception tests but should still meet the requirements for site-specific flood risk assessments set out in footnote 50.

165. Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:

a) take account of advice from the lead local flood authority;

b) have appropriate proposed minimum operational standards;

c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and

d) where possible, provide multifunctional benefits.

Coastal change

166. In coastal areas, planning policies and decisions should take account of the UK Marine Policy Statement and marine plans. Integrated Coastal Zone Management should be pursued across local authority and land/sea boundaries, to ensure effective alignment of the terrestrial and marine planning regimes.

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[50] A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.

[51] This includes householder development, small non-residential extensions (with a footprint of less than 250m^2) and changes of use; except for changes of use to a caravan, camping or chalet site, or to a mobile home or park home site, where the sequential and exception tests should be applied as appropriate.

167. Plans should reduce risk from coastal change by avoiding inappropriate development in vulnerable areas and not exacerbating the impacts of physical changes to the coast. They should identify as a Coastal Change Management Area any area likely to be affected by physical changes to the coast, and:

a) be clear as to what development will be appropriate in such areas and in what circumstances; and

b) make provision for development and infrastructure that needs to be relocated away from Coastal Change Management Areas.

168. Development in a Coastal Change Management Area will be appropriate only where it is demonstrated that:

a) it will be safe over its planned lifetime and not have an unacceptable impact on coastal change;

b) the character of the coast including designations is not compromised;

c) the development provides wider sustainability benefits; and

d) the development does not hinder the creation and maintenance of a continuous signed and managed route around the coast[52].

169. Local planning authorities should limit the planned lifetime of development in a Coastal Change Management Area through temporary permission and restoration conditions, where this is necessary to reduce a potentially unacceptable level of future risk to people and the development.

[52] As required by the Marine and Coastal Access Act 2009.

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What should be considered if bringing forward a Neighbourhood Development Order/Community Right to Build Order in an area at risk of flooding?

The general approach and requirements for site-specific flood risk assessments should be applied to developments in areas at risk of flooding to be permitted by Neighbourhood Development/ Community Right to Build Orders. This means that for any development proposals:

- in Flood Zone 2 or 3;
- or of at least 1 hectare;
- or in an area that has critical drainage problems (as notified to the local planning authority by the Environment Agency);
- or that may be subject to other sources of flood risk;

a site-specific flood risk assessment should support the draft Order. The flood risk assessment checklist may be helpful in this respect.

Where the neighbourhood planning area is in Flood Zone 2 or 3, or is in an area with critical drainage problems, advice on the scope of the flood risk assessment required should be sought from the Environment Agency. Where the area may be subject to other sources of flooding, it may be helpful to consult other bodies involved in flood risk management, as appropriate.

Where a Neighbourhood Development/Community Right to Build Order is under consideration for a site/area in Flood Zone 2 or 3, which has not been allocated in the development plan through the Sequential Test, and if necessary the Exception Test, it will be necessary for those proposing the development, in having regard to the National Planning Policy Framework's policies on flood risk, to demonstrate why the development cannot reasonably be located in areas of lower flood risk.

In all cases where new development is proposed, the sequential approach to locating development in areas of lower flood risk should still be applied within a neighbourhood planning area.

Neighbourhood Development/Community Right to Build Orders that propose new development that would be;

- contrary to the flood risk vulnerability and flood zone compatibility table (Table 3), or;
- within areas at risk of flooding where sequential testing shows there to be places at lower flood risk which are suitable and reasonably available for the development proposed,

should not be considered appropriate, having regard to the national policies on development and flood risk.

Paragraph: 064 Reference ID: 7-064-20140306

Revision date: 06 03 2014

Flood Zone and flood risk tables

- Table 1: Flood Zones
- Table 2: Flood risk vulnerability classification
- Table 3: Flood risk vulnerability and flood zone 'compatibility'

Table 1: Flood Zones

These Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences. They are shown on the Environment Agency's Flood Map for Planning (Rivers and Sea (https://flood-map-for-planning.service.gov.uk/)), available on the Environment Agency's web site, as indicated in the table below.

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding.(Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

Note: The Flood Zones shown on the Environment Agency's Flood Map for Planning (Rivers and Sea) do not take account of the possible impacts of climate change and consequent changes in the future probability of flooding. Reference should therefore also be made to the Strategic Flood Risk Assessment when considering location and potential future flood risks to developments and land uses.

Paragraph: 065 Reference ID: 7-065-20140306

Revision date: 06 03 2014

Table 2: Flood risk vulnerability classification

Essential infrastructure

- Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk.
- Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood.
- Wind turbines.

Highly vulnerable

- Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding.
- Emergency dispersal points.
- Basement dwellings.
- Caravans, mobile homes and park homes intended for permanent residential use.
- Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure').

More vulnerable

- Hospitals
- Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.
- Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.
- Non–residential uses for health services, nurseries and educational establishments.
- Landfill* and sites used for waste management facilities for hazardous waste.
- Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.

Less vulnerable

- Police, ambulance and fire stations which are not required to be operational during flooding.
- Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure.
- Land and buildings used for agriculture and forestry.
- Waste treatment (except landfill* and hazardous waste facilities).
- Minerals working and processing (except for sand and gravel working).
- Water treatment works which do not need to remain operational during times of flood.
- Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.

Water-compatible development

- Flood control infrastructure.
- Water transmission infrastructure and pumping stations.
- Sewage transmission infrastructure and pumping stations.
- Sand and gravel working.
- Docks, marinas and wharves.
- Navigation facilities.
- Ministry of Defence defence installations.
- Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.
- Water-based recreation (excluding sleeping accommodation).
- Lifeguard and coastguard stations.
- Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.
- Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

" * " Landfill is as defined in Schedule 10 of the Environmental Permitting (England and Wales) Regulations 2010 (http://www.legislation.gov.uk/uksi/2010/675/schedule/10/made).

Paragraph: 066 Reference ID: 7-066-20140306

Revision date: 06 03 2014

Table 3: Flood risk vulnerability and flood zone 'compatibility'

Table 3: flood risk vulnerability and flood zone ‘compatibility' (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/575184/Table_3_-_Flood_risk_vulnerability_and_flood_zone__compatibility_.pdf) (PDF, 58.1KB, 1 page)

Key:

✓ Development is appropriate

✗ Development should not be permitted.

Notes to table 3:

- This table does not show the application of the Sequential Test which should be applied first to guide development to Flood Zone 1, then Zone 2, and then Zone 3; nor does it reflect the need to avoid flood risk from sources other than rivers and the sea;
- The Sequential and Exception Tests do not need to be applied to minor developments and changes of use, except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site;
- Some developments may contain different elements of vulnerability and the highest vulnerability category should be used, unless the development is considered in its component parts.

† In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.

” * “ In Flood Zone 3b (functional floodplain) essential infrastructure that has to be there and has passed the Exception Test, and water-compatible uses, should be designed and constructed to:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;
- not impede water flows and not increase flood risk elsewhere.

Paragraph: 067 Reference ID: 7-067-20140306

Revision date: 06 03 2014

Site-specific flood risk assessment: Checklist

1 - Development site and location

You can use this section to describe the site you are proposing to develop. It would be helpful to include, or make reference to, a location map which clearly indicates the development site.

a. Where is the development site located? (eg postal address or national grid reference)

b. What is the current use of the site? (eg undeveloped land, housing, shops, offices)

c. Which Flood Zone (for river or sea flooding) is the site within? (ie Flood Zone 1, Flood Zone 2, Flood Zone 3). As a first step, you should check the Flood Map for Planning (http://apps.environment-agency.gov.uk/wiyby/37837.aspx) (Rivers and Sea). It is also a good idea to check the Strategic Flood Risk Assessment for the area available from the local planning authority.

2 - Development proposals

APPENDIX B: EA INFORMATION & CORRESPONDENCE

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Megan Berry

From: Cooke, Claire <Claire.Cooke@environment-agency.gov.uk> on behalf of GMMC Info Requests <Inforequests.gmmc@environment-agency.gov.uk>
Sent: 16 April 2018 15:43
To: Megan Berry
Subject: GMMC81910CC -Response from the Environment Agency
Attachments: GMMC81910CC_DFM.pdf; GMMC81910CC_P4.pdf

Dear Megan,

Thank you for your enquiry which was received on 11 April 2018.

We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004.

Please see data requested attached and see supporting comments below:

We have no record of flooding affecting this site. However, this does not mean flooding has not occurred in the past or that it will not flood in future. We recommend that you also contact United Utilities and Knowsley Metropolitan District Authority who may hold additional information (the former especially in relation to sewer flooding).

There are no flood defences within the vicinity of the site.

The site lies within Flood Zone 1 on the Environment Agency's Flood map for planning and is therefore considered to be at low risk of flooding from nearby rivers and the sea. As a consequence, we have no specific requirements for any Flood Risk Assessment carried out in support of a planning application for the site.

Please be aware you can check your risk of flooding on our external website https://flood-warning-information.service.gov.uk/long-term-flood-risk/

Please also note that all current EA flood risk strategy documents can be found on our external website https://www.gov.uk/guidance/flood-risk-assessment-local-planning-authorities and https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

Please refer to the Open Government Licence which explains the permitted use of this information.

Please get in touch if you have any further queries or contact us within two months if you'd like us to review the information we have sent.

Kind regards,

Claire Cooke
Customer and Engagement Officer
Greater Manchester, Merseyside and Cheshire
External: 0203 025 0048
Email: Inforequests.gmmc@environment-agency.gov.uk

From: Megan Berry [mailto:meganberry@betts-associates.co.uk]
Sent: 11 April 2018 16:43
To: GMMC Info Requests <Inforequests.gmmc@environment-agency.gov.uk>
Subject: Historical/Current Flooding Issues

F.A.O Flood Risk, Drainage and/or Planning department

Please forward to the correct department/ office

To whom it may concern,

Land off Fox's Bank Ln, Whiston, Prescot

Please could you confirm whether you have any information that you feel would be valuable to a Flood Risk Assessment and Drainage Management Strategy for the site above (see location plan attached), including details of historical flooding and any predicted flood water levels; this would be greatly appreciated. If there are any specific requirements that you require in a scope of works for this site please can you advise at this stage so that it can be fully incorporated into the proposals at an early stage.

Please do not hesitate to contact me on the details below to discuss further should you require additional information or clarification.

Kind Regards

Megan Berry BSc(Hons)
Graduate Flood Risk Analyst

BETTS HYDRO
Specialists in Drainage and Flood Risk
Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire, CH5 2LY

CHESTER OFFICE - 01244 289041

meganberry@betts-associates.co.uk
www.betts-associates.co.uk

CIVIL | STRUCTURAL | GEO-ENVIRONMENTAL | HYDROLOGY | FLOOD RISK MANAGEMENT
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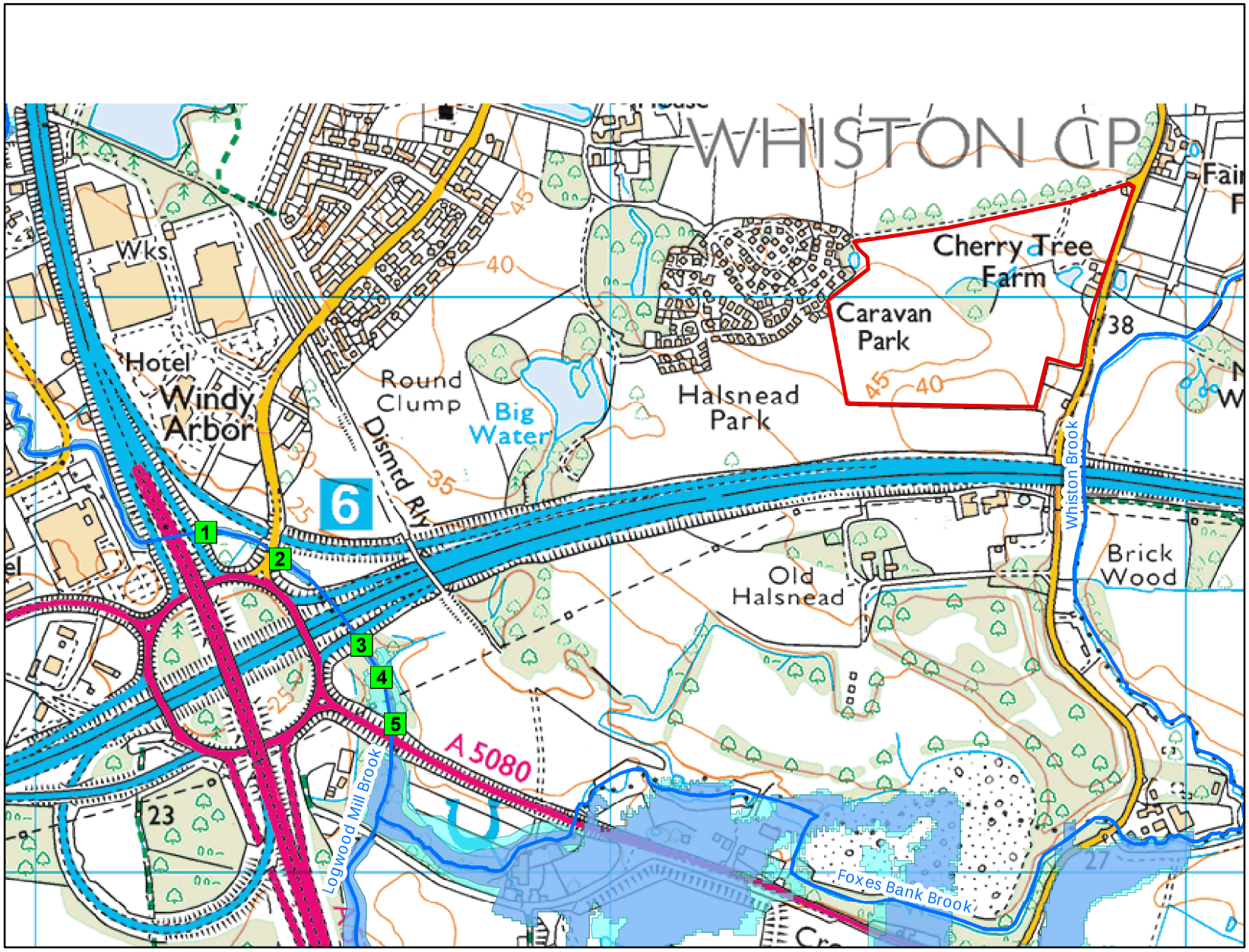
Detailed Flood Map centred on Fox's Bank Lane, Whiston, L35 3SS. Created 13 April 2018 [GMMC81910CC]



Environment Agency

1:10,001

N

Legend

- Site Location
- Model Measurements
- Main River
- Flood Zone 3
- Flood Zone 2

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Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

					Undefended						
Map Reference	Model Node Reference	Easting	Northing	Data	10 % AEP (1 in 10 year)	4 % AEP (1 in 25 year)	1.33 % AEP (1 in 75 year)	1 % AEP (1 in 100 year)	1 % AEP (1 in 100 year) + Climate Change*	0.5 % AEP (1 in 200 year)	0.1 % AEP (1 in 1000 year)
1	ea013_0168_Logwood_073	346297	389591	Modelled Water Level (m aodN)	19.17	19.32	19.56	19.64	19.85	19.83	20.35
				Modelled Flow (cumecs)	6.24	7.54	9.58	10.29	12.22	12.02	17.55
2	ea013_0168_Logwood_075	346427	389545	Modelled Water Level (m aodN)	17.61	17.75	17.98	18.06	18.27	18.25	19.10
				Modelled Flow (cumecs)	6.43	7.76	9.87	10.60	12.60	12.39	18.09
3	ea013_0168_Logwood_077	346568	389395	Modelled Water Level (m aodN)	15.80	15.96	16.22	16.31	16.66	16.62	17.45
				Modelled Flow (cumecs)	6.56	7.92	10.07	10.81	12.84	12.62	18.45
4	ea013_0168_Logwood_078	346604	389339	Modelled Water Level (m aodN)	15.67	15.85	16.15	16.25	16.64	16.59	17.52
				Modelled Flow (cumecs)	6.69	8.08	10.25	11.00	13.05	12.84	19.19
5	ea013_0168_Logwood_079	346628	389258	Modelled Water Level (m aodN)	15.42	15.59	15.89	15.99	16.41	16.35	17.38
				Modelled Flow (cumecs)	6.85	8.27	10.48	11.25	13.31	13.10	18.56

Model data taken from Logwood Mill Brook 2012

AEP - Annual Exceedence Probability

m aodN - metres above ordnance datum Newlyn

cumecs - cubic metres per second

Notes:

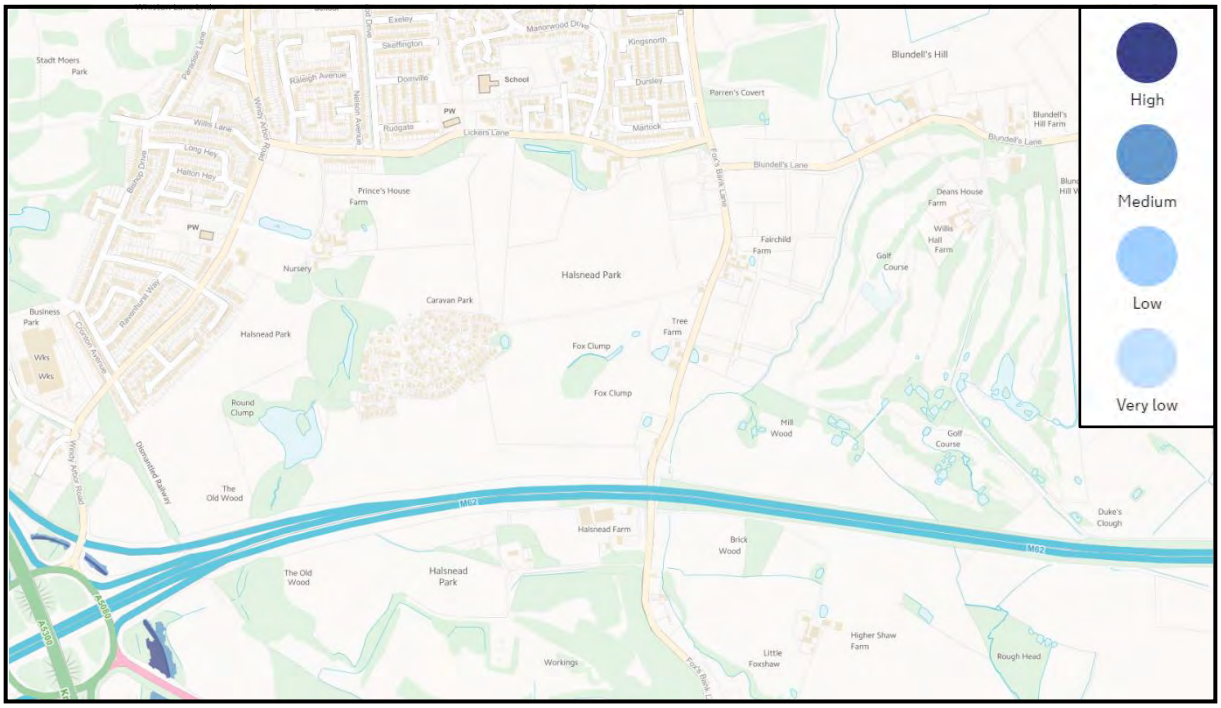
*Climate Change Scenario - 20% increase in flow. We only hold climate change measurements based on the previous climate change guidance.

The new climate change guidance is available at https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances. The location of the site and the type (vulnerability) of development determine the climate change allowances to consider in any flood risk assessment.

NATIONAL FLOOD MAPPING

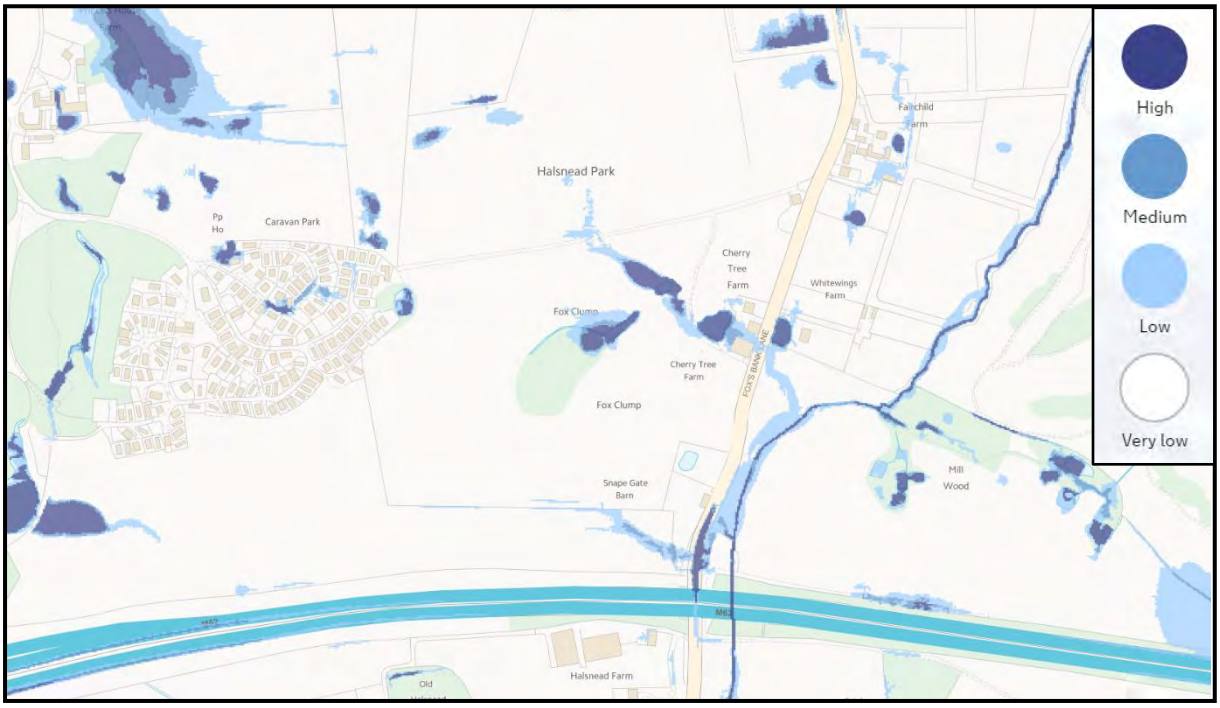
Flood Map for Planning

Long Term Flood Risk – Rivers or Sea



NATIONAL FLOOD MAPPING

Long Term Flood Risk – Surface Water



Long Term Flood Risk - Reservoirs

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APPENDIX C: UU CORRESPONDENCE

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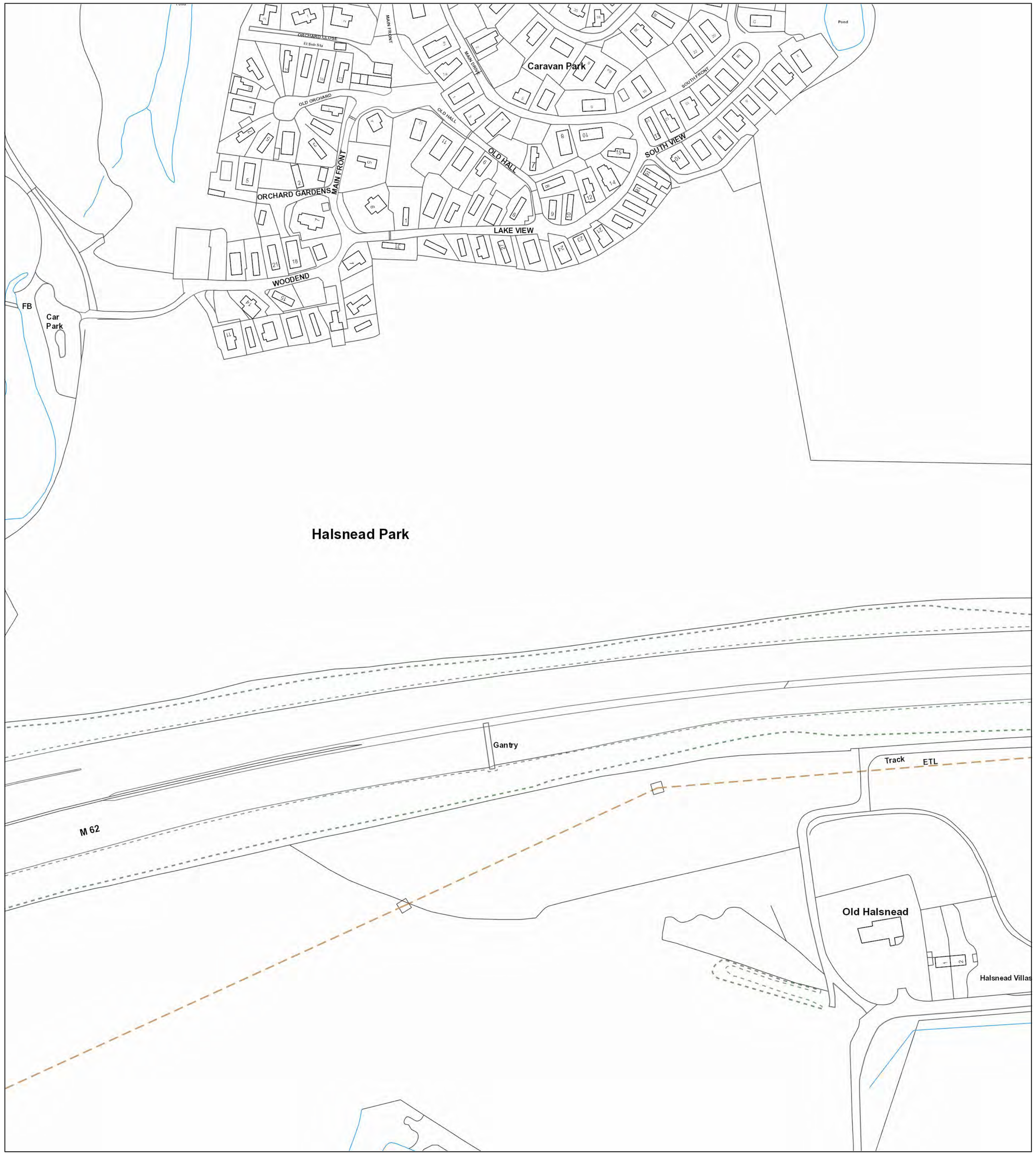

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Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad

Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad

LEGEND

Abandoned | Foul | Surface Water | Combined

- Public Sewer
- Private Sewer
- Section 104
- Rising Main
- Sludge Main
- Overflow
- Water Course
- Highway Drain

All point assets follow the standard colour convention:
red - combined, blue - surface water, brown - foul, purple - overflow

- Manhole
- Head of System
- Extent of Survey
- Rodding Eye
- Inlet
- Discharge Point
- Vortex
- Penstock
- Washout Chamber
- Valve
- Air Vaive
- Non Return Valve
- Soakaway
- Gully
- Cascade
- Flow Meter
- Hatch Box
- Oil Interceptor
- Summit
- Drop Shaft
- Orifice Plate
- Side Entry Manhole
- Outfall
- Screen Chamber
- Inspection Chamber
- Bifurcation Chamber
- Lamp Hole
- T Junction / Saddle
- Catchpit
- Valve Chamber
- Vent Column
- Vortex Chamber
- Penstock Chamber
- Network Storage Tank
- Sewer Overflow
- Ww Treatment Works
- Ww Pumping Station
- Septic Tank
- Control Kiosk
- Change of Characteristic

MANHOLE FUNCTION

FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIAL

AC	Asbestos Cement
BR	Brick
PE	Polyethylene
RP	Reinforced Plastic Matrix
CO	Concrete
CSB	Concrete Segment Bolted
CSU	Concrete Segment Unbolted
CC	Concrete Box Culverted
PSC	Plastic / Steel Composite
GRC	Glass Reinforecd Plastic
DI	Ductile Iron
PVC	Polyvinyl Chloride
CI	Cast Iron
SI	Spun Iron
ST	Steel
VC	Vitrified Clay
PP	Polypropylene
PF	Pitch Fibre
MAC	Masonry, Coursed
MAR	Masonry, Random
U	Unspecified

Address or Site Reference:

Halsnead Garden Village,

OS sheet Number: SJ4789NW

Scale: 1:1250 **Date:** 25/04/2018

Nodes: 0

Sheet: 1 of 4

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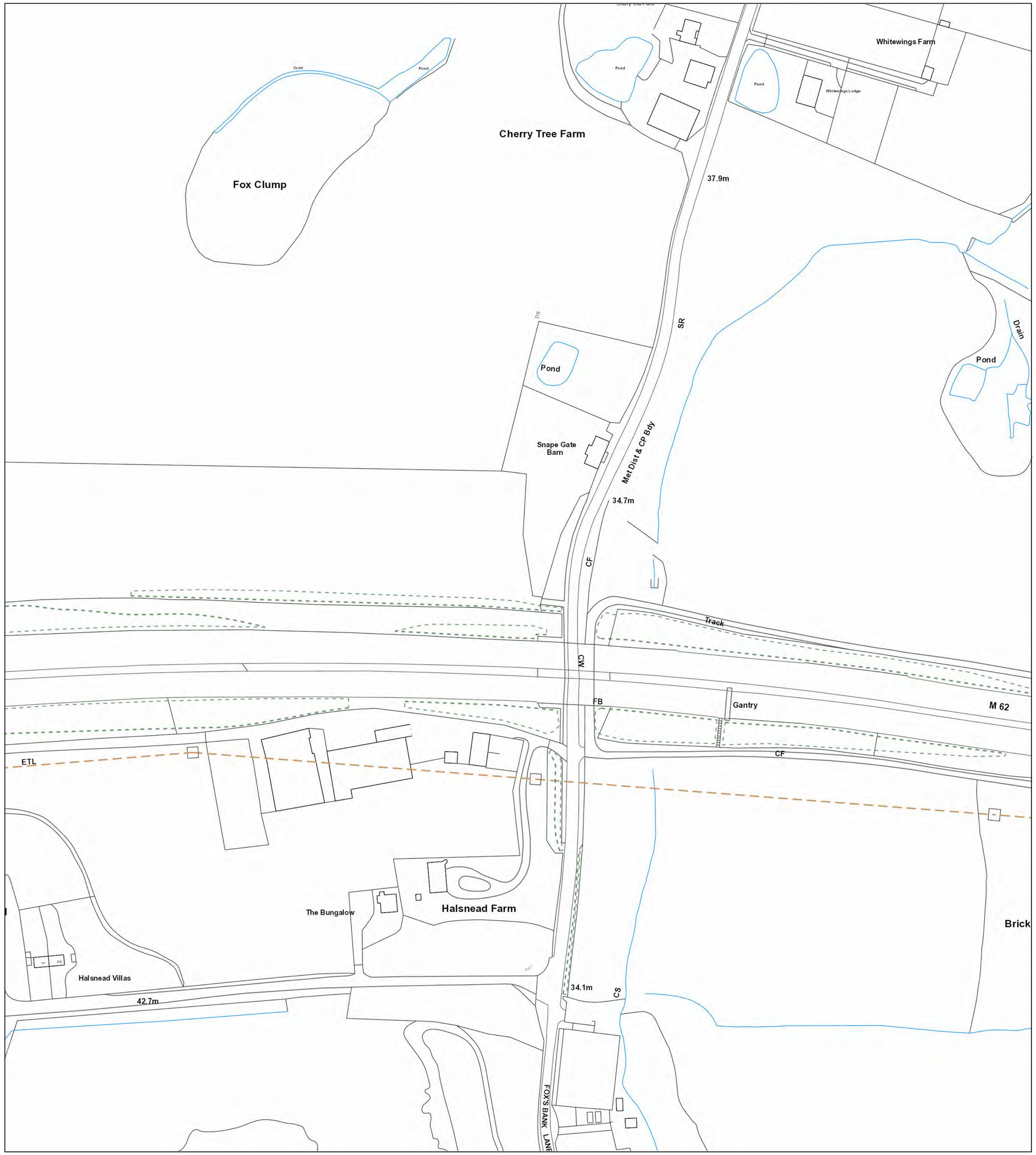

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Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad

LEGEND

Abandoned | Foul | Surface Water | Combined

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MANHOLE FUNCTION

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SEWER MATERIAL

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DI	Ductile Iron
PVC	Polyvinyl Chloride
CI	Cast Iron
SI	Spun Iron
ST	Steel
VC	Vitrified Clay
PP	Polypropylene
PF	Pitch Fibre
MAC	Masonry, Coursed
MAR	Masonry, Random
U	Unspecified

Address or Site Reference:

Halsnead Garden Village,

OS sheet Number: SJ4789NE

Scale: 1:1250 **Date:** 25/04/2018

Nodes: 0

Sheet: 2 of 4

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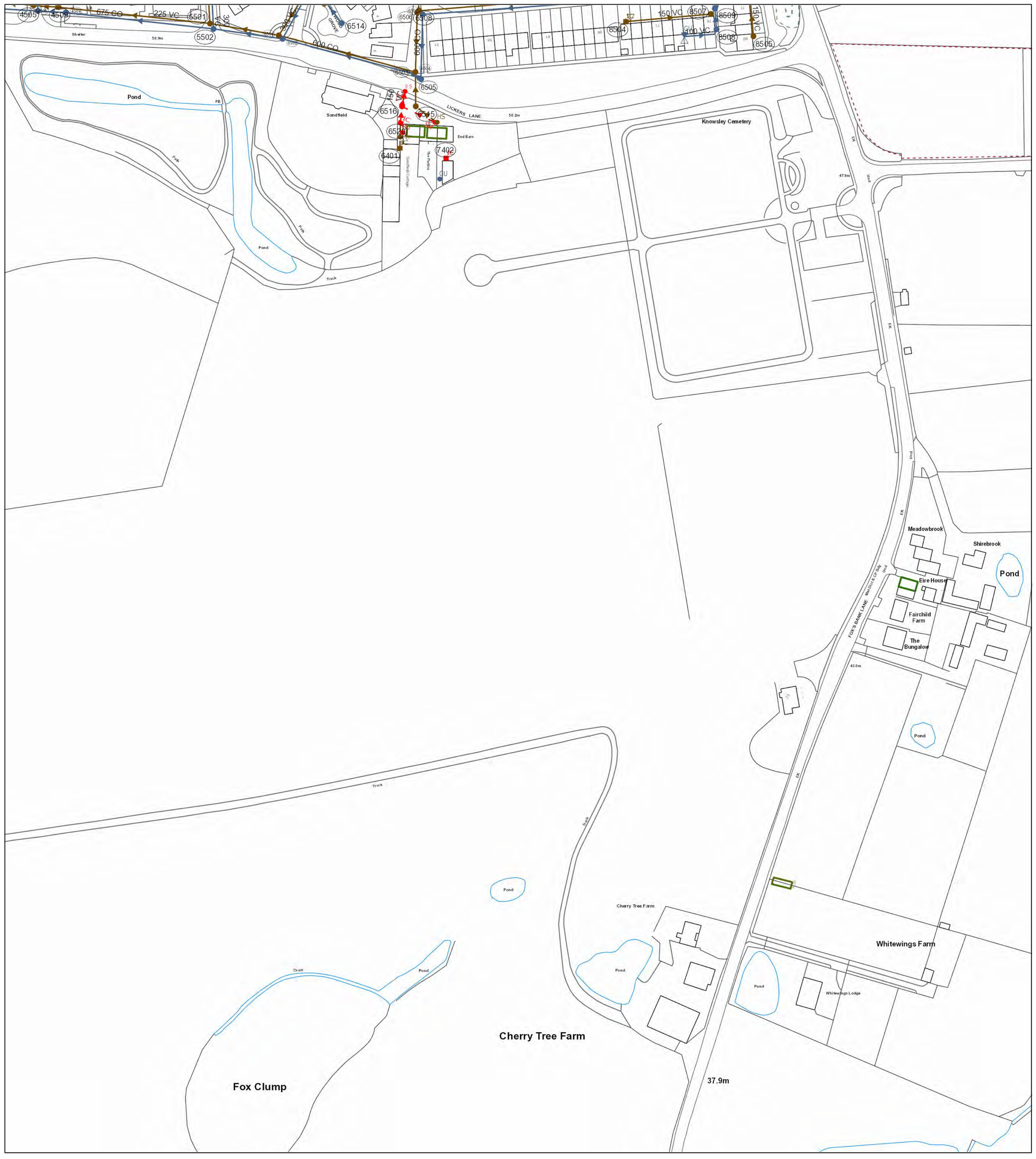

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4506	50.91	FO	45.98	225			VC	23.30016	1 in 333
4509	50.97	FO	46.07	225			VC	13.82243	1 in 173
4509	50.97	FO	46.07	225			VC	13.82243	1 in 173
4504	50.84	SW	46.61	675			CO	15.41318	
4504	50.84	SW	46.61	675			CO	15.41318	
5501	51.05	FO	46.65	225			VC	84.48077	1 in 148
5502	51.03	SW	47.04	675			CO	82.49242	1 in 196
6501	51.41	FO	46.92	225			VC	38.79349	1 in 144
6502	51.2	SW	47.38	600			CO	38.70977	1 in 125
4505	50.78	SW	0	675			CO	53.70279	
4505	50.78	SW	0	675			CO	53.70279	
8508		SW		100			VC	11.29245	
8509		SW		100			VC	1.774988	
6507	51.4	SW	50.56	600			CO	36.01389	1 in 14
6508	51.1	FO	47.55	225			VC	1.414214	
6515		FO		0			VC	19.05644	
6516		CO		150			VC	4.466681	
6505	51.09	SW	47.86	675			CO	5	1 in 8
6503	51.03	SW	47.2	600			CO	75.24828	
6506	50.59	FO	48.09	225			VC	33.01515	1 in 138
6504	51	FO	47.75	225			VC	78.47128	1 in 96
6514	51.17	SW	49.8	225			VC	16.40207	1 in 410
8505		FO		150			VC	20.33736	

Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad

LEGEND

Abandoned	Foul	Surface Water	Combined	
				Public Sewer
				Private Sewer
				Section 104
				Rising Main
				Sludge Main
				Overflow
				Water Course
				Highway Drain

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- Change of Characteristic

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CSU	Concrete Segment Unbolted
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PSC	Plastic / Steel Composite
GRC	Glass Reinforecd Plastic
DI	Ductile Iron
PVC	Polyvinyl Chloride
CI	Cast Iron
SI	Spun Iron
ST	Steel
VC	Vitrified Clay
PP	Polypropylene
PF	Pitch Fibre
MAC	Masonry, Coursed
MAR	Masonry, Random
U	Unspecified

Address or Site Reference:

Halsnead Garden Village,

OS sheet Number: SJ4790SE
Scale: 1:1250 **Date:** 25/04/2018
Nodes: 24
Sheet: 3 of 4

Printed by: Property Searches

SEWER RECORDS

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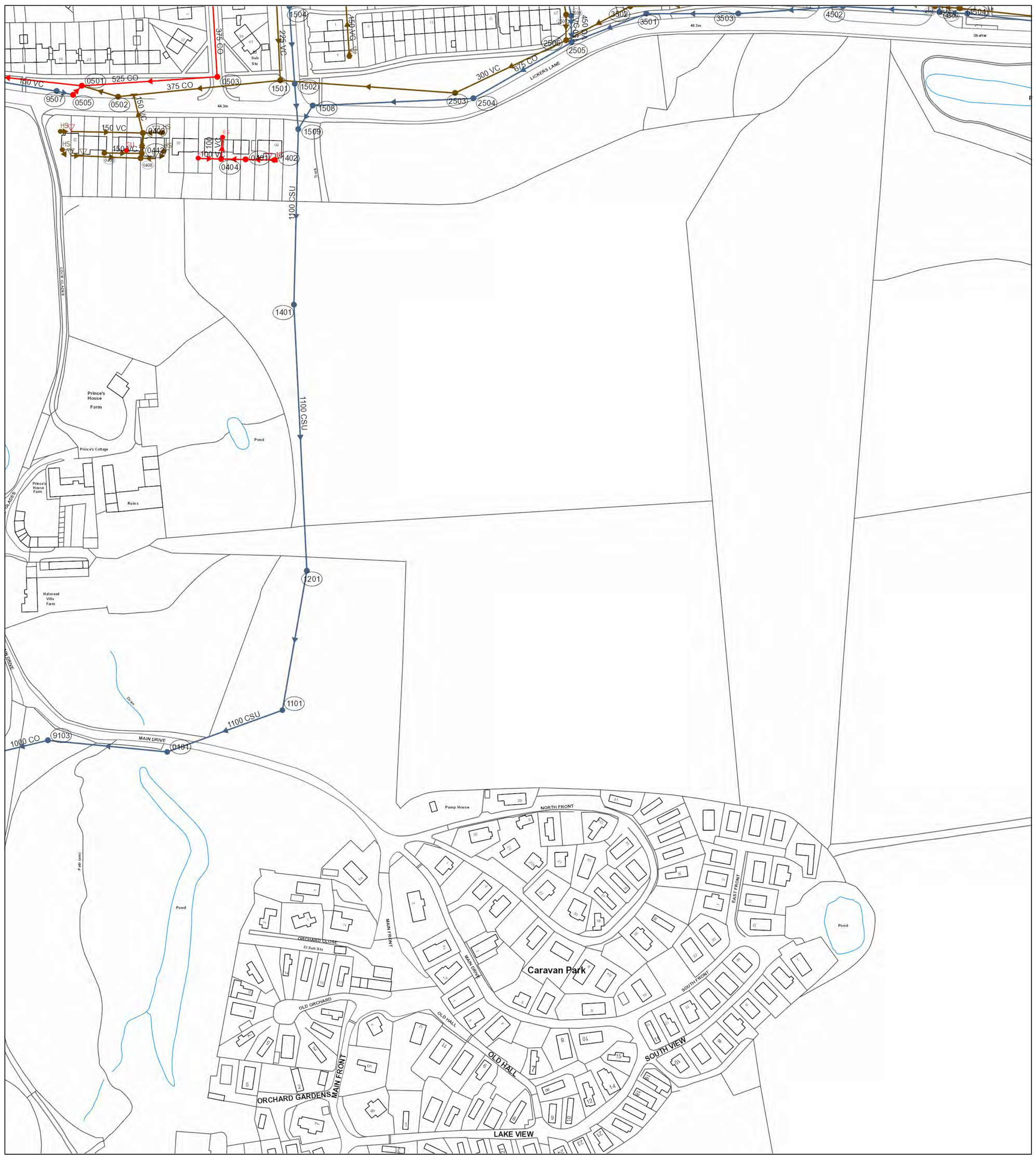

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
4506	50.91	FO	45.98	225			VC	23.30016	1 in 333
4506	50.91	FO	45.98	225			VC	23.30016	1 in 333
4509	50.97	FO	46.07	225			VC	13.82243	1 in 173
4509	50.97	FO	46.07	225			VC	13.82243	1 in 173
4504	50.84	SW	46.61	675			CO	15.41318	
4504	50.84	SW	46.61	675			CO	15.41318	
5501	51.05	FO	46.65	225			VC	84.48077	1 in 148
5502	51.03	SW	47.04	675			CO	82.49242	1 in 196
3501	47.74	SW	45.07	675			CO	44.35704	1 in 87
3502	47.84	FO	44.4	300			VC	40.21017	1 in 134
3503	49.88	SW	45.5	675			CO	51	1 in 116
4502	50.72	SW	46.21	675			CO	58.13777	1 in 81
4505	50.78	SW	0	675			CO	53.70279	
4505	50.78	SW	0	675			CO	53.70279	
2504	45.78	SW	43.36	675			CO	89.08984	1 in 97
2505	46.9	SW	44.49	675			CO	62.82774	1 in 88
2503	45.37	FO	43.62	300			VC	97.25225	1 in 133
2506	46.52	FO	44.06	300			VC	68.03989	1 in 155
1504	44.42	SW	42.42	675			CO	43.10452	1 in 78
2508	46.61	FO	44.33	150			VC	14.31339	1 in 130
2507	46.62	SW	44.9	450			VC	7.560548	
0401		CO		100			VC	13.56324	
0404		CO		100			VC	12.09138	
0408		FO		150			VC	14.39165	
0408		FO		150			VC	20.69285	
0412		FO		150			VC	11.29912	
0402		FO		150			VC	21.6728	
0502	45.46	FO	42.19	375			CO	20.88061	1 in 298
1501	44.52	FO	42.72	375			CO	90.44888	1 in 177
9507	45.88	SW	0	150			VC	9.219544	
0505		CO	0	150			VC	7.071068	
0503	44.21	CO	42.36	525			CO	75.16648	1 in 278
0501	45.86	CO	42.03	525			CO	83.48653	1 in 246
9103		SW	0	1000			CO	29.83287	
1101		SW		1100			CSU	67.97194	
0101		SW		1100			CSU	66.58523	
1201		SW		1100			CSU	78.54323	
1401		SW		1100			CSU	147.7242	
1509		SW		1100			CSU	97.39101	
1508	44.6	SW	42.44	675			CO	15.26434	
1502	44.4	SW	41.85	675			CO	25.07987	

Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad

LEGEND

Abandoned | Foul | Surface Water | Combined

- Public Sewer
- Private Sewer
- Section 104
- Rising Main
- Sludge Main
- Overflow
- Water Course
- Highway Drain

All point assets follow the standard colour convention:
red - combined, blue - surface water, brown - foul, purple - overflow

- Manhole
- Head of System
- Extent of Survey
- Rodding Eye
- Inlet
- Discharge Point
- Vortex
- Penstock
- Washout Chamber
- Valve
- Air Valve
- Non Return Valve
- Soakaway
- Gully
- Cascade
- Flow Meter
- Hatch Box
- Oil Interceptor
- Summit
- Drop Shaft
- Orifice Plate
- Side Entry Manhole
- Outfall
- Screen Chamber
- Inspection Chamber
- Bifurcation Chamber
- Lamp Hole
- T Junction / Saddle
- Catchpit
- Valve Chamber
- Vent Column
- Vortex Chamber
- Penstock Chamber
- Network Storage Tank
- Sewer Overflow
- Ww Treatment Works
- Ww Pumping Station
- Septic Tank
- Control Kiosk
- Change of Characteristic

MANHOLE FUNCTION

FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIAL

AC	Asbestos Cement
BR	Brick
PE	Polyethylene
RP	Reinforced Plastic Matrix
CO	Concrete
CSB	Concrete Segment Bolted
CSU	Concrete Segment Unbolted
CC	Concrete Box Culverted
PSC	Plastic / Steel Composite
GRC	Glass Reinforecd Plastic
DI	Ductile Iron
PVC	Polyvinyl Chloride
CI	Cast Iron
SI	Spun Iron
ST	Steel
VC	Vitrified Clay
PP	Polypropylene
PF	Pitch Fibre
MAC	Masonry, Coursed
MAR	Masonry, Random
U	Unspecified

Address or Site Reference:

Halsnead Garden Village,

OS sheet Number: SJ4790SW

Scale: 1:1250 **Date:** 25/04/2018

Nodes: 41

Sheet: 4 of 4

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SEWER RECORDS

United Utilities — helping life flow smoothly

Megan Berry

From: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Sent: 12 April 2018 12:02
To: Megan Berry
Subject: RE: Historical Sewer Flooding

Dear Sir/Madam

I can confirm that there are no recorded historical sewer flooding issues within the vicinity of the proposed development site, however we have a record of flooding incidents in the surrounding area.

Please note that United Utilities Water plc (UUW) can only record and check flooding events which are reported to us and we have to comply with our Regulators instructions on the qualification of flooding events to place on the 'at risk' register.

Also, this does not include any sewer flooding events caused by blockages or collapses which are the result of third party actions, natural events or other actions over which UUW has no control and not a facet of sewer capacity.

Should you require any further information please do not hesitate to contact me.

Thanks sue

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for outstanding customer service...
If you have received a great service today why not tell us?
Visit: unitedutilities.com/wow

Sue King
Developer Services Assistant
Developer Services and Planning
Operations Services
United Utilities
T: 01925 679413 (internal 79413)
unitedutilities.com

Please note that as from the 1 April 2018 the fee for the administration of a Building Over Agreement will be £172.00 (this fee is none vatable) http://www.unitedutilities.com/build-over-sewer.aspx).

Please send postal applications to the following address:

Wastewater Developer Services and Planning, 1st Floor Windermere House, Lingley Mere Business Park, Lingley Green Ave, Great Sankey, Warrington WA5 3LP

Any applications sent to Gatewarth Industrial Estate will result in delays in your application.

From: Megan Berry [mailto:meganberry@betts-associates.co.uk]
Sent: 11 April 2018 16:43
To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: Historical Sewer Flooding

F.A.O Flood Risk, Drainage and/or Planning department

Please forward to the correct department/ office

To whom it may concern,

Land off Fox's Bank Ln, Whiston, Prescot

Please could you confirm whether you have any information that you feel would be valuable to a Flood Risk Assessment and Drainage Management Strategy for the site above (see location plan attached), including details of historical flooding and any predicted flood water levels; this would be greatly appreciated. If there are any specific requirements that you require in a scope of works for this site please can you advise at this stage so that it can be fully incorporated into the proposals at an early stage.

Please do not hesitate to contact me on the details below to discuss further should you require additional information or clarification.

Kind Regards

Megan Berry BSc(Hons)
Graduate Flood Risk Analyst

BETTS HYDRO
Specialists in Drainage and Flood Risk
Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire, CH5 2LY

CHESTER OFFICE - 01244 289041

meganberry@betts-associates.co.uk
www.betts-associates.co.uk

CIVIL | STRUCTURAL | GEO-ENVIRONMENTAL | HYDROLOGY | FLOOD RISK MANAGEMENT
SUDS | STRUCTURAL SURVEYS | PARTY WALL DUTIES | INFILTRATION | GEO-TECHNICAL

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APPENDIX D: LPA/LLFA CORRESPONDENCE

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Megan Berry

From: Megan Berry
Sent: 11 April 2018 16:40
To: 'planning@knowsley.gov.uk'; 'LLFA@knowsley.gov.uk'
Subject: Flood Risk, Drainage and/or Planning department - Historical Flooding
Attachments: LOCATION PLAN.pdf

F.A.O Flood Risk, Drainage and/or Planning department

Please forward to the correct department/ office

To whom it may concern,

Land off Fox's Bank Ln, Whiston, Prescot

Please could you confirm whether you have any information that you feel would be valuable to a Flood Risk Assessment and Drainage Management Strategy for the site above (see location plan attached), including details of historical flooding and any predicted flood water levels; this would be greatly appreciated. If there are any specific requirements that you require in a scope of works for this site please can you advise at this stage so that it can be fully incorporated into the proposals at an early stage.

Please do not hesitate to contact me on the details below to discuss further should you require additional information or clarification.

Kind Regards

Megan Berry BSc(Hons)
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BETTS HYDRO
Specialists in Drainage and Flood Risk
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CHESTER OFFICE - 01244 289041

meganberry@betts-associates.co.uk
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SUDS | STRUCTURAL SURVEYS | PARTY WALL DUTIES | INFILTRATION | GEO-TECHNICAL

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Sustainable Drainage & Surface Water Management

Technical Guidance for Developers

The Lead Local Flood Authority (LLFA) advises that you first check with the Local Planning Authority that your development proposal is acceptable in principle and on a policy basis.

This advice is based on the current extent of the knowledge of the LLFA and the information available at that time. Therefore our comments are without prejudice.

1. The Role of the Lead Local Flood Authority (LLFA)

The Flood and Water Management Act (FWMA) 2010 introduces a range of new powers, duties and responsibilities and makes Knowsley Council a Lead Local Flood Authority (LLFA). The Flood and Water Management Act 2010 sets out the requirement for LLFAs to manage 'local' flood risk within their area. 'Local' flood risk refers to the flood risk from surface water, groundwater and/or from ordinary watercourses.

The LLFA is a statutory consultee for all major development proposals which have surface water drainage implications in any flood zone. As a statutory consultee the LLFA has a legal obligation to provide the local planning authority with an informed substantive response to applications on which they are statutorily consulted on.

The submission of an acceptable amount and quality of information is fundamental for the LLFA to carry out its statutory duties and also if the local planning authority is to make an informed decision when determining whether your drainage proposals are acceptable in principle and in planning terms. It is in this capacity that this guidance note has been produced.

2. Flood Risk Assessment (FRA)

2.1 Do I need a Flood Risk Assessment?

A site-specific flood risk assessment (FRA) may be required for your development proposal as detailed under Footnote 20 of Paragraph 103 of the National Planning Policy Framework.

A site-specific FRA is required if your development is:

- in Flood Zone 2 or 3 including minor development and change of use
- greater than 1 hectare (ha) in flood zone 1
- less than 1 ha in Flood Zone 1, including a change of use in development type to a more vulnerable class (e.g. from commercial to residential), where they could be affected by sources of flooding other than rivers and the sea (e.g. surface water drains, reservoirs)
- in an area within Flood Zone 1 which has critical drainage problems as notified by the Environment Agency

If your development proposal meets any of these criteria, there are no exemptions to a site-specific FRA and you must submit one in order for your planning application to be validated by the Local Planning Authority.

If your development proposal is less than 1 ha in Flood Zone 1 but is at risk of sources of flooding other than rivers and the sea, for example surface water and groundwater flood risk, the LLFA or Local Planning Authority may request for a site-specific FRA to be carried out in accordance with Footnote 20 of Paragraph 103 of the National Planning Policy Framework to determine the flood risk to and from the development proposal in order to be able to make an informed decision about that risk.

2.2 What information should be contained within the FRA?

A site-specific FRA must assess the risks of river and watercourses (fluvial), sea (tidal), surface water, groundwater, and all other sources of flooding. Once the risks have been assessed appropriate mitigation measures should be identified to reduce or manage the risk, both on-site and elsewhere, to an acceptable level.

The detail and technical complexity of any FRA will reflect the scale, nature and location of your development proposal. Guidance on what information your FRA needs to include is contained within 'Flood risk assessment for planning applications' and the Planning Practice Guidance. Reference should also be made to the Knowsley MBC's Strategic Flood Risk Assessment (SFRA) Level 2 for locally specific guidance and information.

It should be noted than an appropriate level of detail and quality of information is needed if the local planning authority and relevant consultees are able to make an informed decision about the risk of flooding to and from the development proposal. All planning applications must be accompanied by an appropriate drainage strategy, more information on which can be found in Section 3.2 of this guidance.

In summary a minimum of the following key information is needed within a site-specific FRA for development proposals:

- **a)** A location plan that includes geographical features, street names and identifies the catchment, watercourses or other bodies of water in the vicinity.
- **b)** A plan of the site showing existing development proposals, identification of any structures (e.g. embankments) which may influence local overland flow or any watercourses / culvert present on the site.
- **c)** Site levels of both existing and proposed. Reference to Ordnance Datum, may be required where details of context of the site to its surroundings is needed. Site contours should be referenced at intervals appropriate to the site topography.
- **d)** Details of the existing surface water drainage arrangements on site (if any) and the receptor e.g. soakaway, sewer, canal, watercourse etc.
- **e)** Proposals for surface water management that aims to not increase, and where practicable reduce the rate of surface water runoff from the site as a result of the development.
- **f)** Information about the surface water disposal measures already in place and estimates of the rates of run-off generated by the surfaces being drained.
- **g)** An assessment of the volume of surface water run-off likely to be generated from the proposed development and confirmation of how any excess volumes would be retained within the development.
- **h)** Information on how the proposed drainage design will perform under the increased frequency and intensity of rainfall that is predicted as a result of climate change. For more information refer to the 'Flood risk assessments: climate change allowances' webpage.
- **i)** Information about other potential sources of flooding, if any, that may affect the site e.g. streams, surface water run-off, sewers, groundwater, reservoirs, canals and other artificial sources or any combination of these; including details on how these sources of flooding will be managed safely within the development proposal.

It should be noted that the above list is not exhaustive but provides a framework for the site-specific FRA to be prepared.

2.3 What if I don't need to submit a Flood Risk Assessment?

You don't need to do a flood risk assessment for a development that's less than 1 ha in Flood Zone 1 unless it is at risk of sources of flooding other than rivers and the sea, for example surface water and groundwater flood risk. Therefore there may be some circumstances where the LLFA or Local Planning Authority requests for a site-specific FRA outside of those listed above in accordance with Footnote 20 of Paragraph 103 of the National Planning Policy Framework.

For developments less than 1 ha in Flood Zone 1 a FRA will not be required but a drainage strategy must be provided proportional to the scale of the development and follow the same design principles with regards to the calculating the maximum design flow rates for the site.

3. Sustainable Drainage Systems (SuDS)

3.1 What is the planning framework for surface water drainage?

Policies, guidance and standards for sustainable drainage have recently been introduced into the planning framework:

- Paragraph 103 of the National Planning Policy Framework (NPPF)
- Written Statement on Sustainable Drainage Systems (HCWS161)
- DEFRA Technical Standards for Sustainable Drainage Systems
- Planning Practice Guidance
- Relevant Adopted Knowsley Local Planning Policies

Applicants are advised to design the drainage system to comply with all parts of this framework to avoid delays and to minimise amendments to proposals.

3.2 What information do I need to provide?

All planning applications **must** be accompanied by an appropriate drainage strategy encompassing the detail set out in Appendix A as a minimum.

- For Outline applications an Indicative Drainage Strategy will be required.
- For Full and Reserved Matters applications a Detailed Drainage Strategy will be required.

It should be noted that the requirement to provide the appropriate drainage strategy is independent of the requirement for a site-specific FRA.

3.3 How can I demonstrate that I have satisfied the planning framework?

In order to manage flood risk all development, regardless of development type, flood zone and development size, must give priority use to SuDS as required under Paragraph 103 of the NPPF. Particularly for major developments, there is a requirement to assess and include SuDS for managing surface water at the development unless it is demonstrated during the assessment that it is inappropriate for the site.

In order to satisfy the NPPF and its accompanying PPG, applicants must demonstrate that priority has been given to the use of sustainable drainage systems (SuDS) in their development proposals. SuDS should be provided by default unless demonstrated to be inappropriate. Where priority use of SuDS cannot be achieved, applicants must justify this by submitting robust and acceptable evidence.

Applicants can do this by presenting an explanation, supported by acceptable evidence, as to the parameters used to inform their proposed SuDS design. SuDS, including any proposed discharge rate(s), should be designed in line with the Non-Statutory Technical Standards for Sustainable Drainage Systems.

Applicants must also state their intended surface water discharge point with evidence that this discharge point is acceptable. It should be noted that the discharge point for surface water should follow the hierarchy set out in Paragraph 80 of Section 10 of the Planning Practice Guidance. Again, where preferential discharge points set out in the hierarchy cannot be achieved applicants must provide a robust justification, with acceptable evidence, as to why.

Applicants may also submit a narrative in support of their application explaining how the development proposal meets national and local planning policies (stating relevant policies) and guidance in relation to sustainable drainage, management of surface water flood risk and climate change.

Appendix A details what information needs to be submitted with your planning application and the level of information needed is dependent on application type. It should be noted than an appropriate level of detail and quality of information is needed if the local planning authority and relevant consultees are able to make an informed decision about the risk of flooding to and from the development proposal.

The proposed drainage system is to be designed using 'Micro Drainage' or similar approved. A disc containing the input data and the output must be submitted with each surface water drainage scheme for the approval of the LLFA.

3.4 What Climate Change Allowances should be used for Surface Water Drainage Proposals?

The appropriate climate change allowance must also be incorporated into any SuDS design so that the SuDS takes account of the likely impacts of climate change and anticipated changes in impermeable area within the development so it continues to provide effective drainage. This is to ensure that the development proposal can be appropriately flood resilient and resistant for its lifetime, direction on which is set out in Paragraph 26 of Section 10 of the Planning Practice Guidance.

The lifetime of a residential development should be considered for a minimum of 100 years in accordance with Paragraph 26 of Section 10 of the Planning Practice Guidance unless there is specific justification for considering a shorter period, such as a time limiting condition.

'Flood Risk Assessments: Climate Change Allowances' updated advice was produced by the Environment Agency and came into immediate effect on 19th April 2016. The LLFA, in its role as a statutory consultee, will use these allowances when providing advice on surface water flood risk in relation to drainage proposals, flood risk assessments and strategic flood risk assessments and this guidance note sets out how this advice is to be applied.

The LLFA expects applicants to assess the design of a surface water sustainable drainage system in accordance with 'Table 2 Peak Rainfall Intensity Allowance in Small and Urban Catchments'. This table, set out below, shows anticipated changes in extreme rainfall intensity in small and urban catchments.

Applies across all of England	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	10%	20%	40%
Central	5%	10%	20%

Surface water drainage proposals, flood risk assessments and strategic flood risk assessments must assess both the 'Central' and 'Upper End' allowances to understand the range of impact. There is significant uncertainty surrounding future peak rainfall events and hence the purpose of assessing a range of peak rainfall allowances is, under different scenarios:

i. to understand the performance of a proposed surface water sustainable drainage system, and;
ii. to assess flood risk management proposals and the range of risk.

Ultimately this is a more robust approach than providing a single figure. This is because UKCP09 does not provide a full representation of changes to extreme, convective rainfall at the scales needed to manage surface water flooding.

How should these allowances be assessed?

In accordance with the Environment Agency's guidance, the range between 'Central' and 'Upper End' allowances must be assessed to understand the range of impact. Knowsley Council recommends the use of the four stage approach to determine what level of allowance should be incorporate into your surface water drainage design.

STAGE 1: Establish lifetime of the development

To establish the correct range of allowances to assess, first you must start by confirming the expected lifetime of the development.

STAGE 2: Assess the appropriate range of allowances

The range of allowance can then be assessed by running the drainage design model with different climate change allowances at the intervals set out in the table below:

Epoch	'2020s' (2015 to 2039)	'2050s' (2040 to 2069)	'2080s' (2070 to 2115)
Scenarios to Assess	5% and 10%	10%, 15% and 20%	20%, 30% and 40%

The 'Central' estimate is to be used for design purposes to understand the impact on surface water drainage networks (i.e. assessing the performance of the drainage system to check the system can cope with the critical duration design rainfall event).

The range of scenarios from 'Upper End' to 'Central' should be used to examine the potential flood risk implications in the critical duration design rainfall event. For example, is surface water wholly contained on site? Is there an increased flood risk to third parties? Is flood hazard within acceptable tolerances?

STAGE 3: Determine which allowance is to be applied

The minimum allowance to be applied is the 'Central' allowance provided it can be demonstrated, through evidence, that the flood risk is no worse at the 'Upper End' scenario than it is during the 'Central' scenario, and that flood water can be managed safely for the range of scenarios between 'Central' and 'Upper End' for the development's lifetime. If this cannot be demonstrated then the applicant must apply to 'Upper End' allowance.

This approach **must** be evidence based, justified and supported by an appropriate hydraulic output e.g. MicroDrainage. A disc containing the input data and the output must be submitted with each surface water drainage proposal.

STAGE 4: Incorporate mitigation measures

If the hydraulic output shows that the proposed sustainable drainage system will 'Flood' then the application must identify clear and appropriate exceedance routes, taking account of the flood risk vulnerability of the development and ensuring the development can be made safe during a design flood for the lifetime of the development.

It may also be appropriate to consider the use of flood resilience and flood resistance measures in the design of the development should the calculated surface water flood depth, either in isolation or in combination with other flood sources, present a flood risk.

3.5 SuDS Funding, Maintenance & Access

The local planning authority will look to ascertain that the minimum standards of operation of the SuDS are appropriate and ensure, through the use of planning conditions or planning obligations, that there are clear and confirmed arrangements in place for the ongoing funding and maintenance of all elements of the SuDS, both surface and subsurface components, over the lifetime of the development. This should include, where applicable, details of access for future maintenance works allowing for any personnel, vehicle or machinery access required to undertake this work.

SuDS should be designed to ensure that the maintenance and operation requirements are economically proportionate, and this should be considered by reference to the costs that would be incurred by consumers for the use of an effective drainage system connecting directly to a public sewer.

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APPENDIX E: LOCATION PLAN

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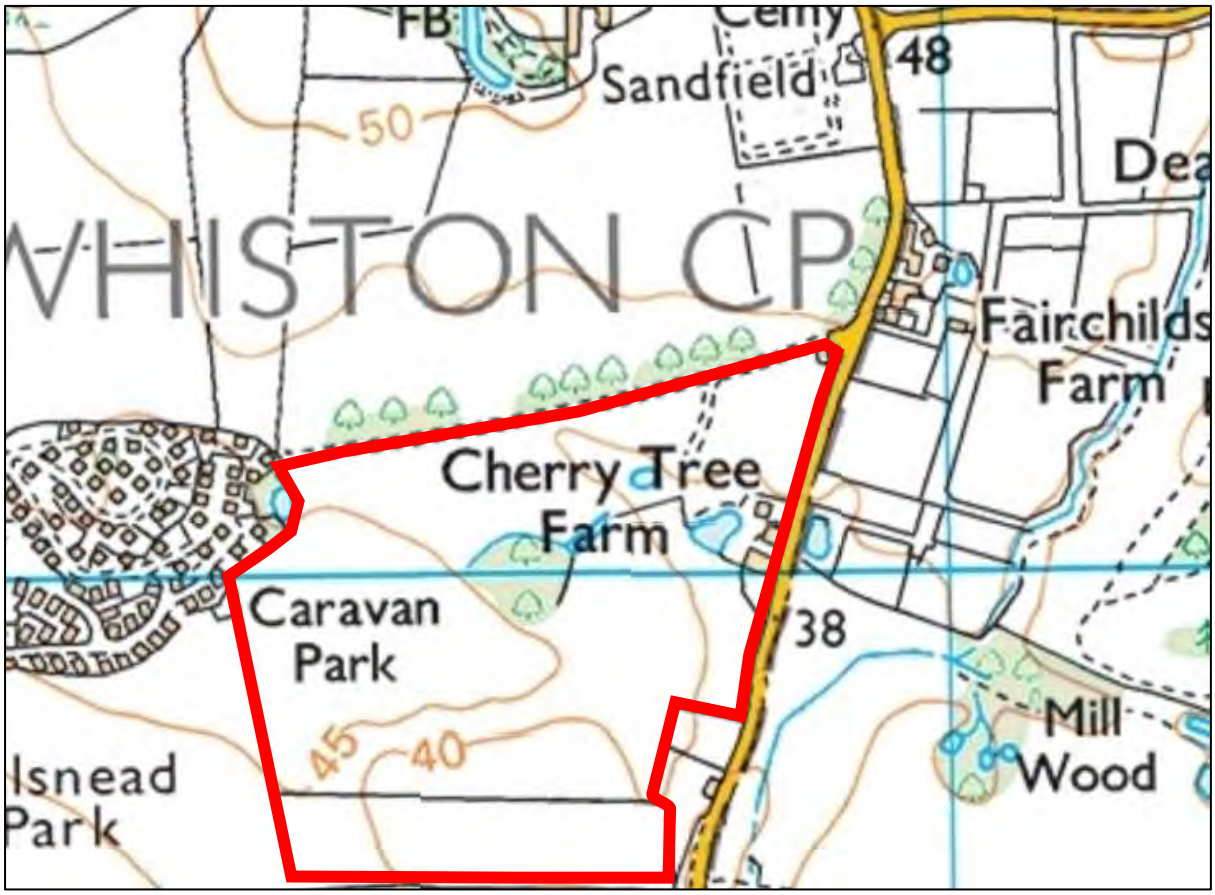
LOCATION PLAN

Fox's Bank Ln, Whiston, Prescot



OS X (Eastings)	347671
OS Y (Northings)	389955
Nearest Post Code	L35 3RA
Lat (WGS84)	N53:24:14 (53.403807)
Long (WGS84)	W2:47:19 (-2.788558)
Lat,Long	53.403807,-2.788558
Nat Grid	SJ476899 / SJ4767189955
mX	-310420
mY	7023713

APPENDIX F: TOPOGRAPHIC SURVEY

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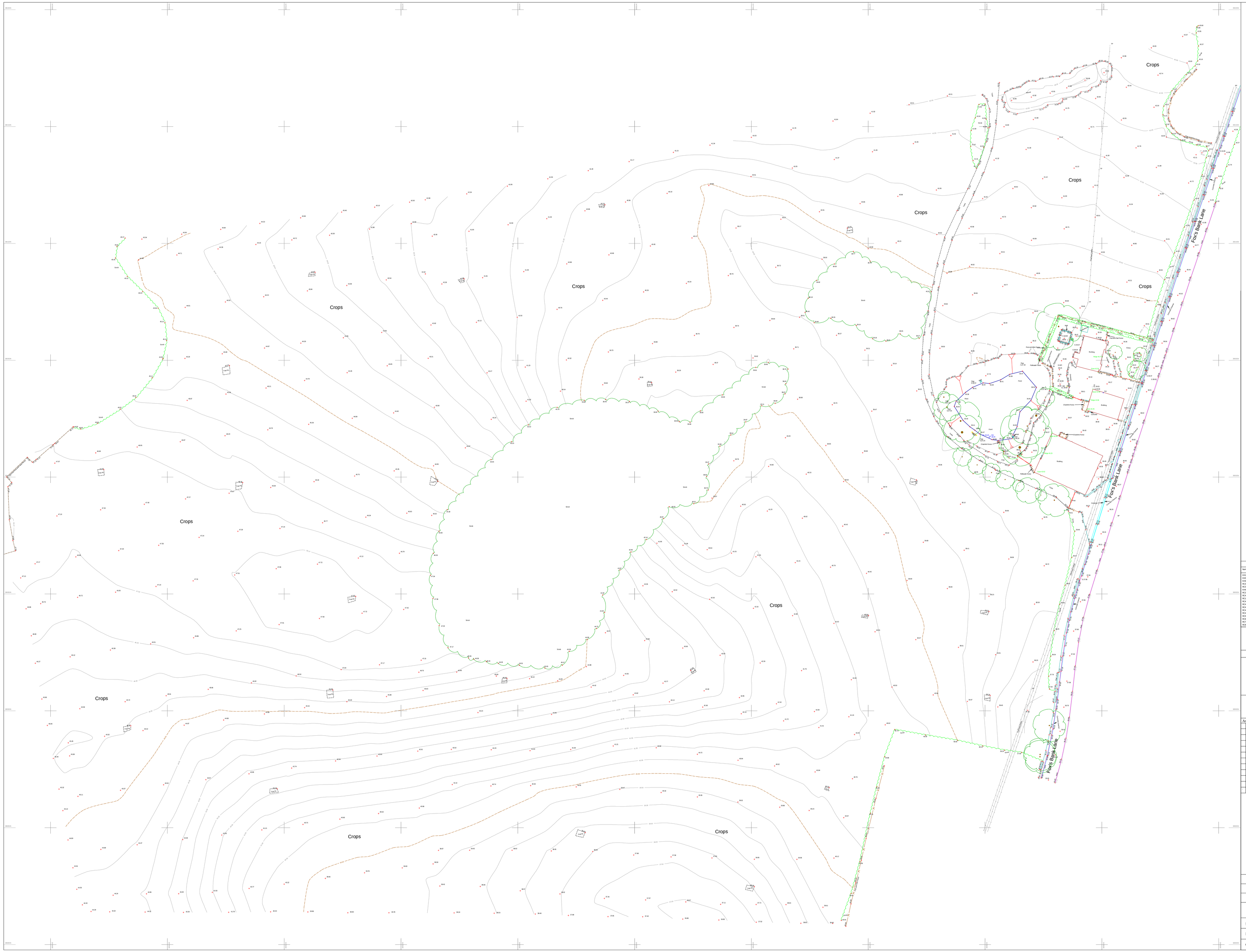


Members of

Legend

AV	Air valve
BH	Borehole
BOL	Bollard
BT	British Telecom cover
CATV	Cable television cover
CL	Cover level
DPC	Damp-proof coarsing level
EarthER	Earthing rod
ELEC	Electric cover
EP	Electricity pole
Fence I/R	Iron railing fence
Fence C/B	Concrete block fence
Fence C/P&P	Concrete post & panel fence
Fence Pa	Palisade fence
Fence P/W	Post and wire fence
Fence P/R	Post and rail fence
Fence P/P	Post and panel fence
FFL	Finished floor level
F/B	Flower bed
FH	Fire Hydrant
G	Gulley
GAS	Gas cover
IC	Inspection chamber
IL	Invert level
INV	Invert level
LP	Lamp post
LT	Light
MH	Manhole
Nynex	Telecommunications cover
OSBM	Ordnance Survey Bench Mark
PTM	Parking ticket machine
RE	Rodding eye
RS	Road sign
Rt wall	Retaining wall
SBX	Switch box
SP	Sign post
SPS	Safety playing surface
ST	Stop tap
SV	Service valve
TBM	Temporary Bench Mark
TP	Telegraph pole
TRP	Trial pit
TRL	Traffic light
W	Water cover
WL	Water level
WO	Wash out

SURVEY STATIONS

Name	Easting	Northing	Height
FH1	347705.467	389610.783	42.405
FH2	347707.127	389611.967	42.405
IN40	347934.129	389613.867	47.030
RC1	347646.238	389885.955	39.180
RC2A	347621.484	390207.442	43.671
IN44	347661.471	389897.287	42.407
IN45	347662.485	389896.287	42.407
RC4	347614.566	390003.846	39.626
RC1	347628.909	389864.501	39.148
RC3A	347631.243	389913.348	39.036
RC6A	347664.877	390041.469	39.396
RC8C	347663.897	390041.465	39.396
RC4D	347662.773	390056.726	39.336
RC4E	347634.917	390063.235	39.427
RC5	347616.488	390124.151	39.125
RC6	347715.488	390024.151	39.125
RC7	347784.992	390000.984	39.548
RC9	347738.987	390000.973	40.012

KEY DIMENSIONS SHOULD BE CHECKED ON SITE BEFORE COMMENCEMENT OF ANY WORKS

NOTE

Grid and Levels
Related to OS
Via Active GPS Network

Amendments

	Date	Surveyor	Description of work

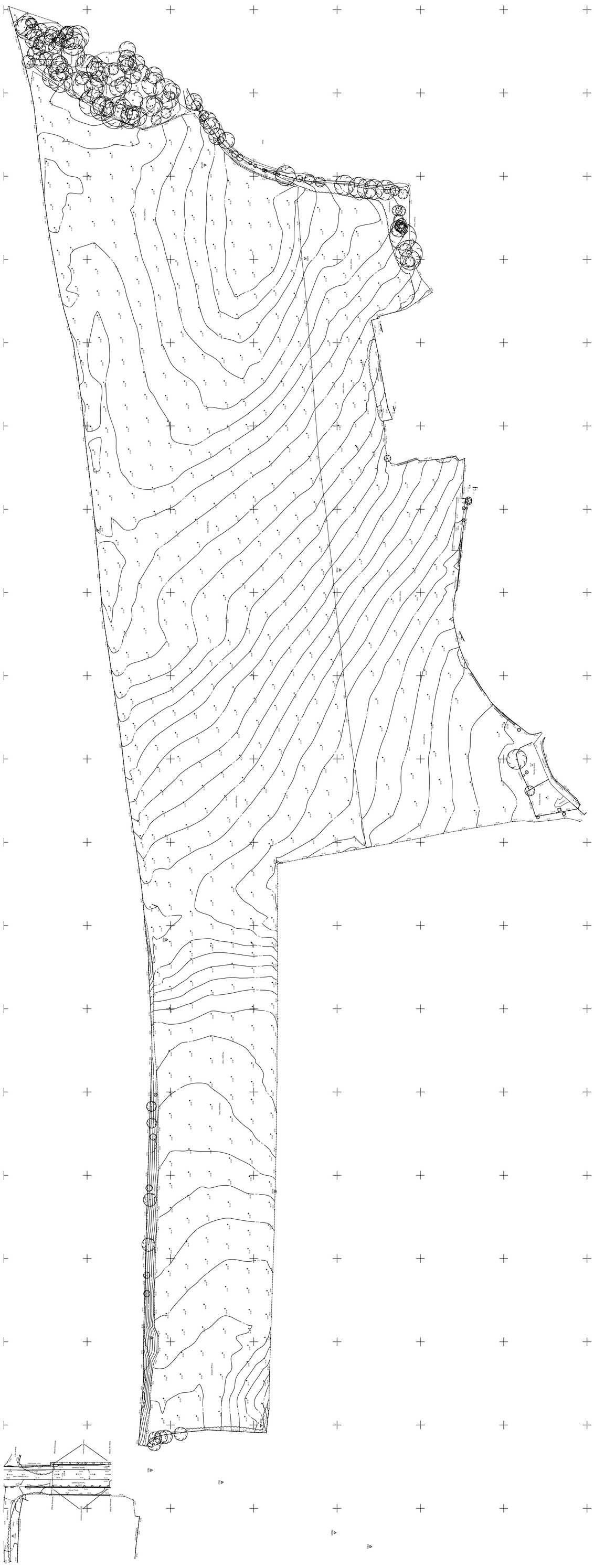
Powers & Tiltman Ltd
Land Surveyors

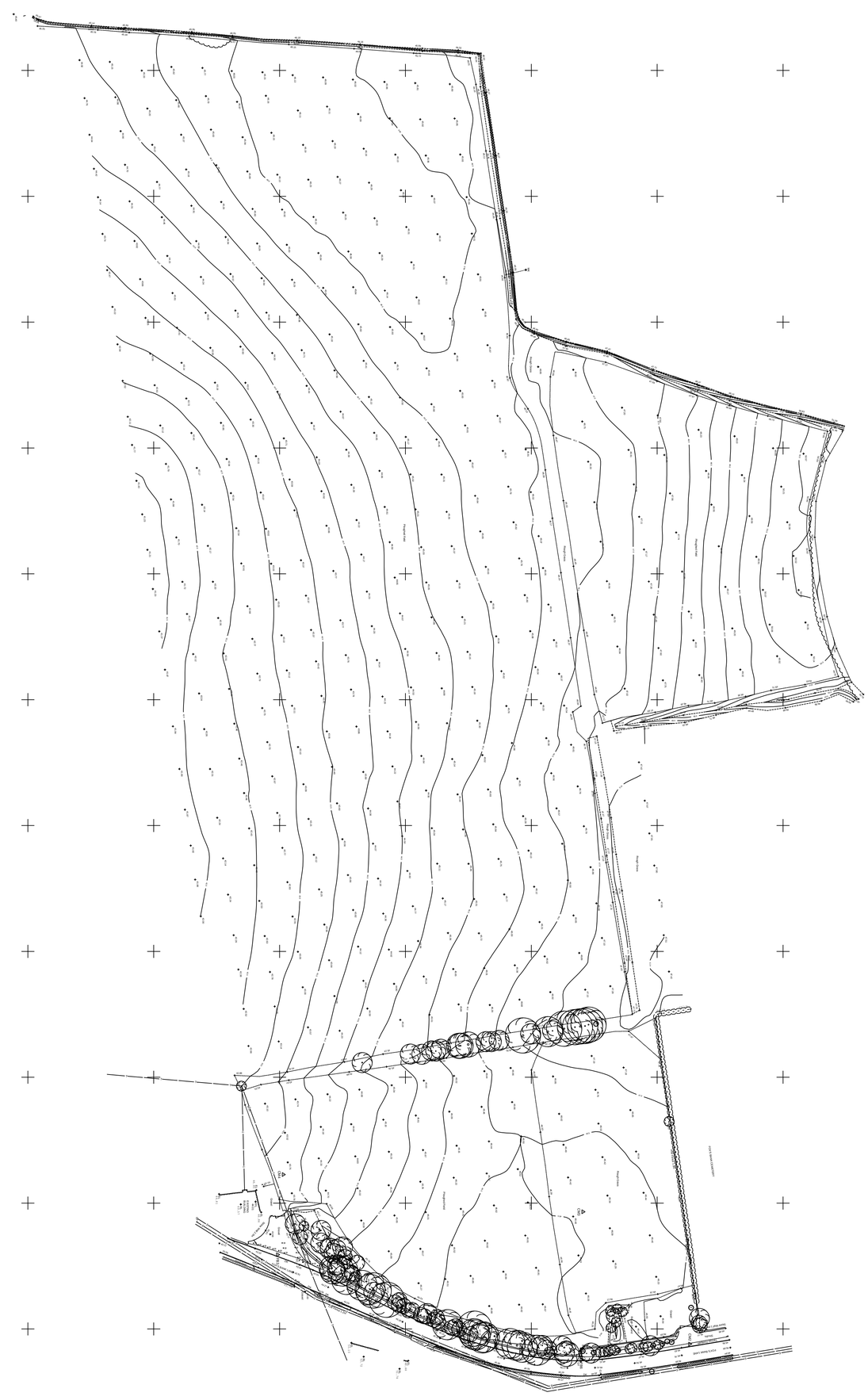
Meridian House
58/60 Hillside Road, Frodsham, Cheshire WA6 6AG
Tel: 01928 734473 Fax: 01928 735573
Email: mail@powersttilman.co.uk
www.powersttilman.co.uk

Land off Fox's Bank Lane
Whiston
Topographical Survey

Client : Land 4 Homes

Surveyed By : JL/RM	Date : 28/09/17	A0 @
Drawn By : RM	Drawing No : 7928/01	1:500
Checked By : DG	Amendment :	





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APPENDIX G: PROPOSED PLANNING LAYOUT

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Revisions

Rev	Description	Date	Initial
A	Updated schedule of accommodation.	18/06/19	NS

Taylor Wimpey

Taylor Wimpey North West
Washington House, Birchwood Park,
Warrington, Cheshire WA3 6GR
Tel 01925 849 500 Fax 01925 849 501
www.taylorwimpey.com

DRAWING TITLE:

FOX WOOD

GARDEN VILLAGE

PLANNING LAYOUT

A0@250

DRAWING STATUS

DWG SCALE	DATE	DRAWN	CHECKED BY
1:1000 @ A1	15/02/19	NB	NB

DRAWING NUMBER

SITE CODE	DRAWING CODE	DRAWING NO	REVISION
LPE	PLA	01	

APPENDIX H: PFRA/SFRA PLANNING EXTRACTS

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4. FLOOD RISK IN THE PAST

The PFRA requires significant historic flood events to be recorded and reported to Europe through this report. There has been no formal guidance on what 'significant' means in terms of historic local flooding; Defra has left it to LLFAs to determine their own definition. For the recording of past local flood risk, the "indicative flood risk" criteria of 200 people in a 1km grid square was reduced to 20 people (or approximately 8 houses) in a 1km grid. To ensure a consistent Merseyside approach, this method for establishing past local flood risk was discussed at the Merseyside Drainage Group meeting on 17th January 2011 and on 21st February 2011 adopted across the region as the accepted way forward.

Figure 4-1: Spatial Distribution of Past Surface Water Flood Locations.

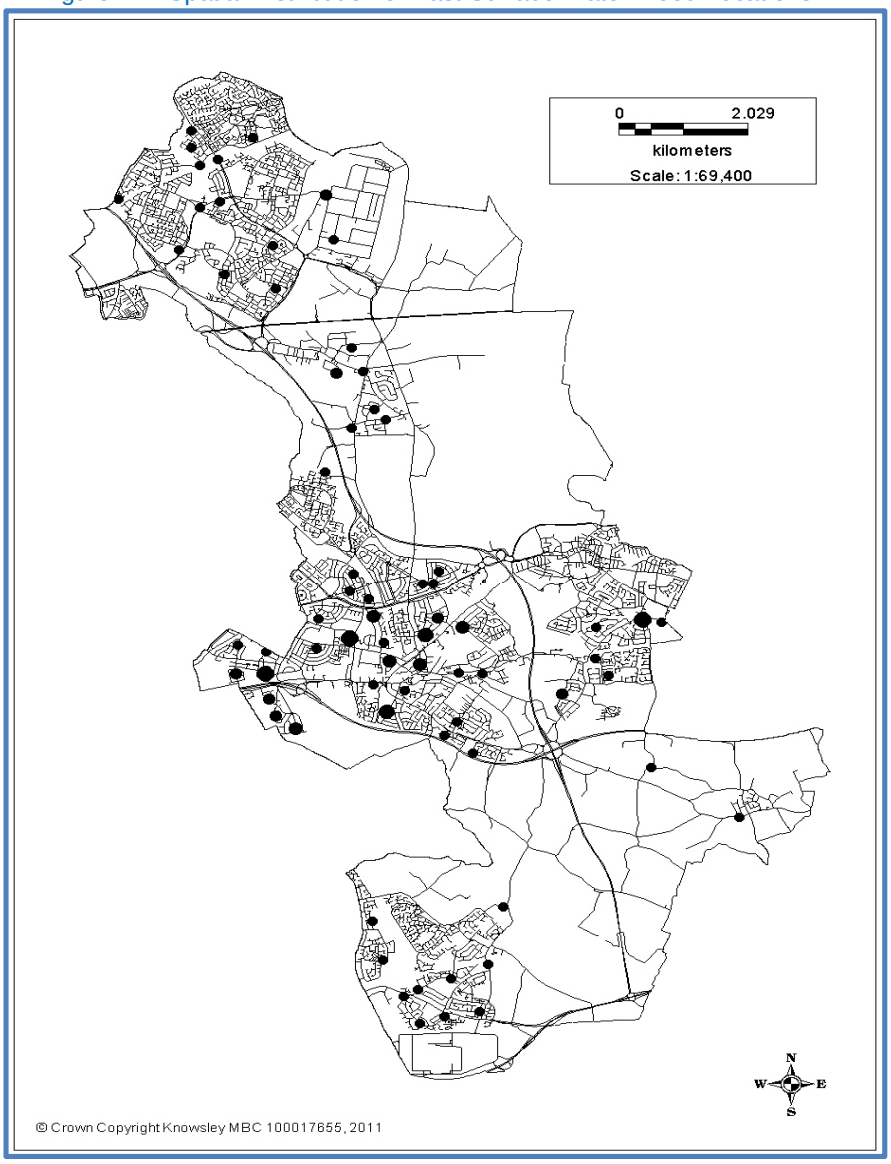
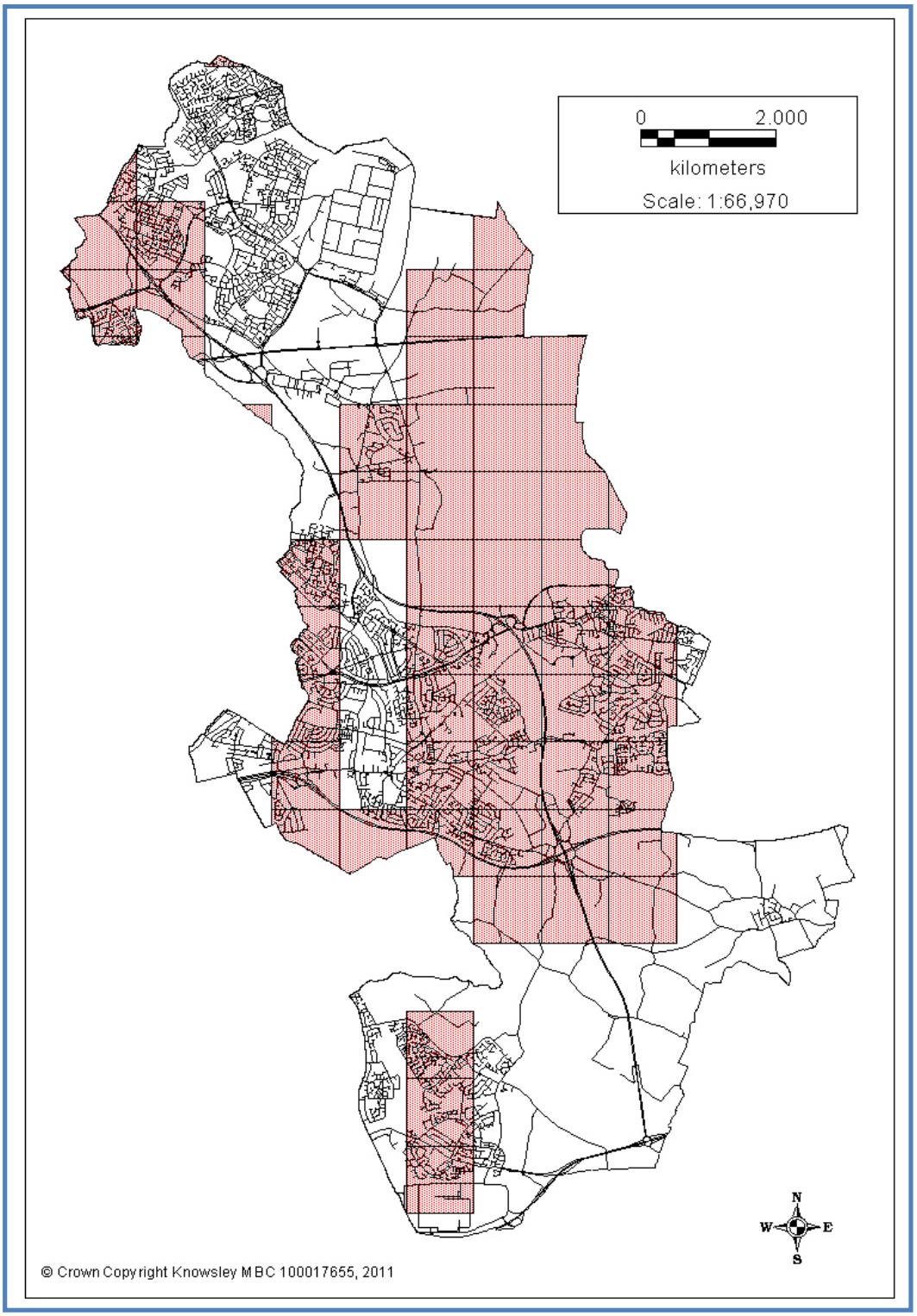
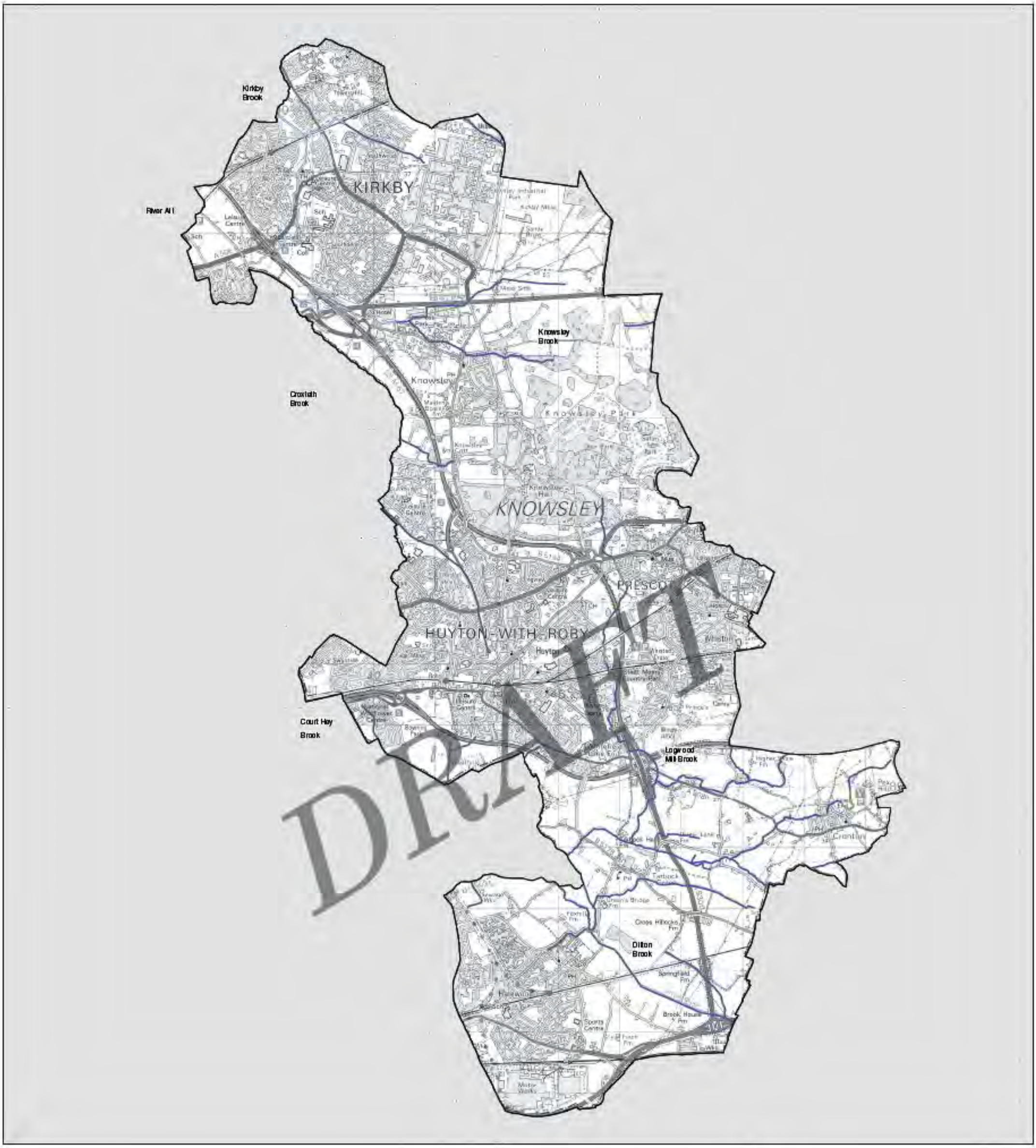


Figure 5-1 – Areas Susceptible to Ground Water Flooding





Legend:

- Knowsley Boundary
- Water Bodies
- River Centrelines
- Canals
- Culverts

SCALE: NTS

Crown © Copyright, Knowsley MBC 100017655

Project Title:

Knowsley and Sefton Strategic Flood Risk Assessment

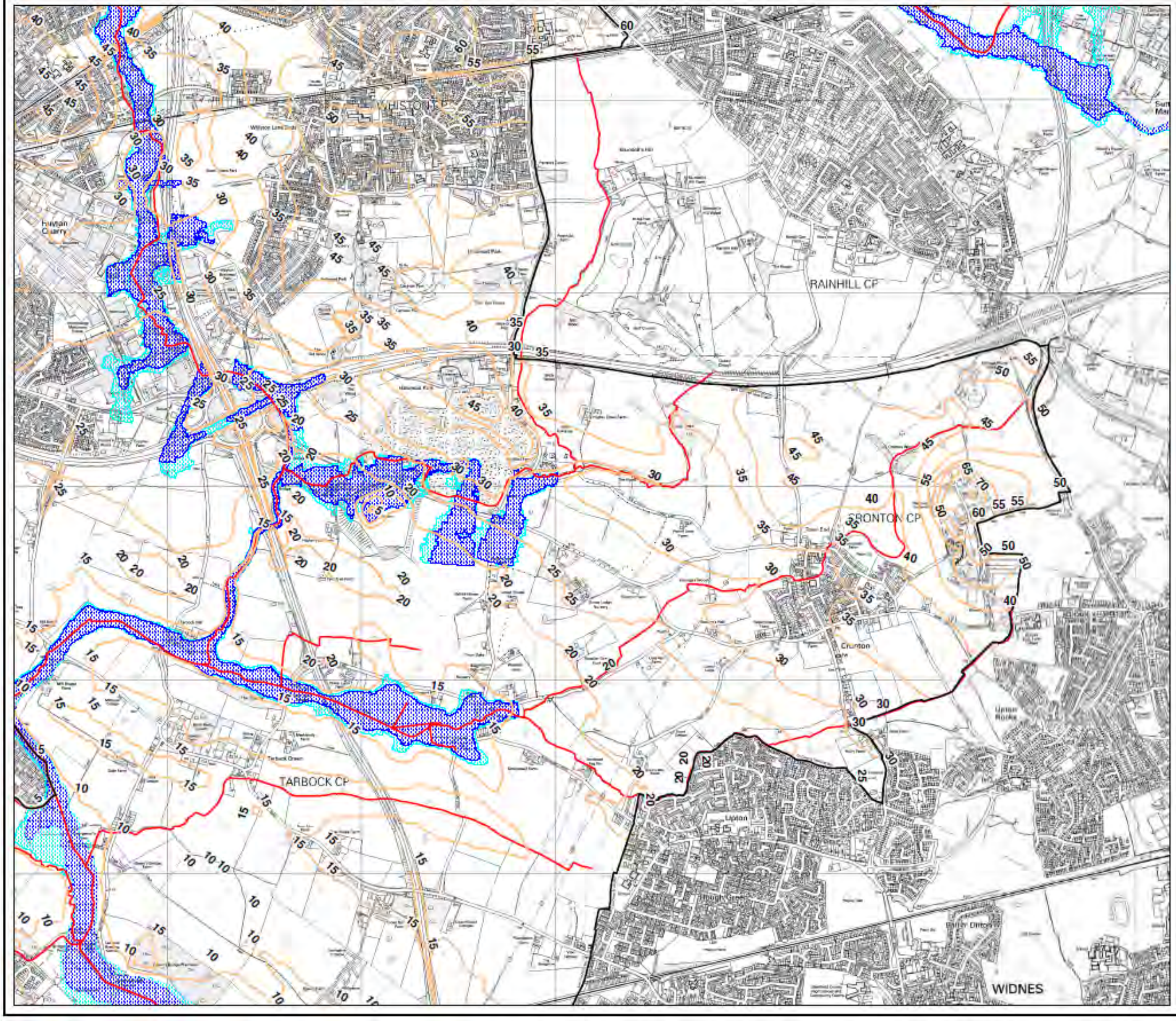
Figure Title:

Watercourses in the Borough Areas Knowsley

Document Ref:	Figure Ref:
5074164/62/DG/002	A1

Knowsley Council

ATKINS



Legend:

- Knowsley Boundary
- Watercourse
- Contour Lines
- Fluvial Flood Map 3
- Fluvial Flood Map 2
- Tidal Flood Map 3
- Tidal Flood Map 2
- Flood Warning Area (None located in Knowsley)

SCALE: NTS

Project Title:

Knowsley and Sefton Strategic Flood Risk Assessment

Figure Title:

Environment Agency Published Flood Maps with contours and flood warning areas Knowsley 6

Document Reference: **5074164/62/DG/002**

Figure Number: **B1-7**

Knowsley Council

ATKINS

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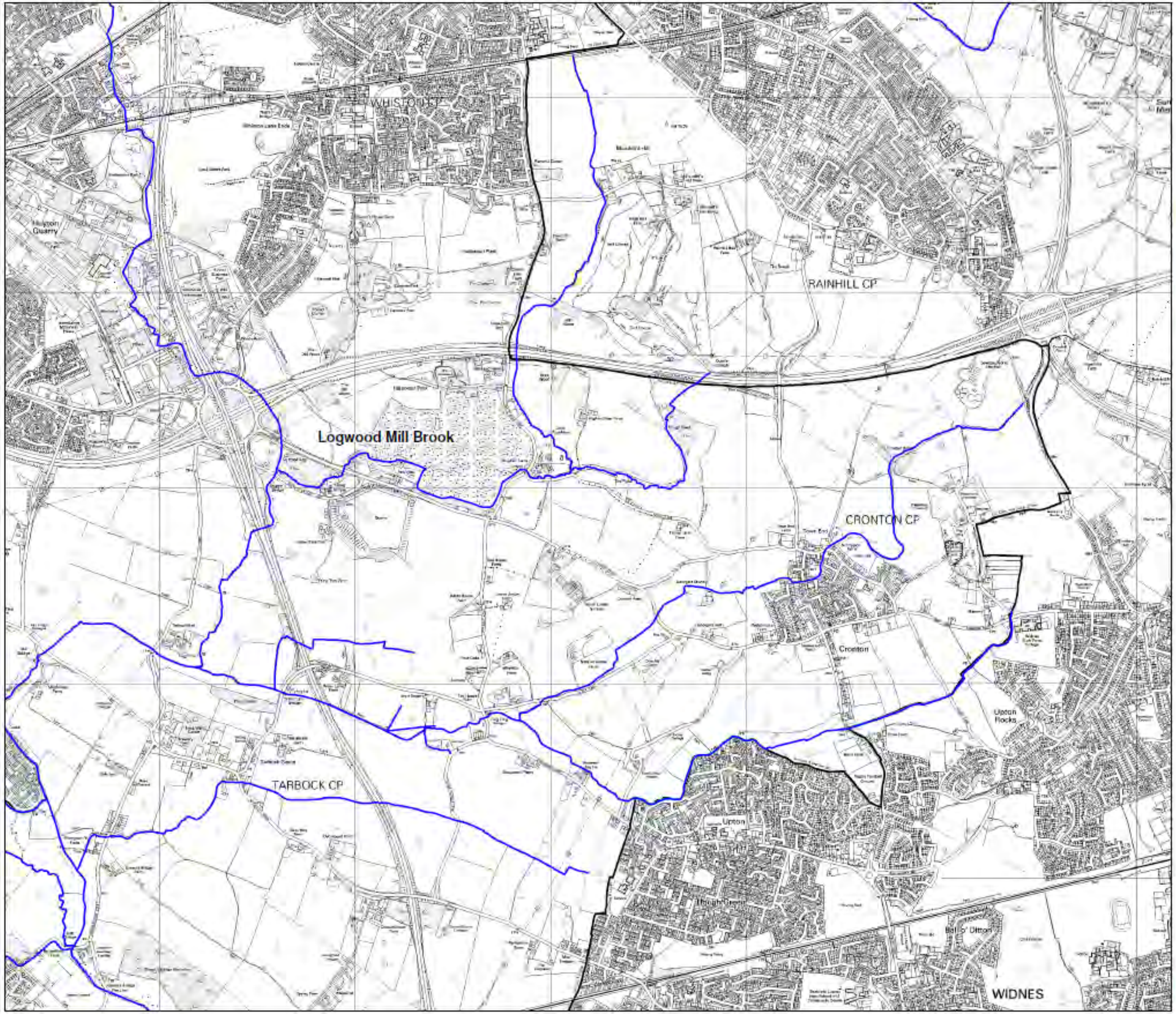

Legend:

- Knowsley Boundary
- Areas Benefitting from Defences
- River Centrelines
- Coastal Protection
- Culverted Channel
- Flood Defence Structure
- Raised Coastal Defences
- Raised Defence Man Made
- Sea Defence Man Made
- Sea Defence Natural

Note: Knowsley Borough Council contains no areas benefitting from defences (ABD) due to a lack of defences that provide a 1% AEP event standard of protection. Further detail is given in Section 3.9.1 of the report.

SCALE: NTS

Project Title:

Knowsley and Sefton Strategic Flood Risk Assessment

Figure Title:

Flood Defence Assets and Areas Benefitting from Defences Knowsley 6

Document Reference: **5074164/62/DG/002**

Figure Number: **C1-7**

Knowsley Council

ATKINS

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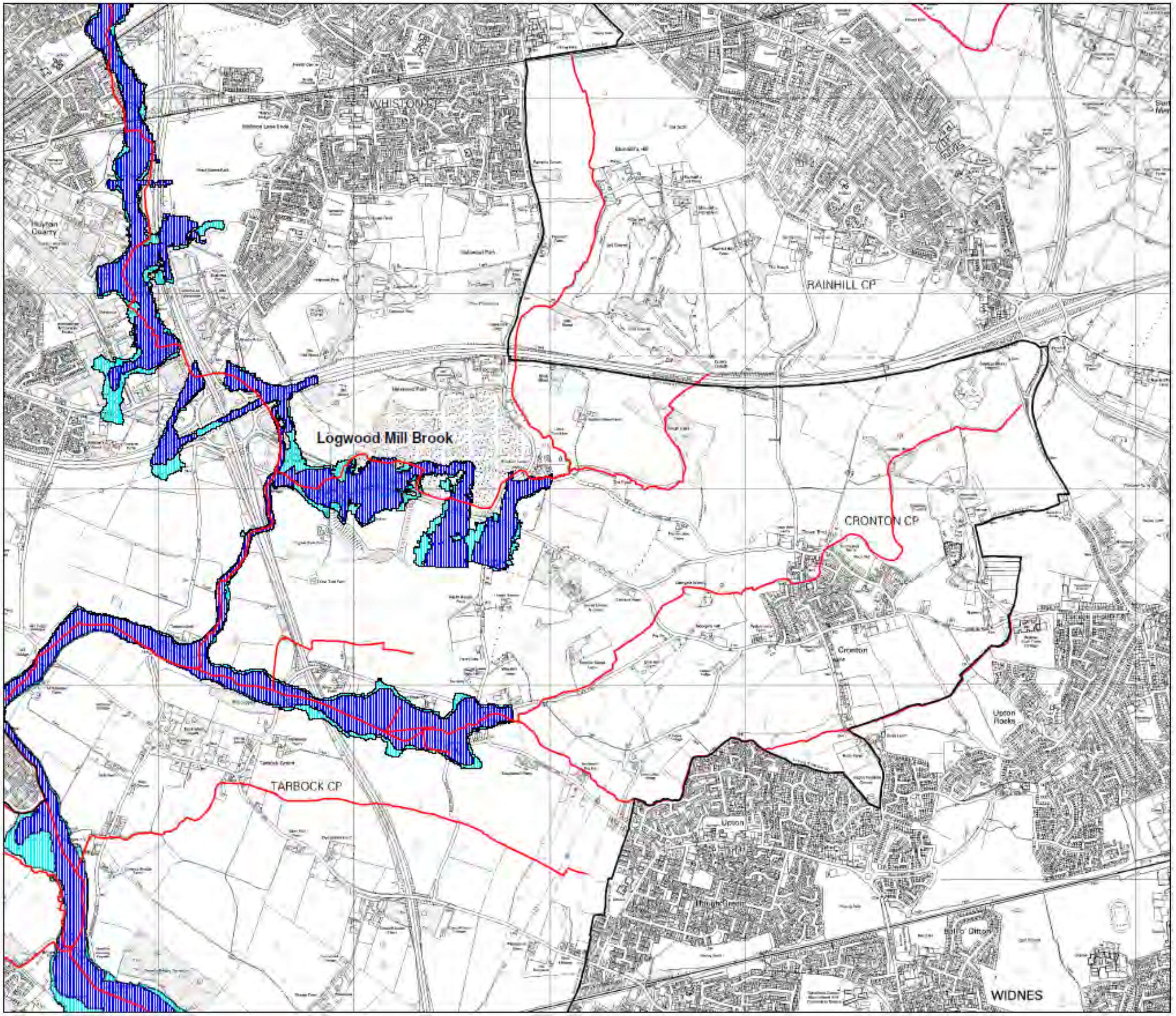

Legend:

- Knowsley Boundary
- Watercourse
- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

Figure Title:

PPS25 Updated Flood Zones
Knowsley 6

Document Reference: 5074164/62/DG/002

Figure Number: F1-7

Knowsley Council

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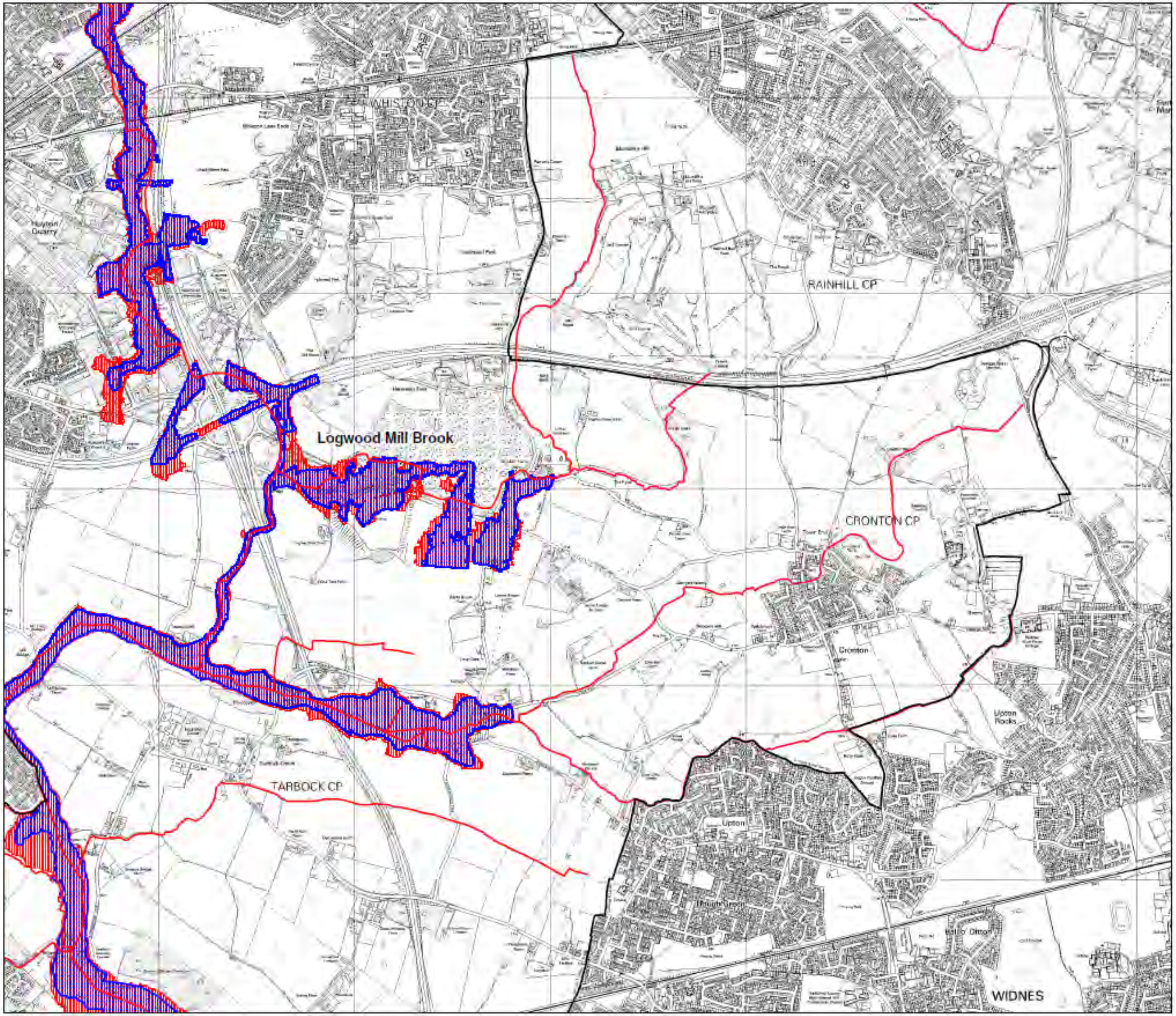

Legend:

Knowsley Boundary

Watercourse

Flood Zone 3a - Current Respresentation of 1% AEP event

Flood Zone 3a with Climate Change - Representation of 1% AEP event with climate change

N.B. In the absence of bespoke modelling data for climate change and in line with Environment Agency advice the outline used to represent the 1% AEP (1 in 100 year) event is based upon the Environment Agency Flood Map 2 (1 in 1000 year) outline.
This work estimates the flood outline in the year 2050, but due to the absence of bespoke modelling, the results are conservative.

SCALE: NTS

Project Title:

Knowsley and Sefton Strategic Flood Risk Assessment

Figure Title:

PPS25 Flood Zone 3a with Climate Change Knowsley 6

Document Reference:	Figure Number:
50741464/62/DG/002	G1-7

Knowsley Council

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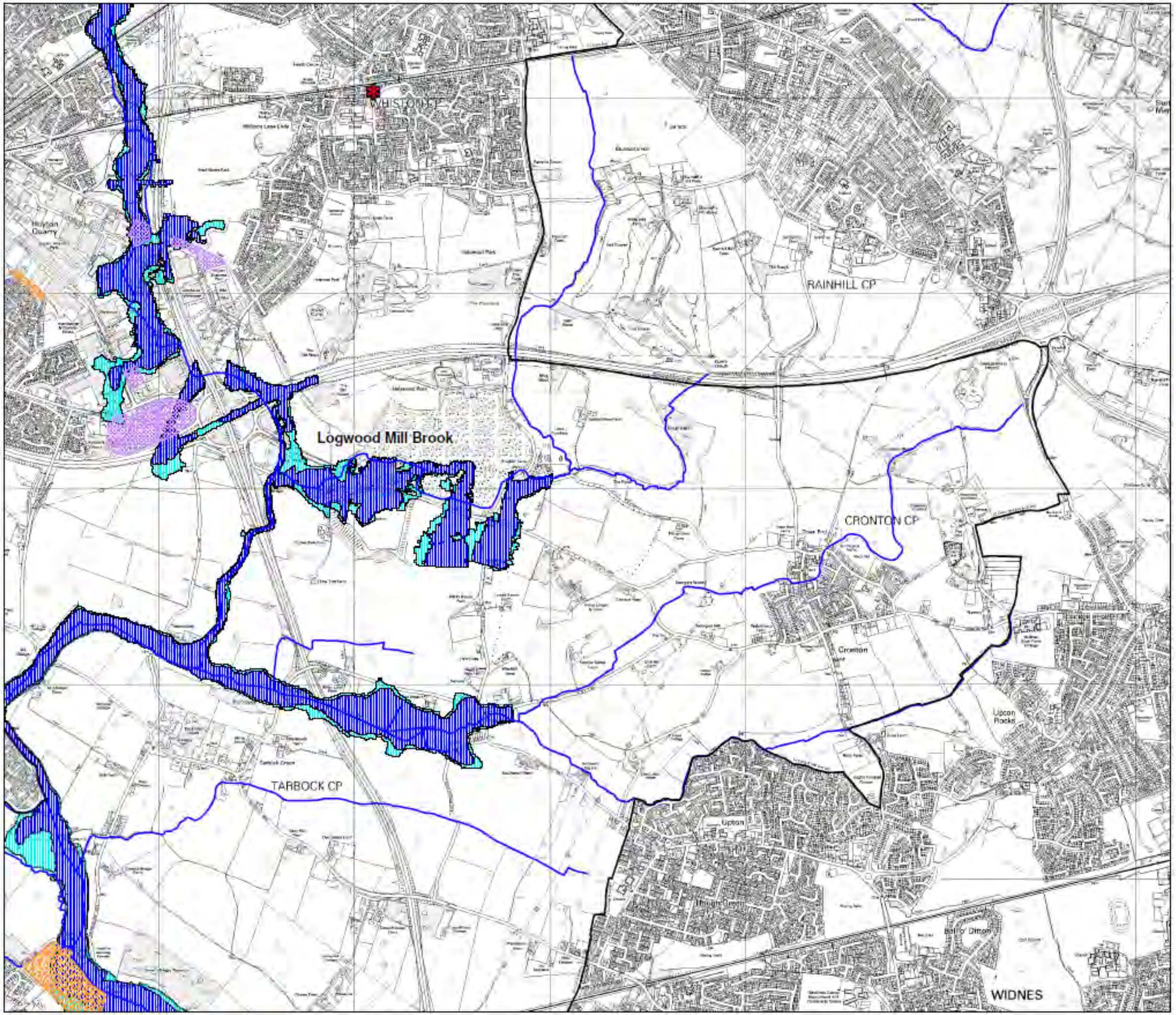

Legend:

- Knowsley Boundary
- Watercourse
- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2

Land Allocations

- Housing Development
- Transport
- Action Areas
- The Economy

SCALE: NTS

Project Title:

Knowsley and Sefton Strategic Flood Risk Assessment

Figure Title:

Identified Development Sites and PPS25 Flood Zones Knowsley 6

Document Reference: **5074164/62/DG/002**

Figure Number: **H1-7**

Knowsley Council

ATKINS

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APPENDIX I: SURFACE WATER RUN-OFF CALCULATIONS

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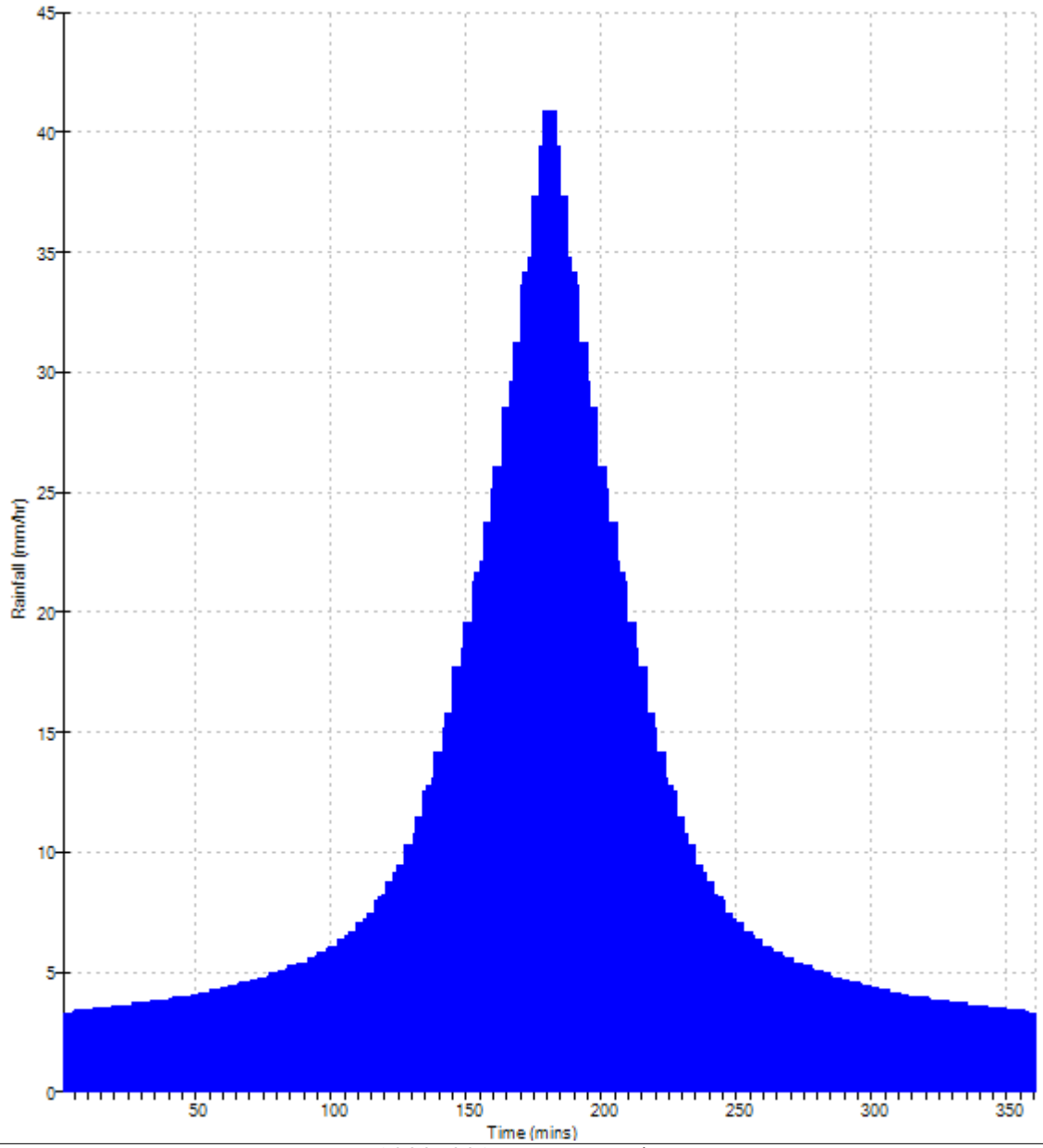
Rainfall profile

Storm duration (mins) 360

FSR Data	
Region	England and Wales
M5-60 (mm)	20.000
Ratio R	0.399
Peak Intensity (mm/hr)	40.878
Ave. Intensity (mm/hr)	10.428
Return Period (years)	100.0



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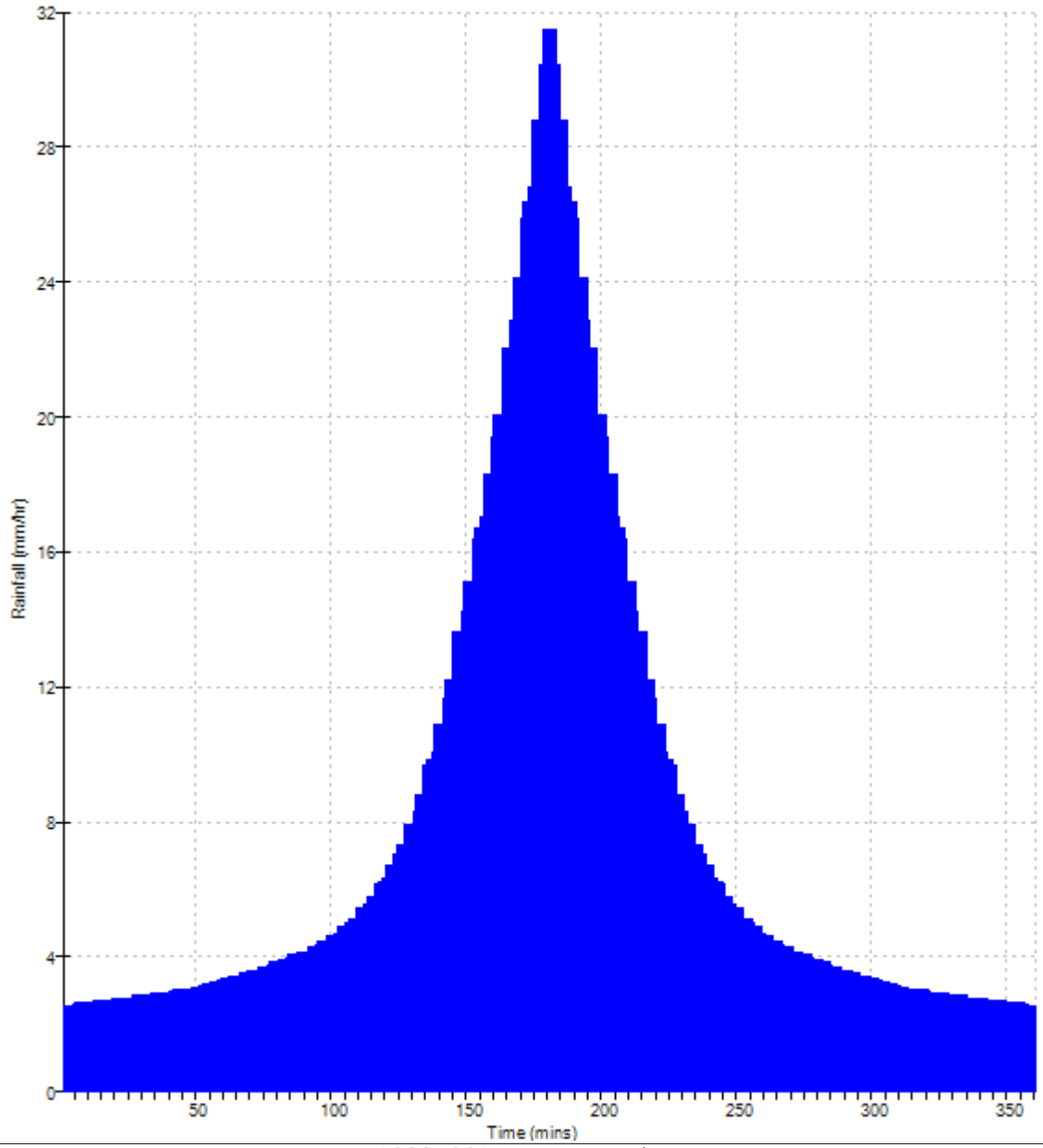
Rainfall profile

Storm duration (mins) 360

FSR Data	
Region	England and Wales
M5-60 (mm)	20.000
Ratio R	0.399
Peak Intensity (mm/hr)	31.528
Ave. Intensity (mm/hr)	8.043
Return Period (years)	30.0



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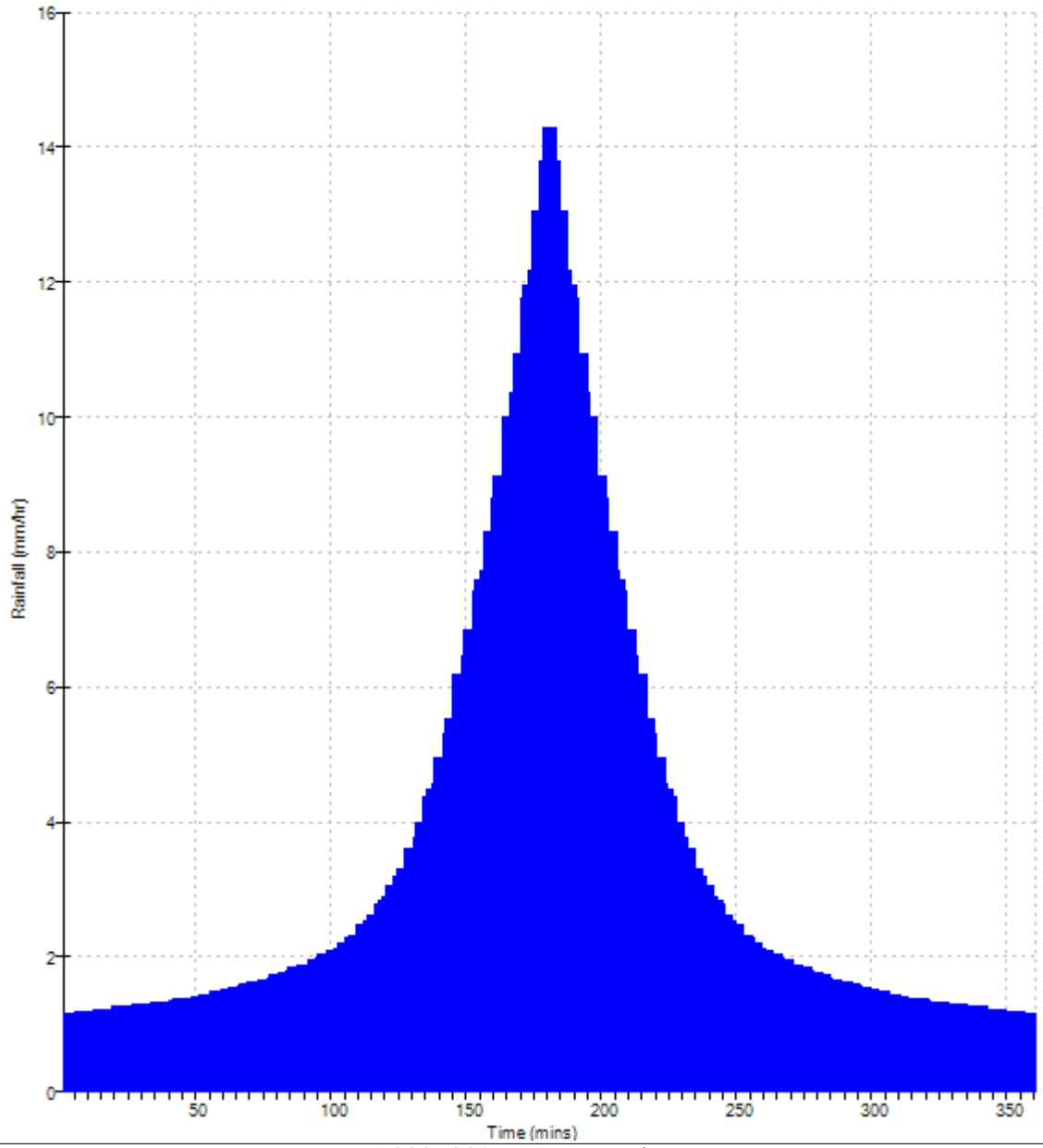
Rainfall profile

Storm duration (mins) 360

FSR Data	
Region	England and Wales
M5-60 (mm)	20.000
Ratio R	0.399
Peak Intensity (mm/hr)	14.311
Ave. Intensity (mm/hr)	3.651
Return Period (years)	1.0



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Greenfield Runoff Volume

FEH Data

Return Period (years)	2
Storm Duration (mins)	360
FEH Rainfall Version	2013
Site Location	GB 347611 389983
Data Type	Point
Areal Reduction Factor	1.00
Area (ha)	11.530
SAAR (mm)	867
CWI	120.588
SPR Host	47.000
URBEXT (1990)	0.0000

Results

Percentage Runoff (%)	45.90
Greenfield Runoff Volume (m^3)	1300.600

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Greenfield Runoff Volume

FEH Data

Return Period (years)	30
Storm Duration (mins)	360
FEH Rainfall Version	2013
Site Location	GB 347611 389983
Data Type	Point
Areal Reduction Factor	1.00
Area (ha)	11.530
SAAR (mm)	867
CWI	120.588
SPR Host	47.000
URBEXT (1990)	0.0000

Results

Percentage Runoff (%)	47.10
Greenfield Runoff Volume (m^3)	2392.542

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Greenfield Runoff Volume

FEH Data

Return Period (years)	100
Storm Duration (mins)	360
FEH Rainfall Version	2013
Site Location	GB 347611 389983
Data Type	Point
Areal Reduction Factor	1.00
Area (ha)	11.530
SAAR (mm)	867
CWI	120.588
SPR Host	47.000
URBEXT (1990)	0.0000

Results

Percentage Runoff (%)	49.39
Greenfield Runoff Volume (m^3)	3343.880

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Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	
Site name:	HALSNEAD GARDEN VILLAGE
Site location:	PRESCOT

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site coordinates

Latitude:	53.40390° N
Longitude:	2.78826° W
Reference:	
Date:	2019-06-27 11:55

Methodology	FEH Statistical

Site characteristics

Total site area (ha)	13.772

Methodology

Qmed estimation method	Calculate from BFI and SAAR
BFI and SPR estimation method	Specify BFI manually
HOST class	10
BFI / BFIHOST	0.508
Qmed (l/s)	62.46
Qbar / Qmed Conversion Factor	1.08

Hydrological characteristics

	Default	Edited
SAAR (mm)	860	860
Hydrological region	10	10
Growth curve factor: 1 year	0.87	0.87
Growth curve factor: 30 year	1.7	1.7
Growth curve factor: 100 year	2.08	2.08

Notes:

(1) Is Q_{BAR} < 2.0 l/s/ha?

(2) Are flow rates < 5.0 l/s?

(3) Is SPR/SPRHOST ≤ 0.3?

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	67.15	69.74
1 in 1 year (l/s)	58.42	60.68
1 in 30 years (l/s)	114.15	118.57
1 in 100 years (l/s)	139.66	145.07

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at http://uksuds.com/terms-and-conditions.htm. The outputs from this tool have been used to estimate storage volume requirements. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for use of this data in the design or operational characteristics of any drainage scheme.

SURFACE WATER RUN-OFF CALCULATION SHEET

BETTS HYDRO
CONSULTING ENGINEERS

Development	HALSNEAD GARDEN VILLAGE
Project No.	HYD318

Revision	2	Completed by	MB
Date	12.04.19	Checked by	KW

Areas

Total Site	16.204	ha	
Development Area[1]	13.772	ha	
Existing Impermeable	0.125	ha	1%
Existing Impermeable[2]	0.000	ha	
Existing Pervious	16.080	ha	
Existing Pervious[2]	0.000	ha	
Proposed total impermeable	7.575	ha	55%

Catchment Characteristics

SAAR	867	mm
SPR	0.47	
BFI	0.508	

i_1	16.1	mm/hr	d_1	20.6	mm
i_{30}	28.8	mm/hr	d_{30}	44.1	mm
i_{100}	38.4	mm/hr	d_{100}	58.7	mm

Run-off Rates

Pre-development

Impermeable ------	1yr	0.0	l/s
	30yr	0.0	l/s
	100yr	0.0	l/s
	40mm/hr[3]	0.0	l/s
Pervious[4] ------	1yr	60.7	l/s
	30yr	118.6	l/s
	100yr	145.1	l/s
	QBar[5]	69.7	l/s
Total ------	1yr	60.7	l/s
	30yr	118.6	l/s
	100yr	145.1	l/s

Post-development (without control)

Impermeable[6] ------	1yr	337.9	l/s
	30yr	605.7	l/s
	100yr+40%CC	1130.0	l/s

Volumes

Pre-development

Impermeable ------	1yr	0.0	cu.m
	30yr	0.0	cu.m
	100yr	0.0	cu.m
Pervious[4] ------	1yr	1382.8	cu.m
	30yr	3177.5	cu.m
	100yr	4293.6	cu.m
Total ------	1yr	1382.8	cu.m
	30yr	3177.5	cu.m
	100yr	4293.6	cu.m

Post-development

Impermeable[6] ------	1yr	155.8	cu.m
	30yr	333.8	cu.m
	100yr+40%CC	444.7	cu.m

Stormwater Storage Estimates

Based on Greenfield run-off QBar

Microdrainage Quick Storage Estimates (using FEH catchment data)

Return Period	Rate		lower	upper	mean	
1yr	69.7	l/s	649	1125	887	cu.m
30yr	69.7	l/s	1690	2391	2040.5	cu.m
100yr+40%CC	69.7	l/s	3802	5129	4465.5	cu.m

1/ The 'development area' removes areas of POS and/or landscaped areas of the wider site that are to remain as existing.
2/ On occasion the existing impermeable area cannot be evidenced to connect and a reduction is applied.
3/ 50mm/hr is used for BRegs calculations and often used by Water Companies when considering allowable post-development rates of discharge. (Rational Method)
4/ The Greenfield rates and of run-off have been calculated using the UK SUDS Calculator - FEH Stat. Method
5/ QBar is the estimated flood flow for the 2.33yr return period event and is often used as a post-development rate restriction.
6/ Post-development run-off is only considered from the impermeable area when the proposed post-development impermeable area >50% in accordance with the EA Guidance Preliminary rainfall runoff management for developments (W5-074/A/TR1/1 rev E (2012).

NB. The catchment characteristics are from the FEH catchment, the UK SUDS Calculator and Microdrainage.
NB. The rainfall intensities and depths are calculated for the 6hr duration rainfall event (peak summer intensity)

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APPENDIX J: IMPERMEABLE AREAS PLANS

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DO NOT SCALE

LEGEND

- SITE BOUNDARY
- PRE-DEVELOPMENT IMPERMEABLE AREAS

REV	DATE	BY	DESCRIPTION	CHK
B	11/04/19	KW	UPDATED RED EDGE	DK
A	17.0418	KW	PRELIMINARY FOR REVIEW	DK

DRAWING STATUS: PRELIMINARY

BETTS HYDRO
CONSULTING ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 enquiries@betts-associates.co.uk

Taylor Wimpey

PROJECT:
HALSNEAD GARDEN VILLAGE
WHISTON

TITLE:
IMPERMEABLE AREAS PLAN
PRE-DEVELOPMENT

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
APR 2019	1:1000 @ A0	KW	DK

PROJECT No:	DRAWING No:	REV:
HYD318	101	B

DO NOT SCALE

LEGEND

SITE BOUNDARY - 16.204ha

DEVELOPMENT AREA - 13.772ha

POST-DEVELOPMENT IMPERMEABLE AREA - ASSUMED TO BE 55% OF DEVELOPMENT AREA

REV	DATE	BY	DESCRIPTION	CHK
E	11.02.20	KW	UPDATED TO REFLECT LAYOUT	DK
D	15.08.19	KW	UPDATED TO REFLECT LAYOUT	DK
C	27.06.19	KW	UPDATED TO REFLECT LAYOUT	DK
B	11.04.19	KW	UPDATED LAYOUT AND RED EDGE	DK
A	17.04.18	KW	PRELIMINARY FOR REVIEW	DK

DRAWING STATUS: PRELIMINARY

BETTS HYDRO
CONSULTING ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 enquiries@betts-associates.co.uk

Taylor Wimpey

PROJECT:

HALSNEAD GARDEN VILLAGE
WHISTON

TITLE:

IMPERMEABLE AREAS PLAN
POST-DEVELOPMENT

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
FEB 2020	1:1000 @ A0	KW	DK

PROJECT No:	DRAWING No:	REV:
HYD318	201	E

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APPENDIX K: PRELIMINARY PROPOSED DRAINAGE PLANS

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SITE: Halsnead Garden Village
REF: HYD318
REV: 1.0
DATE: 12.04.2019

BETTS HYDRO
CONSULTING ENGINEERS

EXISTING DRAINAGE SITUATION PLAN

LEGEND

- Site Extents
- Drainage Areas

Existing Land Features

- Contours
- General Topographic Fall

Existing Drainage Features

- Main River
- Ordinary Watercourse
- Ponds
- Piped Connections
- Land Drainage Route

Existing Sewer Infrastructure

- Surface Water Sewer (public)
- Foul Water Sewer (public)
- Combined Sewer (public)

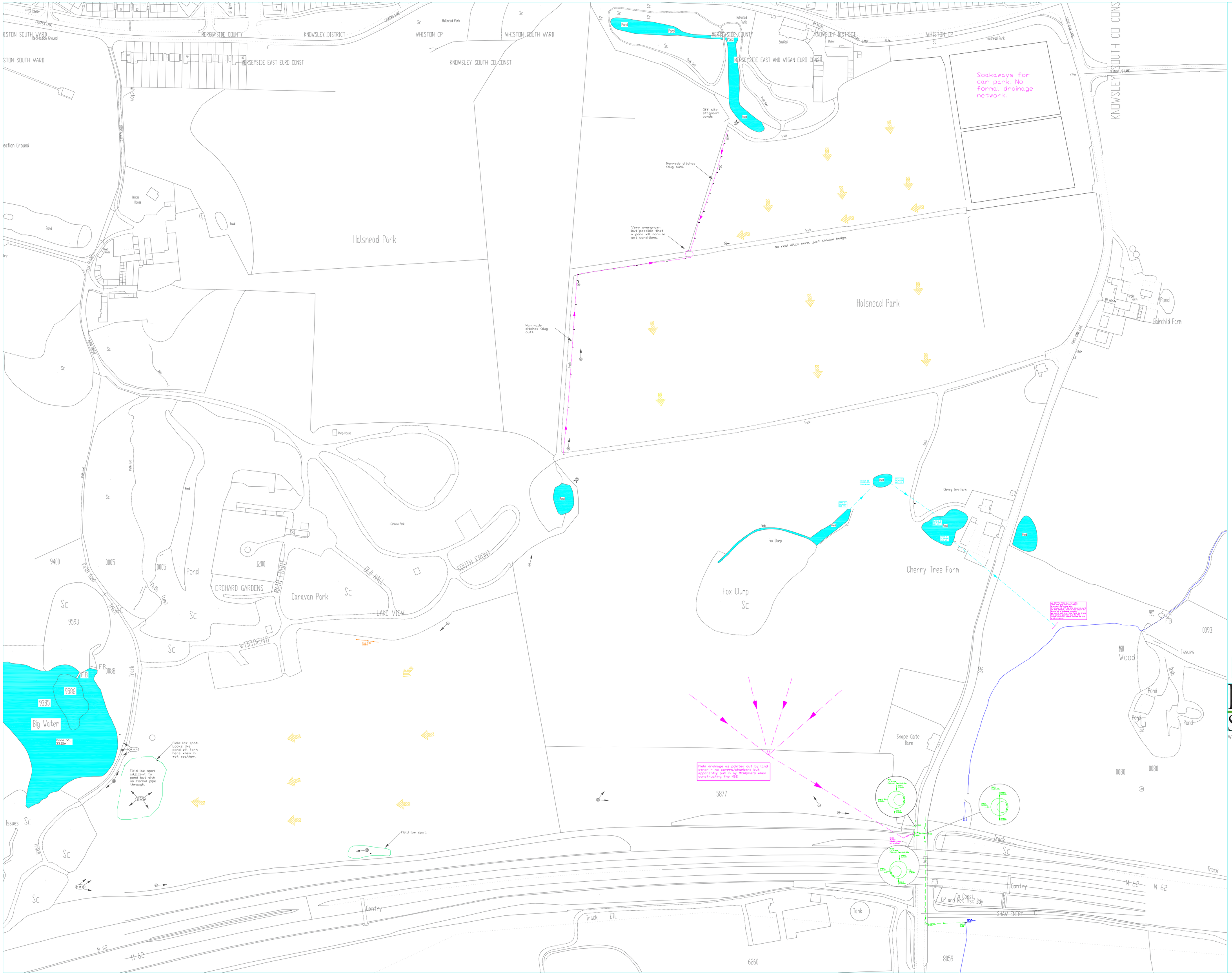
FURTHER NOTES:

This drawing is not a drainage 'design' it is a preliminary drainage strategy showing existing sewer locations.

No hydraulic simulation or assessment of these proposals has been undertaken.

Proposed points of connection to the existing watercourse and sewer require invert levels to be accurately established. Refer to proposed drainage plan.

Surcharging of the proposed outfall will require modelling to satisfy the requirements of united utilities along with full hydraulic analysis.



Legend/Notes:

- Combined Sewer
- Foul Sewer
- SW Sewer
- Assumed Sewer (Not Proven)
- Rising Main
- Highway Drainage
- Culvert Sewer
- Open Water Course
- RWD Rain Water Down Pipe
- FDP Foul Down Pipe
- CDP Combined Down Pipe
- GDP Grey Water Down Pipe
- Highway Gully
- Septic Tanks

INVEK SURVEYS LTD.
Warrington Business Park, Long Lane, Warrington, Cheshire, WA2 8TX
Tel: 01925 244376 Fax: 01925 241517
Email: kevin@invek.com — www.invek.com

Client
Betts Hydro

Drawing Title
Halsnead
Drainage Layout

Scale(s)	N.T.S	Drawn	PW
Date	06.08.18	Checked	RD
Job Number	1380	Approved	KN

Sheet Size, Drawing Number & Revision
A1_1380/01_Rev_01

SITE: Halsnead Garden Village
REF: HYD318
REV: 3.0
DATE: 11.02.20

BETTS HYDRO
CONSULTING ENGINEERS

PRELIMINARY PROPOSED DRAINAGE PLAN

LEGEND

- Site Extents
- Drainage Areas

Existing Land Features

- Contours
- General Topographic Fall

Existing Drainage Features

- Main River
- Ordinary Watercourse
- Ponds
- Piped Connections
- Land Drainage Route

Existing Sewer Infrastructure

- Surface Water Sewer (public)
- Foul Water Sewer (public)
- Foul Water Sewer (Private)
- Combined Sewer (public)

Proposed Drainage Connections

- Surface Water Connection(s)
- SuDS/Attenuation Basins
- Foul Water Connection(s)

FURTHER NOTES:

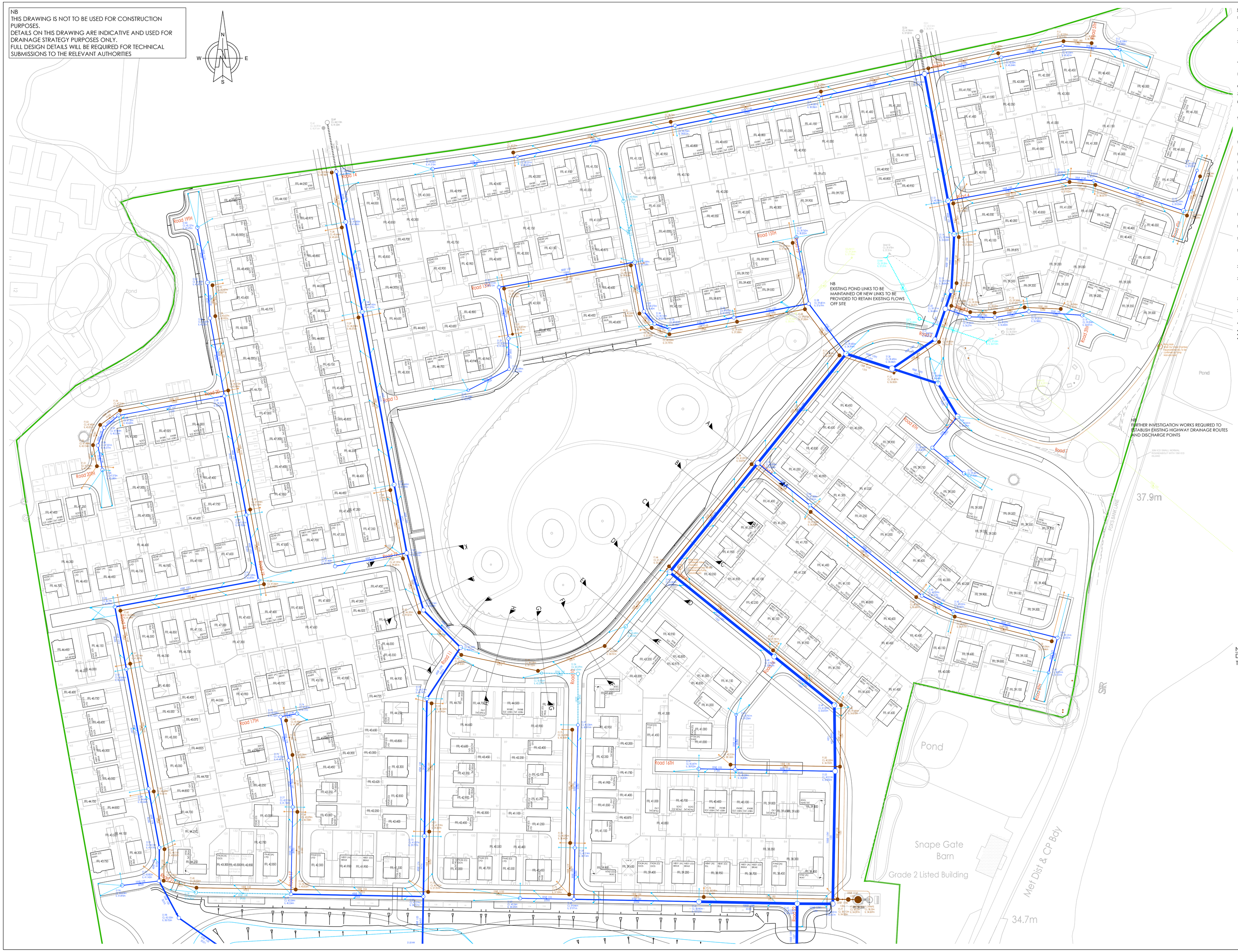
This drawing is not a drainage 'design' it is a preliminary drainage strategy showing existing sewer locations.

No hydraulic simulation or assessment of these proposals has been undertaken.

Proposed points of connection to the existing watercourse and sewer require invert levels to be accurately established. Refer to proposed drainage plan.

Surcharging of the proposed outfall will require modelling to satisfy the requirements of united utilities along with full hydraulic analysis.

NB
THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION PURPOSES.
DETAILS ON THIS DRAWING ARE INDICATIVE AND USED FOR DRAINAGE STRATEGY PURPOSES ONLY.
FULL DESIGN DETAILS WILL BE REQUIRED FOR TECHNICAL SUBMISSIONS TO THE RELEVANT AUTHORITIES



NOTES

1. Drainage design and construction is in accordance with Sewers for Adoption 6th Edition and the requirements of the statutory undertaker.
2. All SVP, RWP and BIG connections are indicative and must be confirmed by architect.
3. Pipe gradients out of building to connecting manhole to be laid an 1:40 in accordance with Part H of the 2002 Building Regulations, Table 6. All inverts to SVP within 3 storey buildings must be 750mm in accordance with Building Regulations.
4. Tolerances in pipe laying to be in accordance with Sewers for Adoption 6th Edition Clause 4.5.9
5. For pipes 150-450mm dia. all rocker pipes to be in accordance with "Sewers for Adoption" 6th Edition.
6. Engineering bricks shall not contain frogs or holes.
7. Brickwork to manholes to be English Bond.
8. Where pipes surrounded in concrete, flexibility to be maintained at pipe joints by the use of suitable compressible material eg. "flexcell" or "fibreboard".
9. All manhole covers and frames must comply with BS EN124. Covers in roads to be Grade D400 and be 150mm deep. Manhole covers in car parking areas and drives to be Grade B125, whilst landscaped areas may be Grade A15. All to be sized in accordance with Part H of Building Regulations : 2002, Tables 11 & 12.
10. Pipes to be clayware to be 65 extra strength quality "hepseal" or similar approved.
11. Granolithic benching to manholes to be 40mm thickness minimum.
12. Precast concrete chamber rings to be reinforced.
13. The slope of benching in all cases should be 1 in 30.
14. Manholes shall not incorporate double square or double oblique channel junctions in their inverts.
15. All incoming pipes shall be surrounded with 150mm of concrete to the face of the collar of the first flexible joint and the outgoing pipe shall also be surrounded to within 50mm of the first flexible joint and a compressible filler used as a former between the concrete surround and downstream pipe collar.
16. All underground services to be confirmed by contractor prior to commencement on site. Any discrepancies to be reported to engineer.
17. Private sewers not located in roads to be Class F granular bed and surround as per standard details.
18. Sewers located under adopted roads to be Class S granular bed and surround (more than 1.2m cover.)
19. Sewers located under private roads and car parking bays to be Class F granular bed and surround as per standard details unless adopted, then provide class s (if more than 1.2m cover)
20. Private sewers with less than 0.6m of cover to be concrete surrounded as class z on standard details.
21. Adopted sewers with less than 1.2m cover, provide Class Z concrete bed and surround. Concrete haunching may be suitable for large diameter storage sewers, guidance must be sought from adopting authority prior to use.
22. Road gullies to be trapped for connection to proposed combined sewer.
23. No deep or wide rooted trees to be planted within close proximity of the proposed and existing public sewer system.

ADOPTABLE SEWER PIPE MATERIALS

- 150mm, 225mm and 300mm to be plastic pipework to WIS Standard 4-35-01
- 375mm, 450mm and 525mm to be concrete pipework
- 600mm and above to be Aquaspira

KEY

- PROPOSED SURFACE WATER SEWERS PHASE 1
- PROPOSED FOUL WATER SEWERS PHASE 1
- PROPOSED HIGHWAY DRAINAGE PHASE 1
- PROPOSED SURFACE WATER SEWERS PHASE 2
- PROPOSED FOUL WATER SEWERS PHASE 2
- PROPOSED FOUL WATER RISING MAIN PHASE 1
- EXISTING SURFACE WATER SEWERS
- EXISTING FOUL WATER SEWERS
- EXISTING POND DRAINAGE (LINKS BETWEEN PONDS TO BE RETAINED OR RE-LAID)
- PROPOSED EXISTING POND DRAINAGE

MANHOLE REFERENCES:-

TYPE 1	UU MANHOLE TYPE 1 (STND/19/001 A)
TYPE 4	UU MANHOLE TYPE 4 (STND/19/003 A)
RH	UU SW SHALLOW MANHOLE (STND/19/004 A)
AMP5	ALTERNATIVE MANHOLE PLATFORM SYSTEM
HB	HYDROBRAKE MANOLE

NOTE
DETAILS ON THIS DRAWING ARE SUBJECT TECHNICAL APPROVALS

Mark	Date	Details	By
D	04.12.19	Up dated for review prior to technical submissions	JC
C	22.08.19	Updated for initial review comments	JC
B	12.08.19	F.S.R.F.I.R amended to 150mmØ	JC
A	31.07.19	Produced for initial review/comments	JC

Revision History

Drawing originator:

BETTS HYDRO CONSULTING ENGINEERS | BETTS ASSOCIATES CONSULTING ENGINEERS | BETTS GEO CONSULTING ENGINEERS

Client:

Taylor Wimpey

Project title:

Halsnead Garden Centre
Whiston

Drawing title:

Main Drainage Layout
Development Area
Phase 1

Scale: 1:500 for the original size of A0

Drawn by: JC | Checked by: RA | Passed by: | Date: 31.07.19

Drawing status:

Preliminary

Job No:	Drawing No: Project	Origin	Volume	Level	Type	Discip	Number	Revision:
TAY90		BET				C	101	D

Do not scale this drawing

6-7 Old Maidh Farm Barns, Welsh Road, Sealand, Flintshire, CH5 2LY
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| Chester 01244 288178 | Altrincham 0161 6178291 |

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APPENDIX L: STORMWATER STORAGE ESTIMATES

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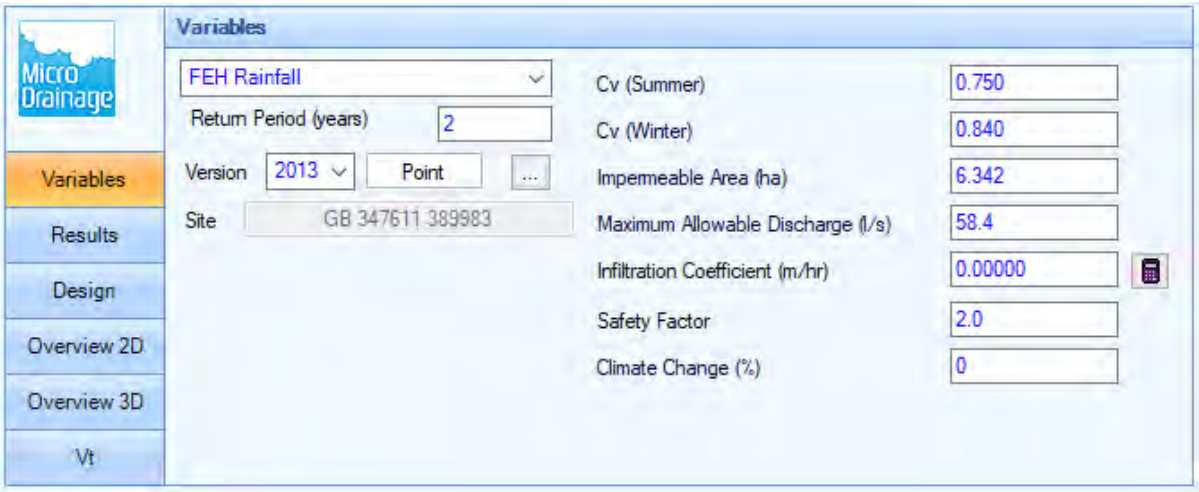
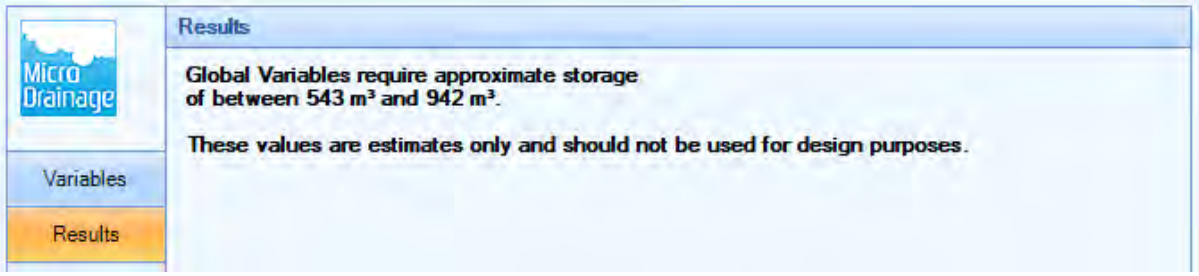
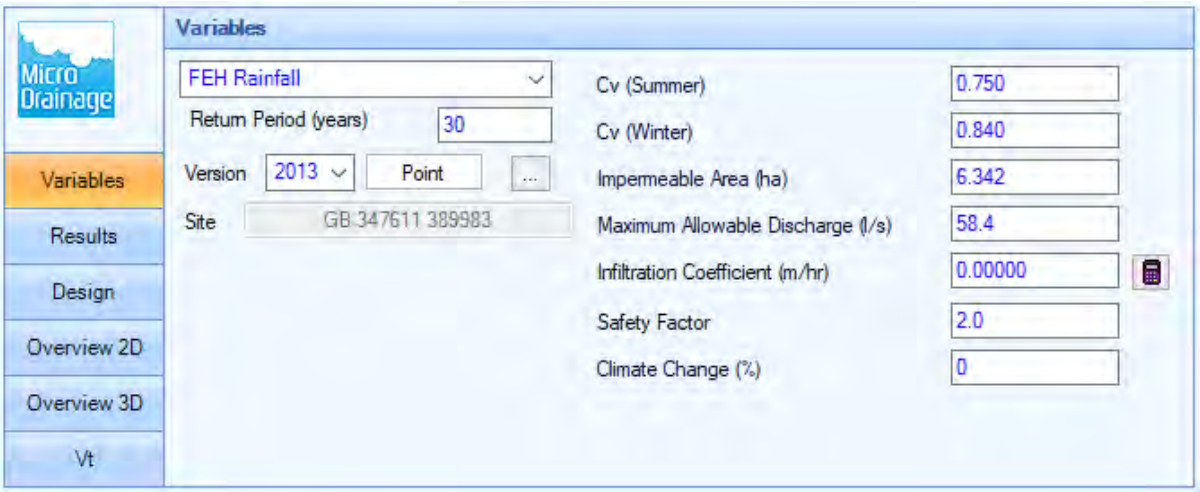
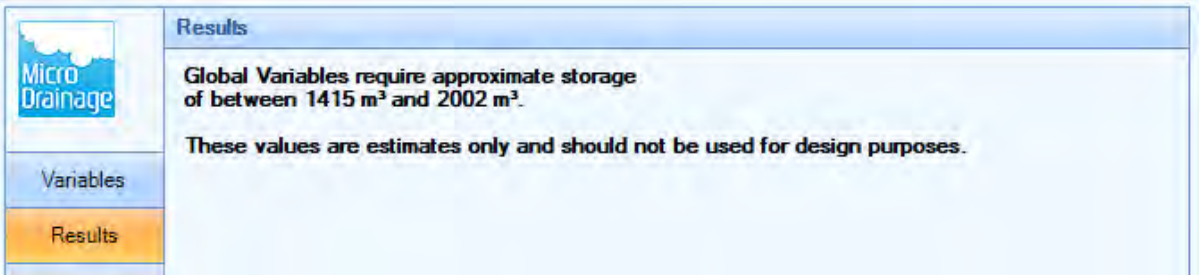
2 YEAR RETURN PERIOD STORM EVENT





30 YEAR RETURN PERIOD STORM EVENT





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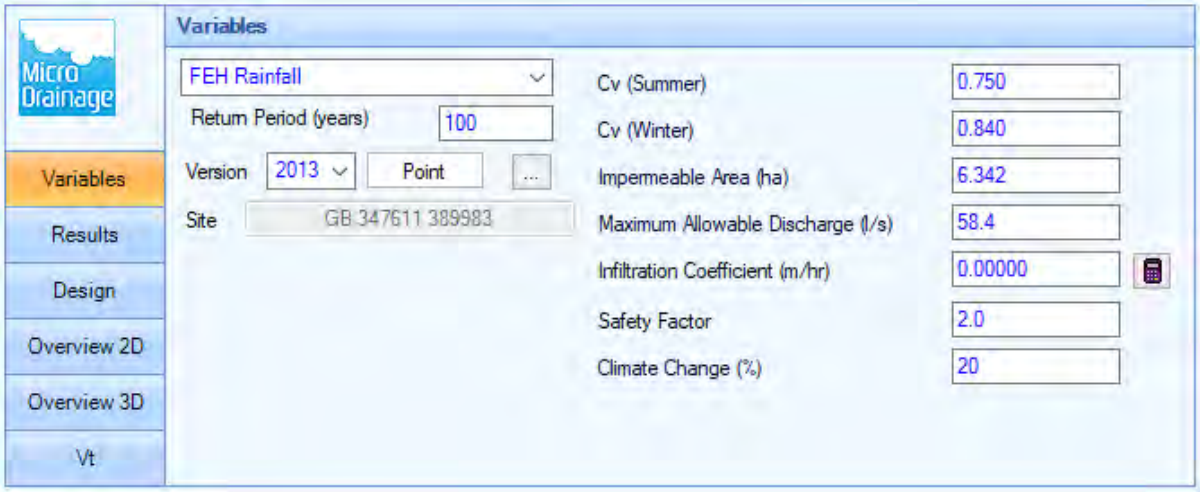

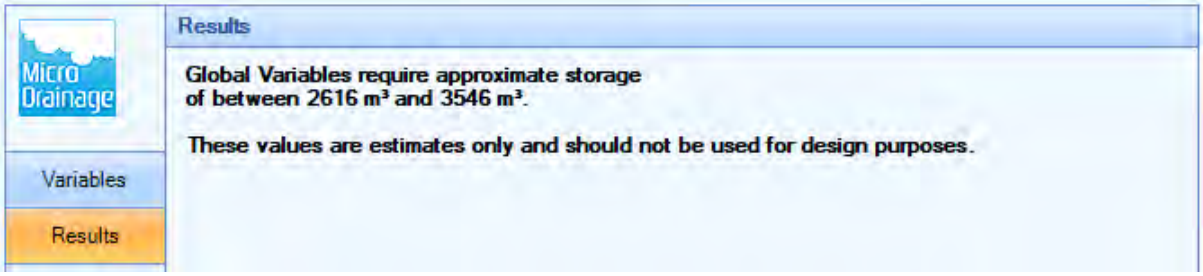

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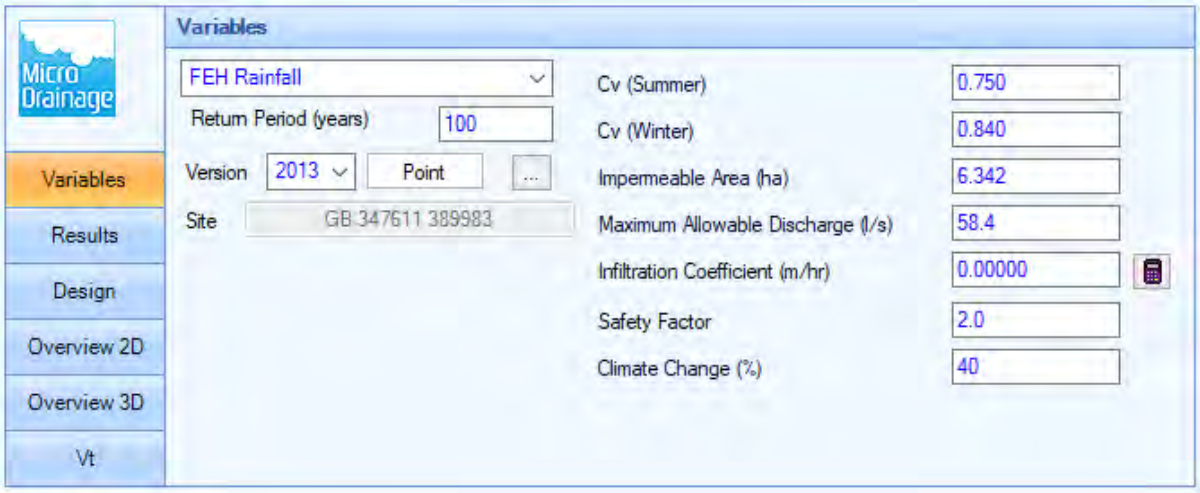

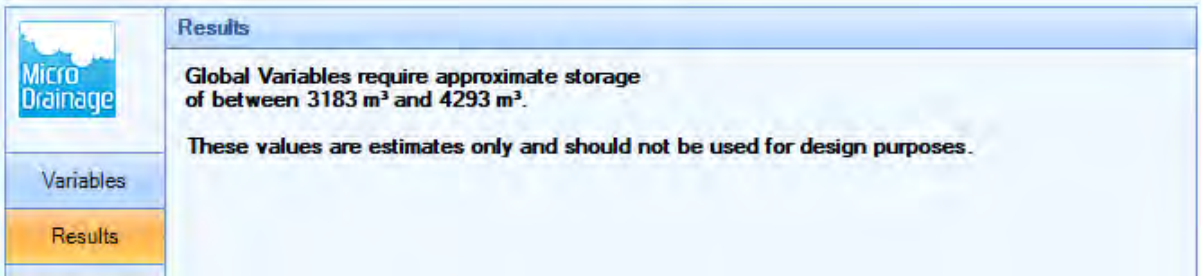

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APPENDIX M: OVERLAND FLOOD FLOW ROUTING PLANS

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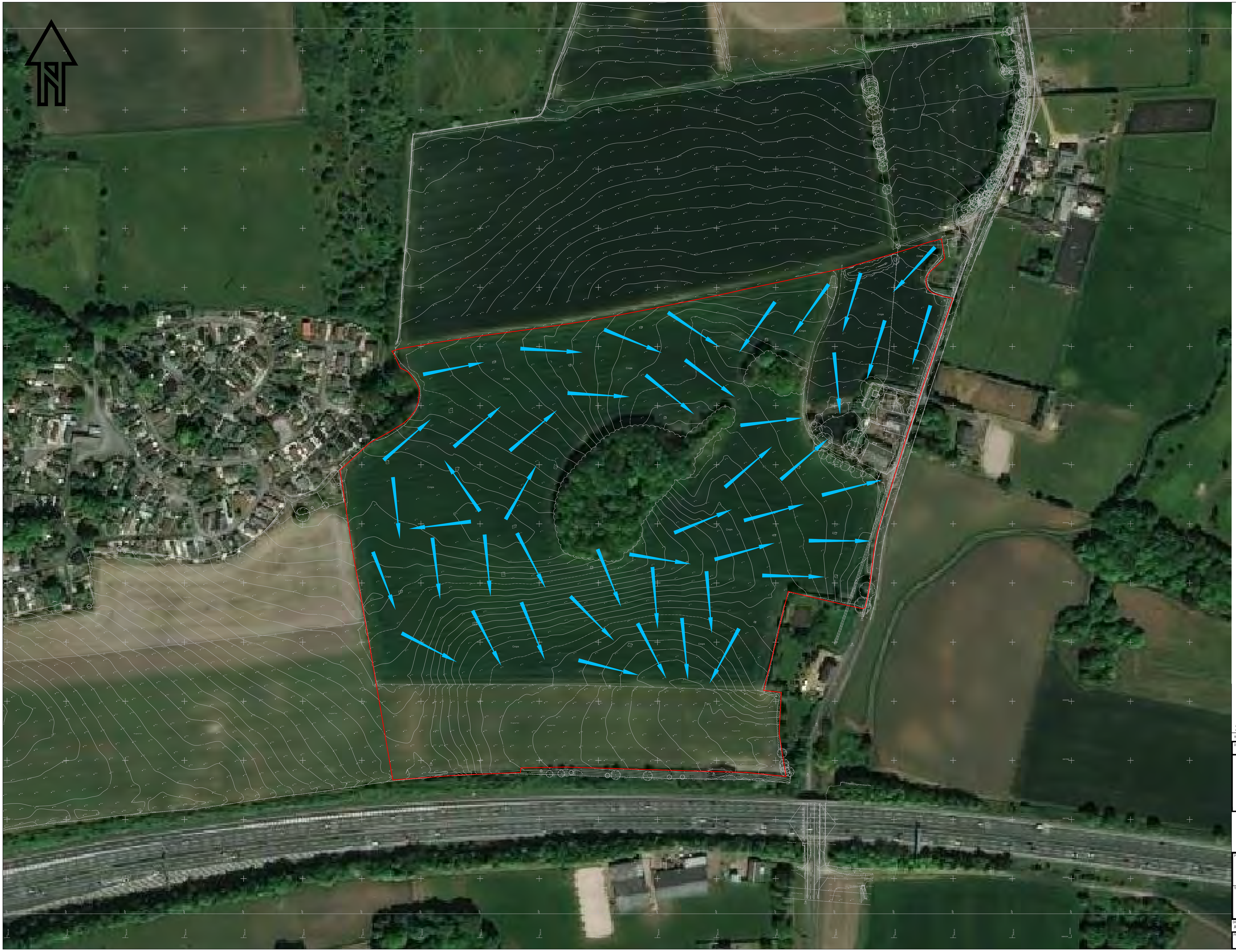

DO NOT SCALE

LEGEND

SITE BOUNDARY

OVERLAND FLOOD FLOW ROUTING

REV	DATE	BY	DESCRIPTION	CHK
A	11.04.19	KW	UPDATED RED EDGE	DK
A	17.04.18	KW	PRELIMINARY FOR REVIEW	DK

DRAWING STATUS: PRELIMINARY

BETTS HYDRO
CONSULTING ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 enquiries@betts-associates.co.uk

Taylor Wimpey

PROJECT: HALSNEAD GARDEN VILLAGE WHISTON

TITLE: OVERLAND FLOOD FLOW ROUTES
PRE-DEVELOPMENT

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
APR 2019	1:1000 @ A0	KW	DK

PROJECT No:	DRAWING No:	REV:
HYD318	102	B

DO NOT SCALE

LEGEND

SITE BOUNDARY

REV	DATE	BY	DESCRIPTION	CHK
D	12.02.20	KW	UPDATED TO REFLECT NEW LAYOUT	DK
C	15.08.19	KW	UPDATED TO REFLECT NEW LAYOUT	DK
B	27.06.19	KW	UPDATED TO REFLECT NEW LAYOUT	DK
A	17.04.18	KW	PRELIMINARY FOR REVIEW	DK

DRAWING STATUS: PRELIMINARY

BETTS HYDRO
CONSULTING ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 298178 enquiries@betts-associates.co.uk

Taylor Wimpey

PROJECT:
HALSNEAD GARDEN VILLAGE
WHISTON

TITLE:
FLOOD FLOW EXCEEDANCE ROUTING PLAN
POST-DEVELOPMENT

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
FEB 2020	1:500 @ A0	KW	DK

PROJECT No:	DRAWING No:	REV:
HYD318	202	D

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APPENDIX N: TYPICAL SUDS DETAILS

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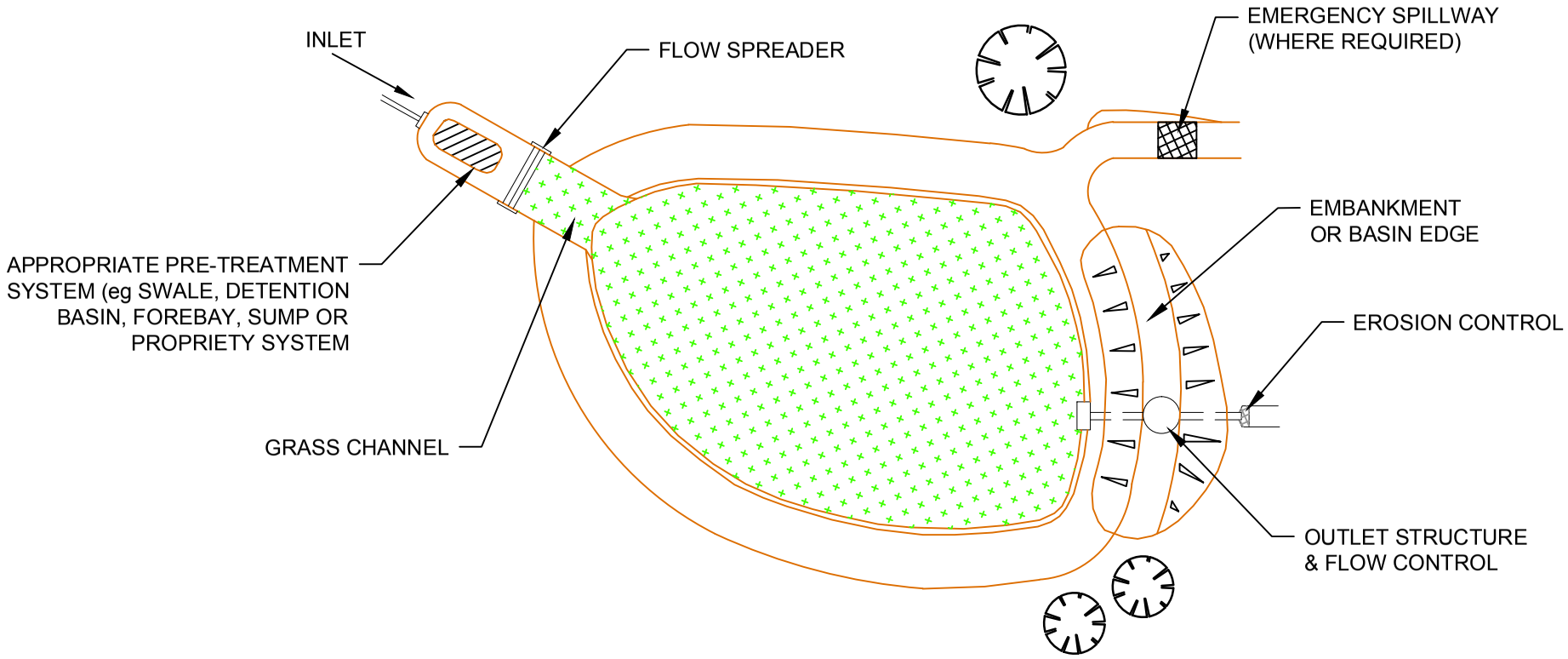
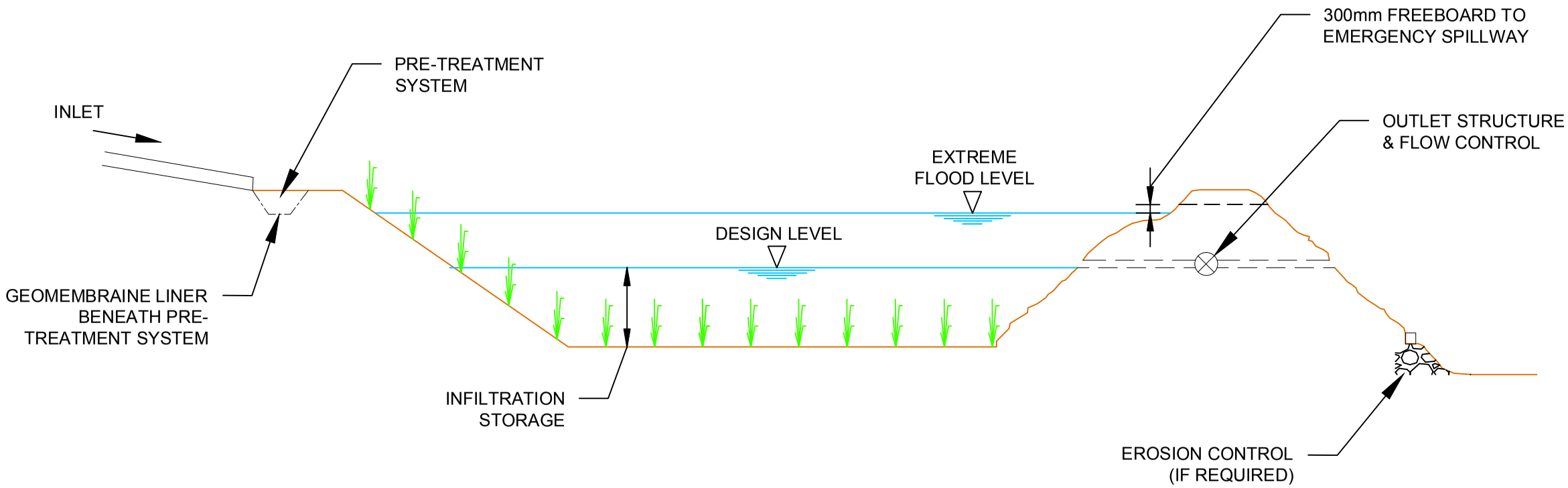


PLAN VIEW



ELEVATION

REV	DATE	BY	DESCRIPTION	CHK

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BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

PROJECT: TYPICAL SUDS DETAIL

TITLE: INFILTRATION BASINS

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
SEP 2014	@ A3	CP	RDN

PROJECT No:	DRAWING No:	REV:
BETTS	109	A

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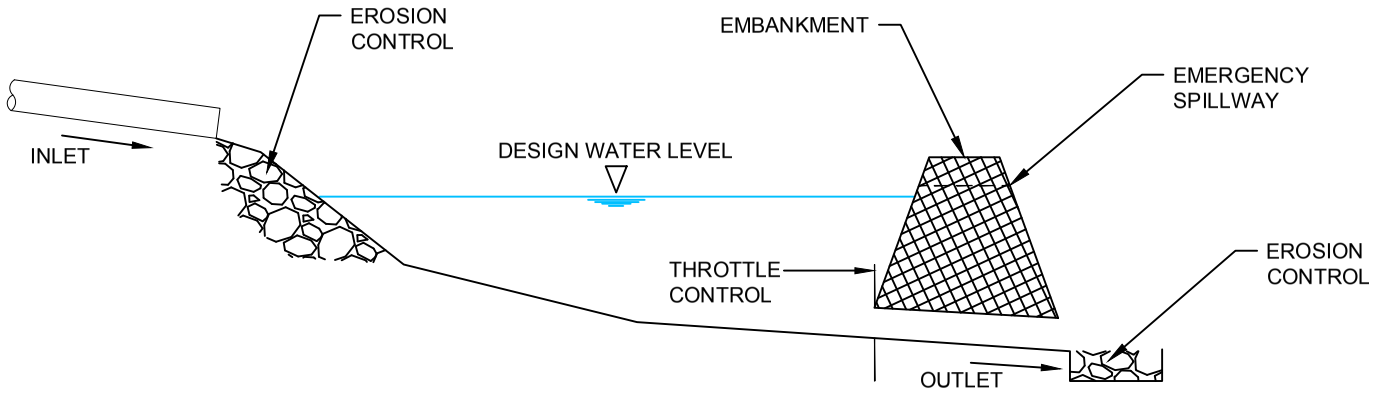
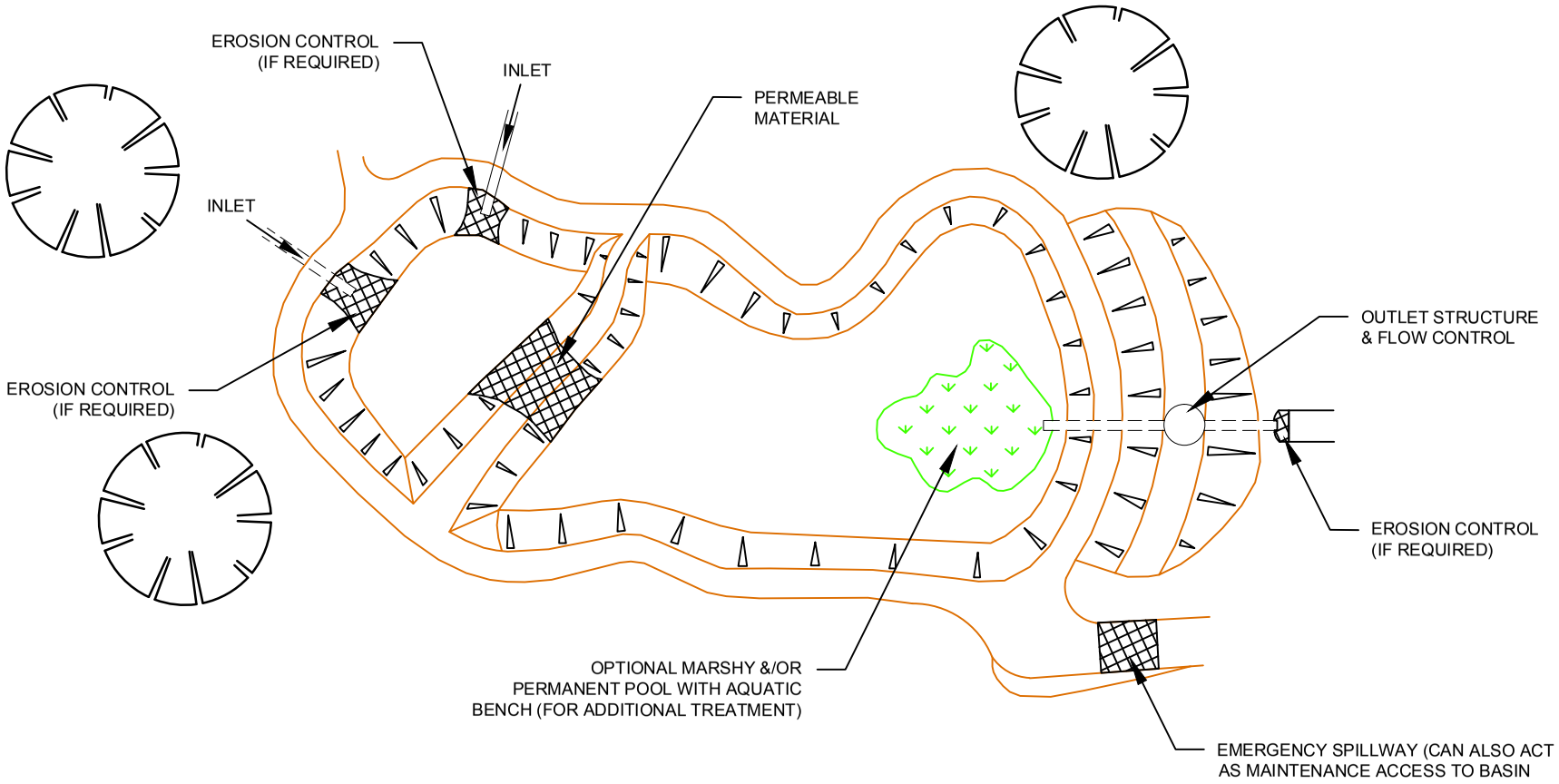
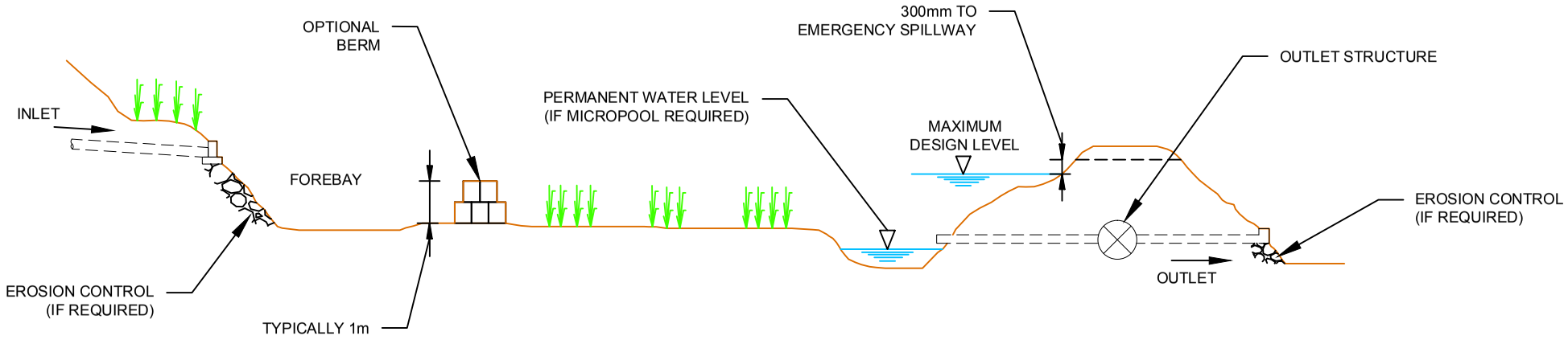


SCHEMATIC OF DETENTION BASIN PROFILE



PLAN VIEW



ELEVATION

REV	DATE	BY	DESCRIPTION	CHK

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BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
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PROJECT: TYPICAL SUDS DETAIL

TITLE: DETENTION BASINS

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
SEP 2014	@ A3	CP	RDN

PROJECT No:	DRAWING No:	REV:
BETTS	110	A

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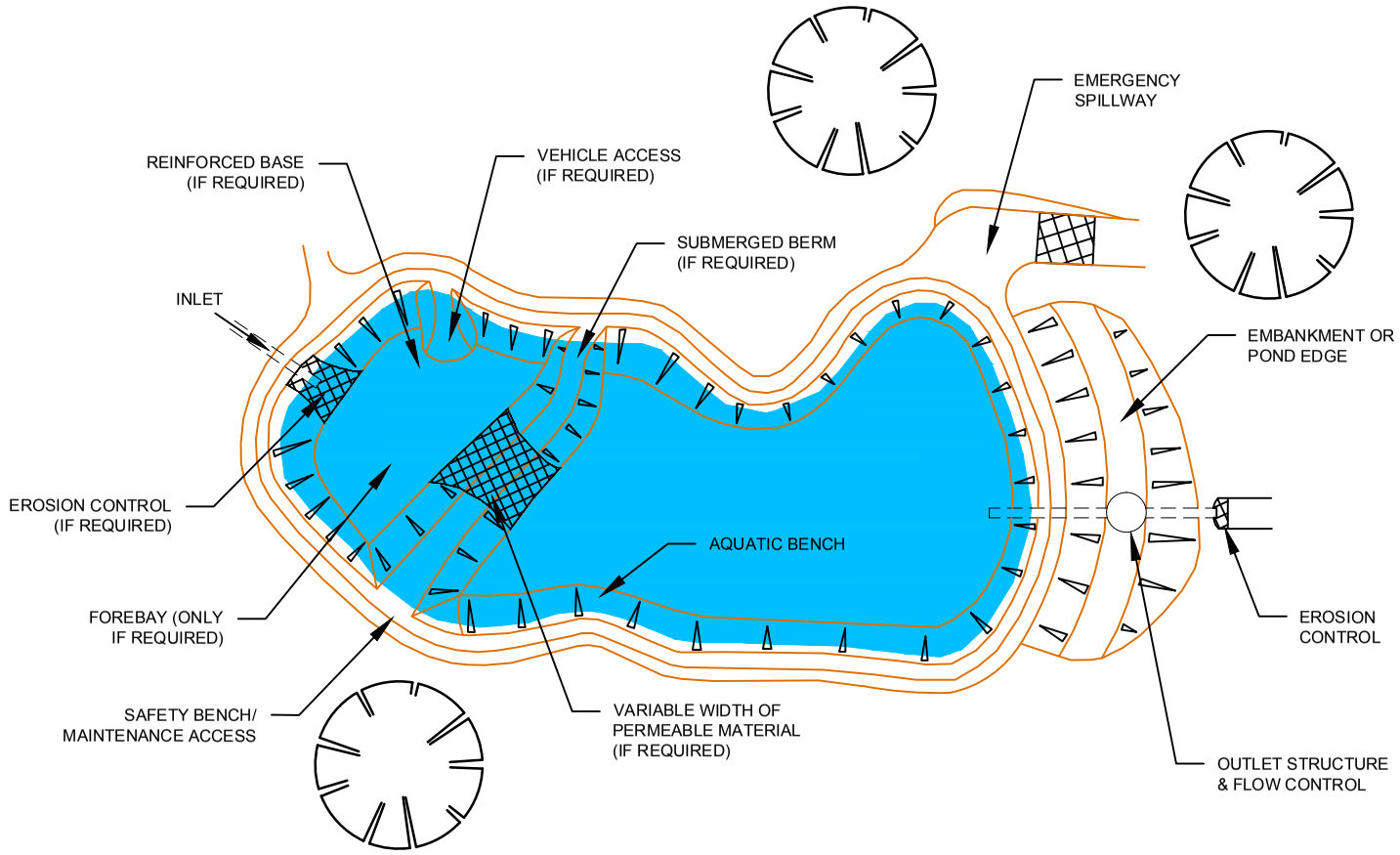
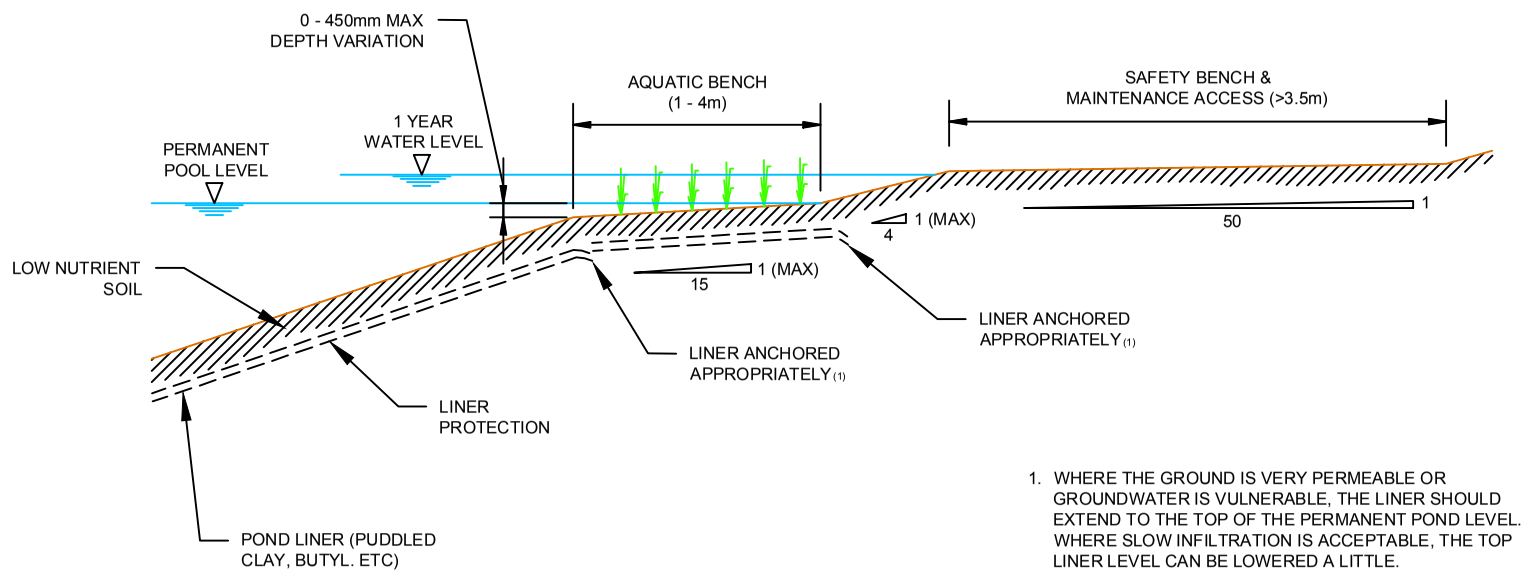
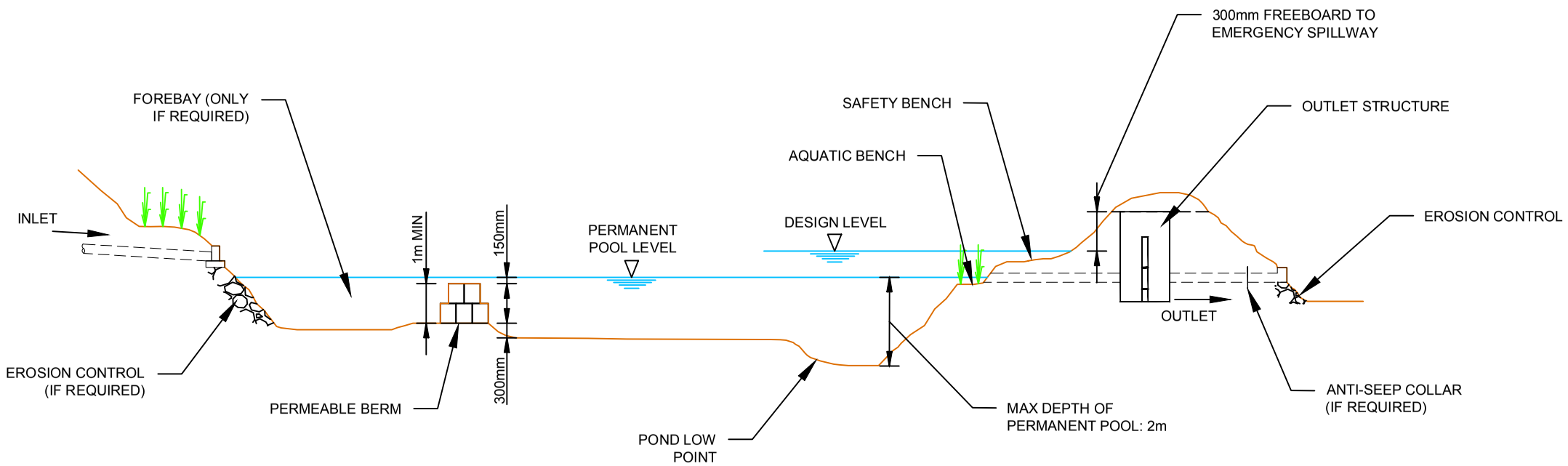


PLAN VIEW



1. WHERE THE GROUND IS VERY PERMEABLE OR GROUNDWATER IS VULNERABLE, THE LINER SHOULD EXTEND TO THE TOP OF THE PERMANENT POND LEVEL. WHERE SLOW INFILTRATION IS ACCEPTABLE, THE TOP LINER LEVEL CAN BE LOWERED A LITTLE.

TYPICAL POND EDGE GEOMETRY



PROFILE

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

PROJECT: TYPICAL SUDS DETAIL

TITLE: WET PONDS

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
SEP 2014	@ A3	CP	RDN

PROJECT No:	DRAWING No:	REV:
BETTS	111	A

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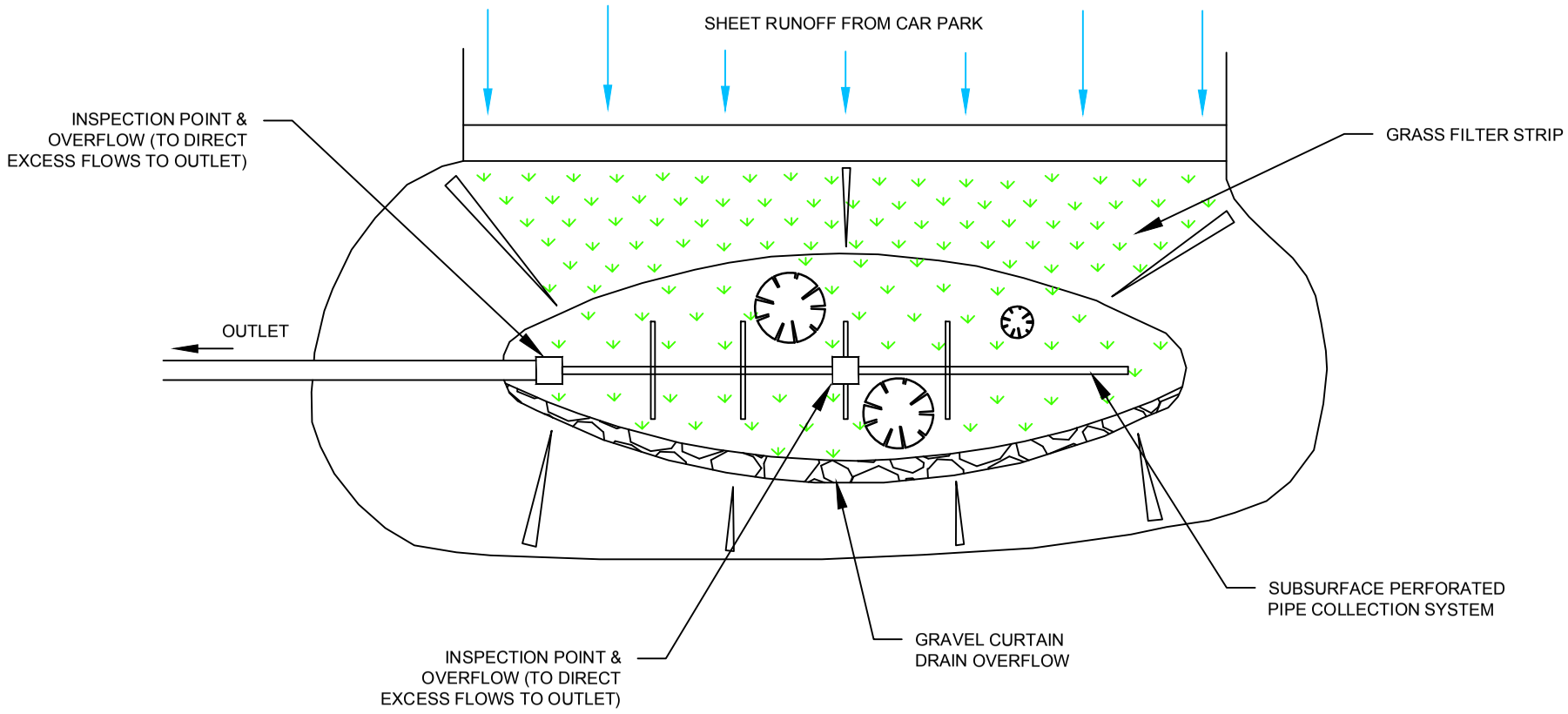
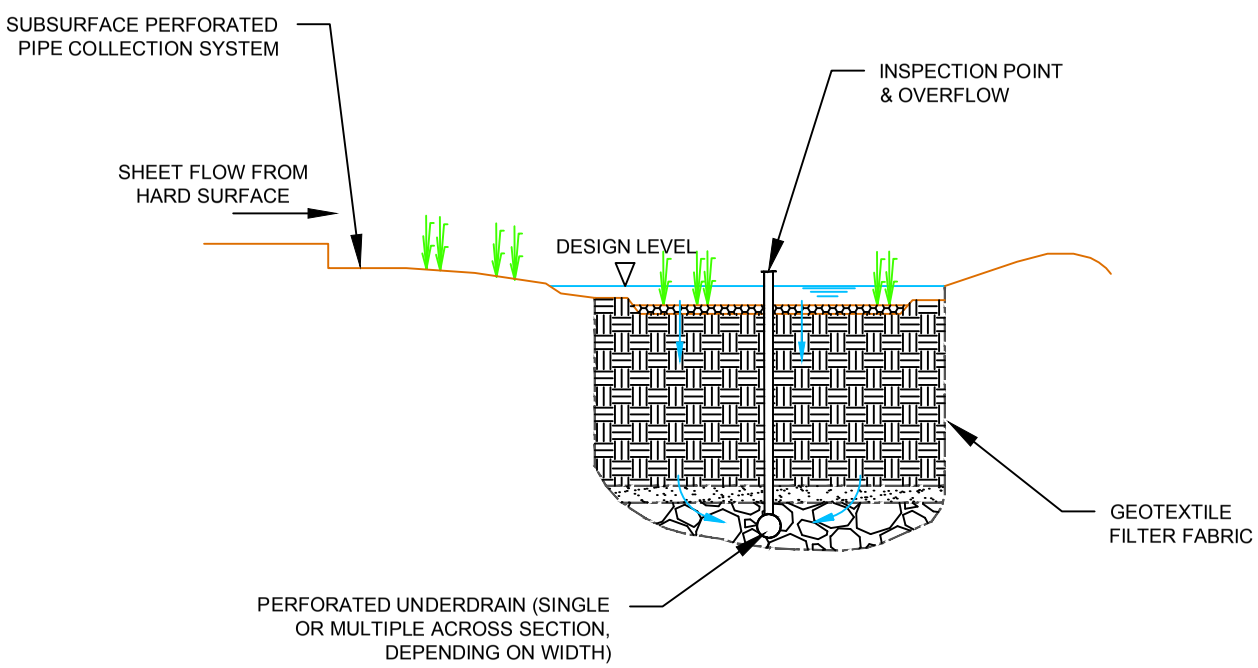
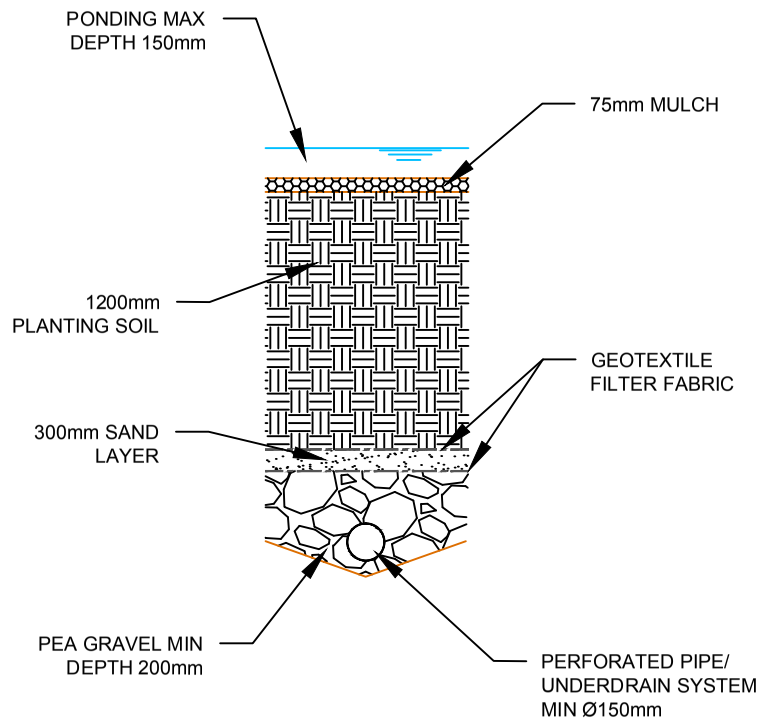


PLAN VIEW



PROFILE



TYPICAL SECTION

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

PROJECT: TYPICAL SUDS DETAIL

TITLE: BIORETENTION APPLICATIONS

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
SEP 2014	@ A3	CP	RDN

PROJECT No:	DRAWING No:	REV:
BETTS	112	A

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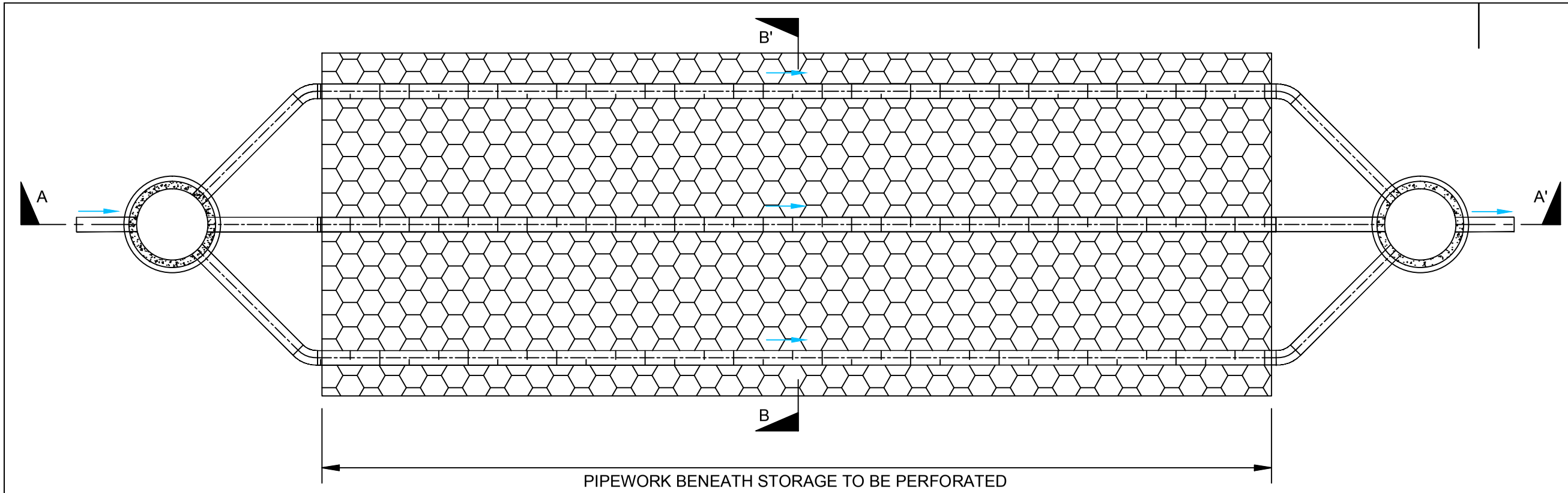

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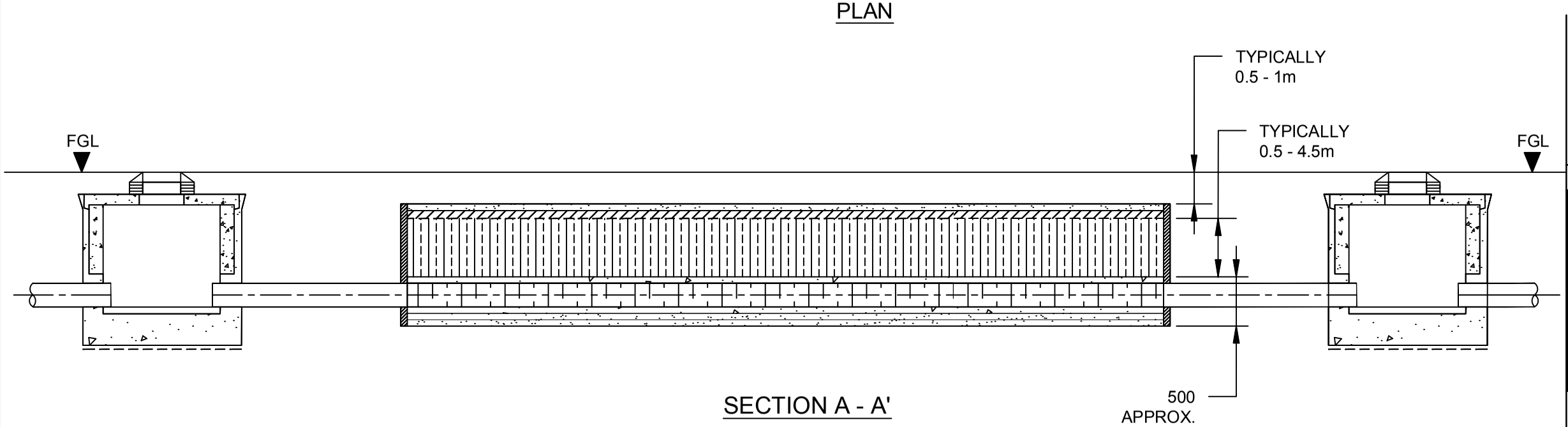
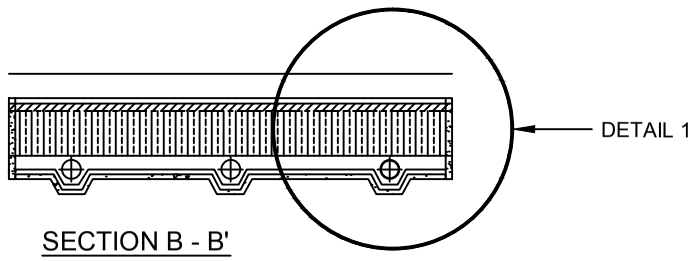
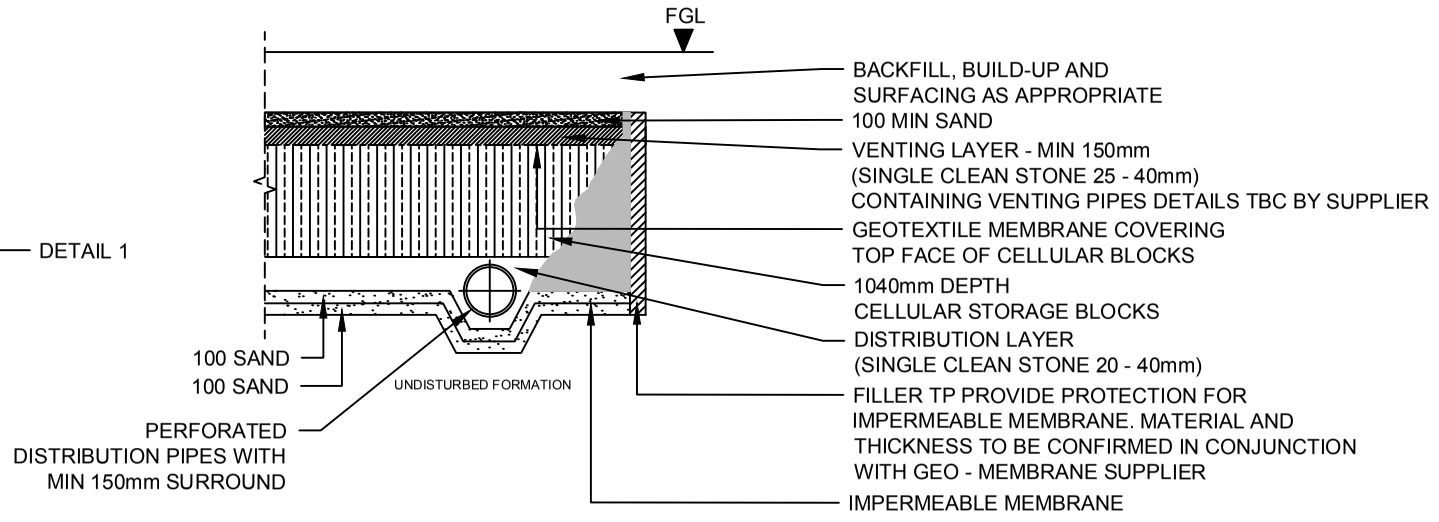


SECTION A - A'

ALL DIMENSIONS AND DEPTHS DEPENDENT ON REQUIRED VOLUME AND LOCAL GROUND CONDITIONS



SECTION B - B'



DETAIL 1

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

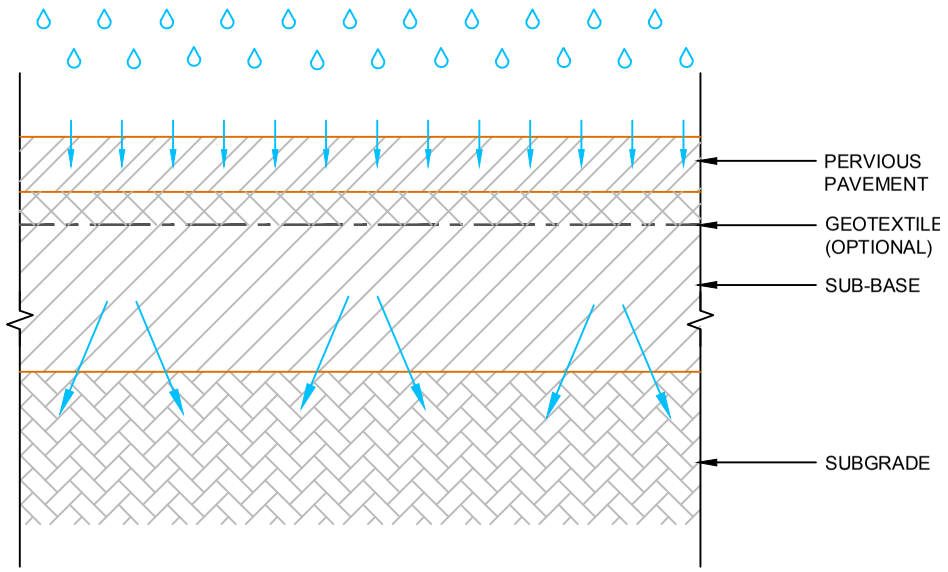
PROJECT: TYPICAL SUDS DETAIL

TITLE: CELLULAR STORAGE

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
SEP 2014	@ A3	CP	RDN

PROJECT No:	DRAWING No:	REV:
BETTS	113	A

DO NOT SCALE



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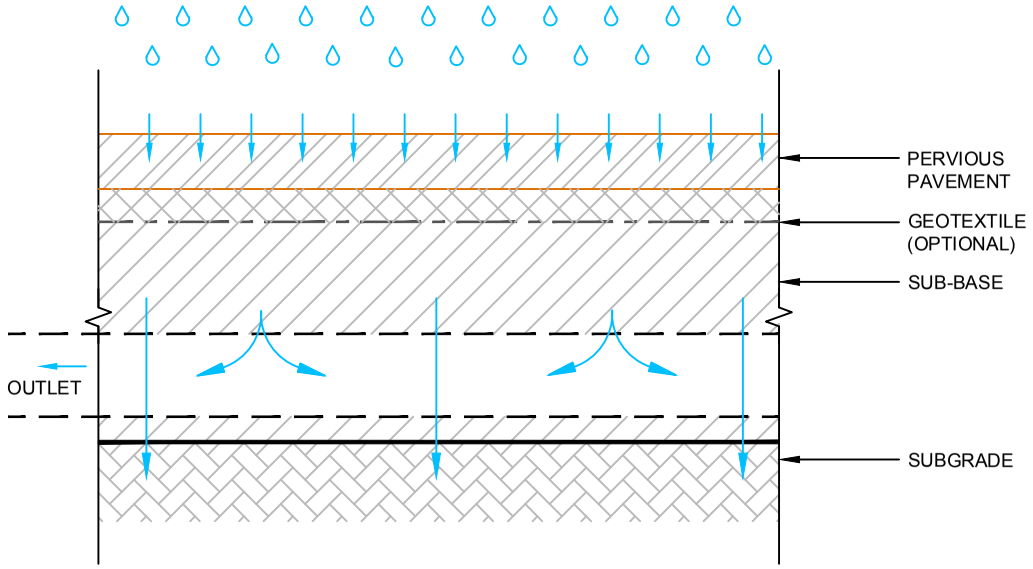

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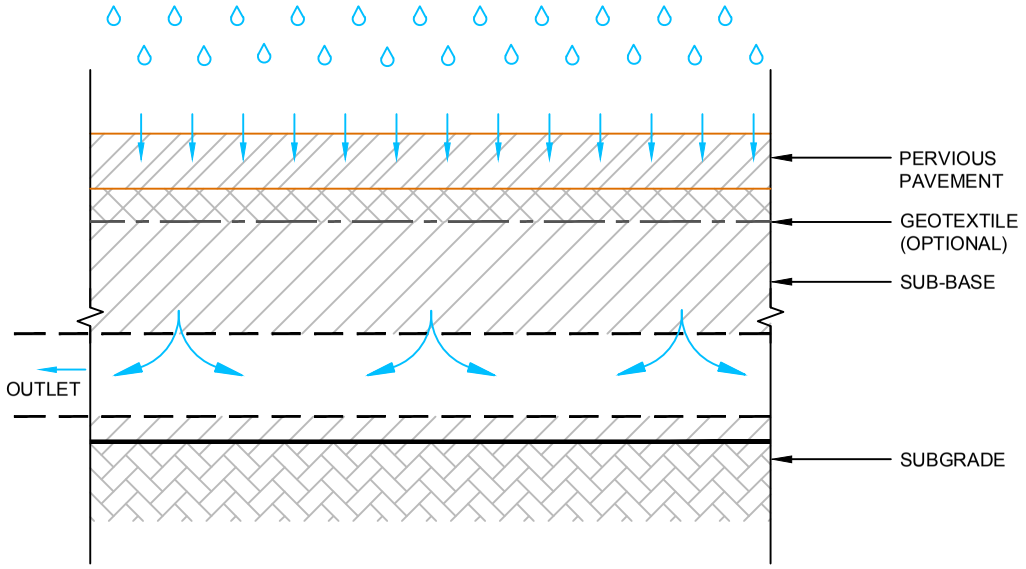

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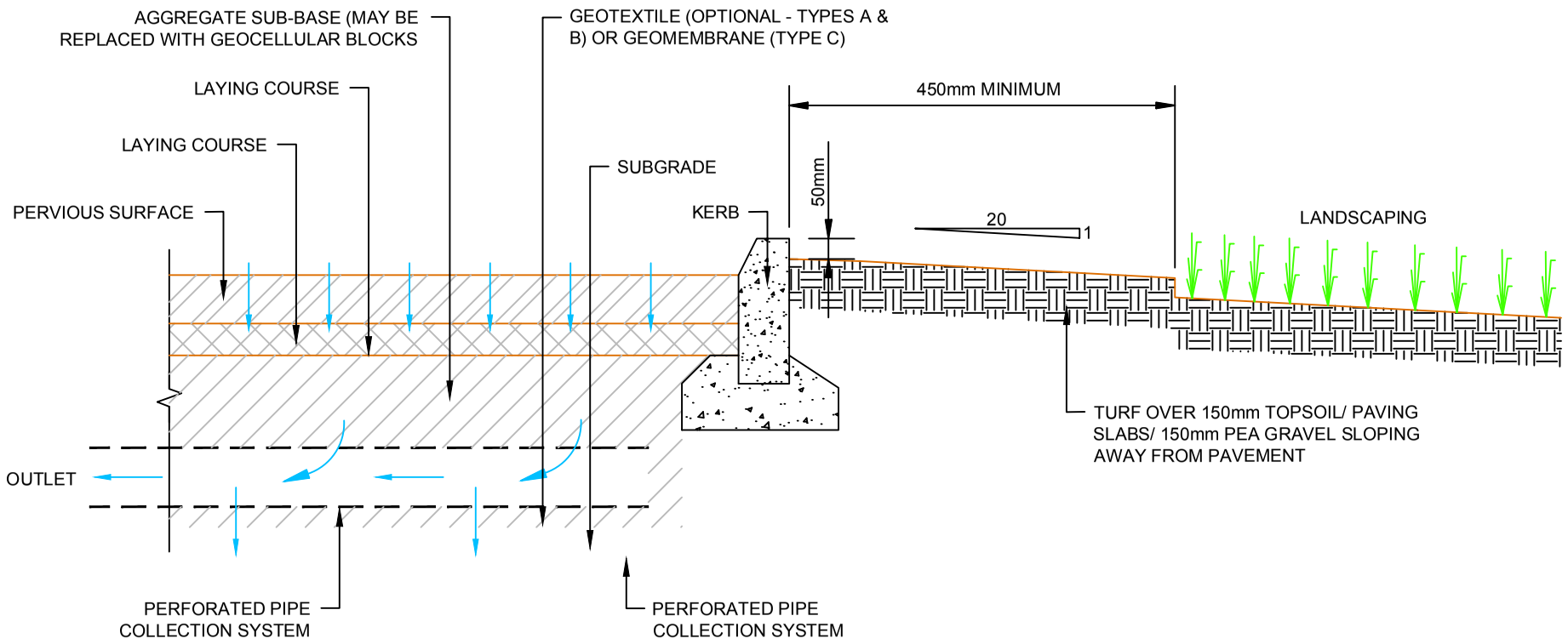


LANDSCAPING DETAIL

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

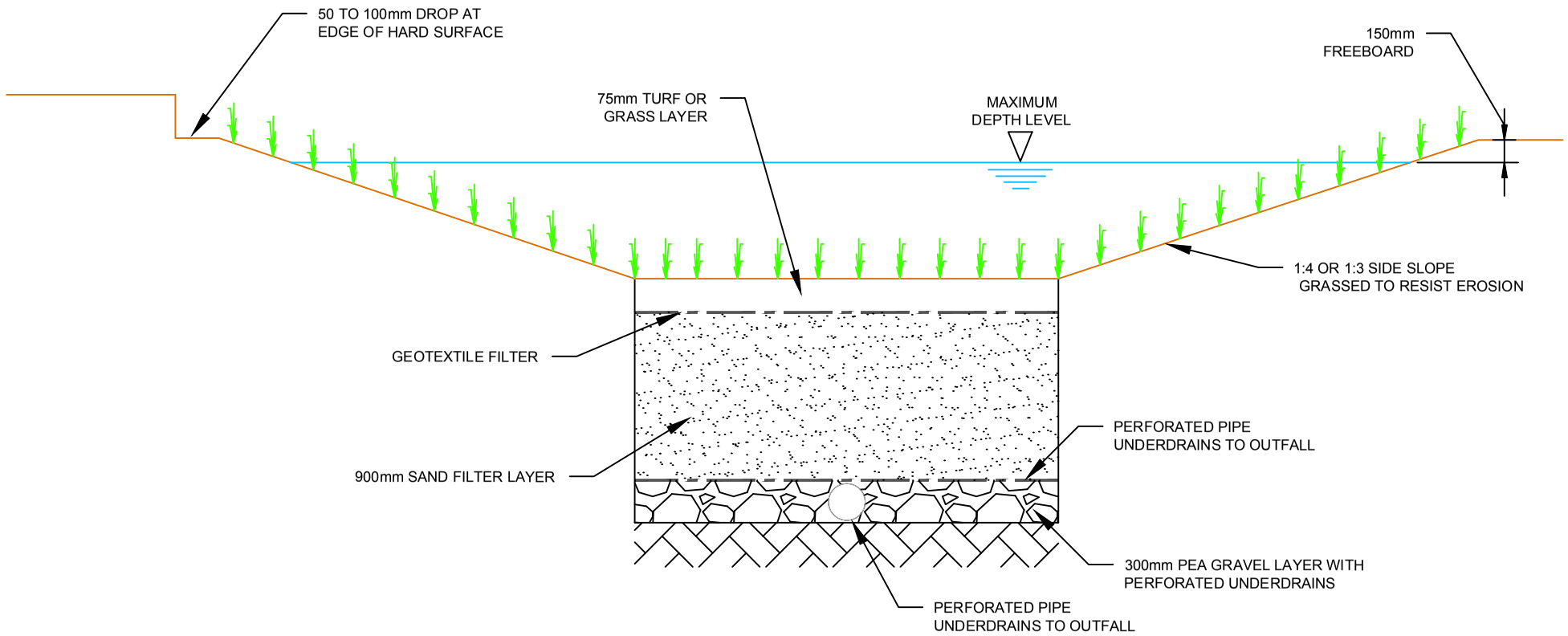
PROJECT: TYPICAL SUDS DETAIL

TITLE: PERVIOUS PAVEMENTS

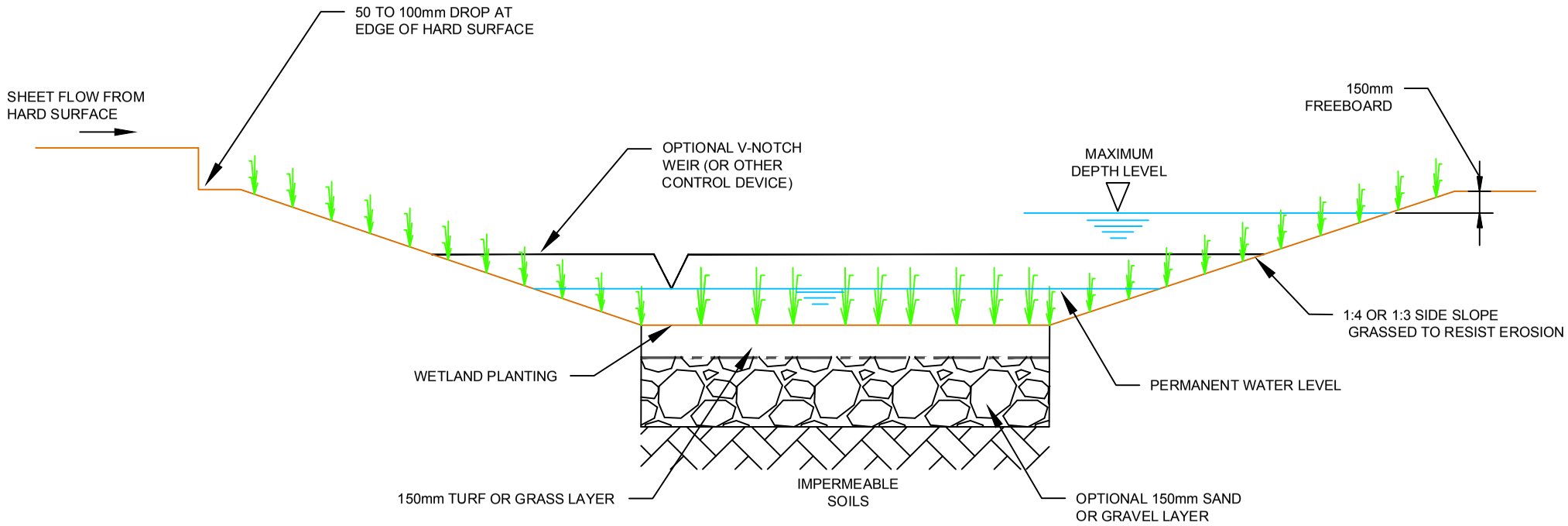
DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
SEP 2014	@ A3	CP	RDN

PROJECT No:	DRAWING No:	REV:
BETTS	105	A

DO NOT SCALE



DRY SWALE



WET SWALE

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

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PROJECT: TYPICAL SUDS DETAIL

TITLE: SWALES (1 of 2)

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
SEP 2014	@ A3	CP	RDN

PROJECT No:	DRAWING No:	REV:
BETTS	103	A

APPENDIX O: NOTES AND LIMITATIONS

The data essentially comprised a study of available documented information from various sources together with discussions with relevant authorities and other interested parties. There may also be circumstances at the site that are not documented. The information reviewed is not exhaustive and has been accepted in good faith as providing representative and true data pertaining to site conditions. If additional information becomes available which might impact our conclusions, we request the opportunity to review the information, reassess the potential concerns and modify our opinion if warranted.

It should be noted that any risks identified in this report are perceived risks based on the available information.

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