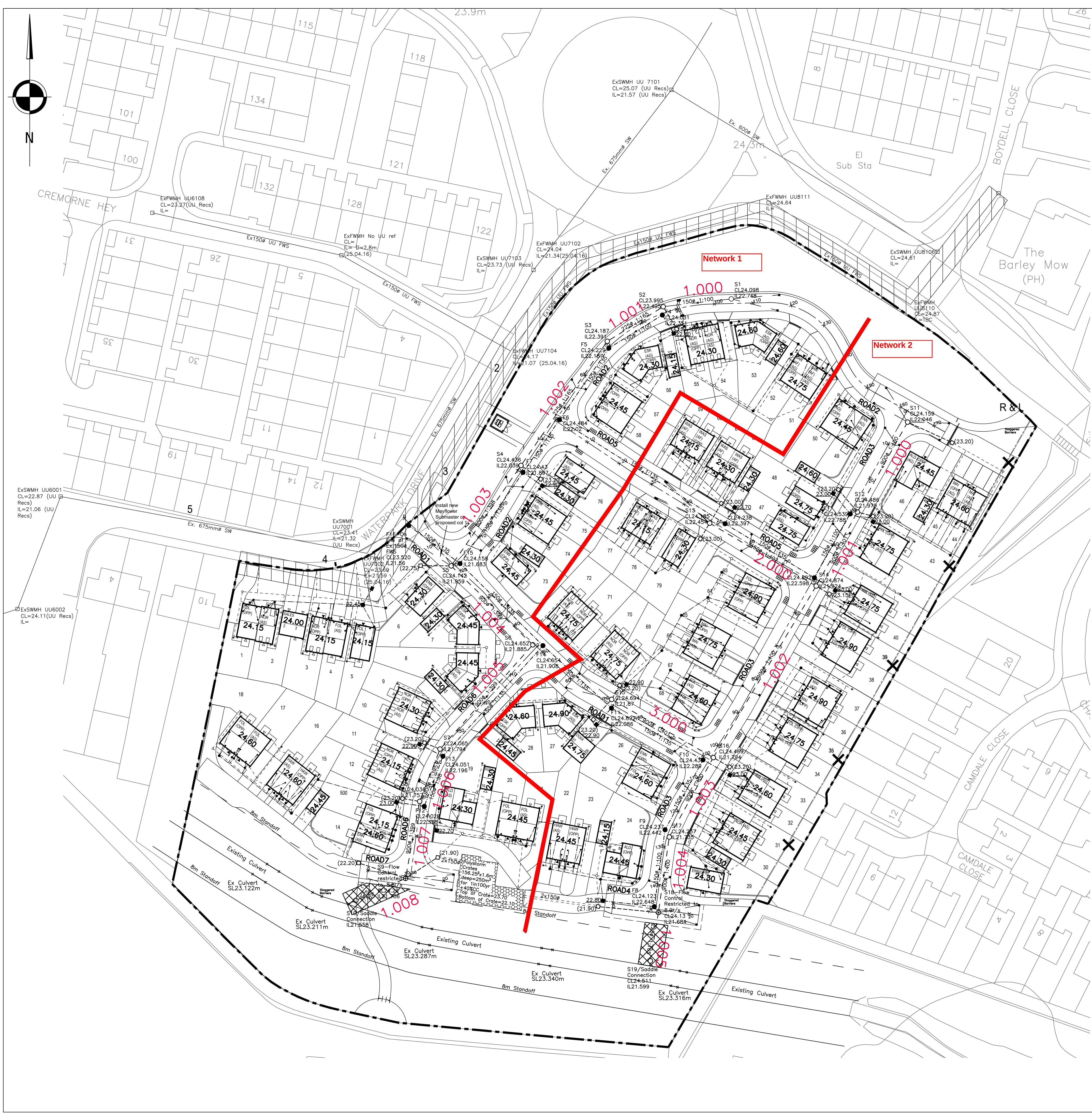




KEY

- 19 PROPOSED 6 METRE NOMINAL HEIGHT TUBULAR LIGHTING COLUMN PAINTED AIRCRAFT GREY (BS381693), COMPLETE POST TOP MOUNTED LANTERN (AIRCRAFT GREY) (WRTL PHILIPS SS CHIP, MICRO LUMA 4.2x1.20 NW LEDS WITH DNO55 REFLECTOR AT 0 DEGREE TILT (20W)) - ORDER CODE - MC15820A 2DWSNWDCTPTMFMNM1.5
- 7 INSTALL SMARTSCAPE NEW ROOT MOUNTED ZETALED SOLAR BOLLARDS INSTALLED DURING PFI WORKS, MOVE UNIT 3M TO LOCATION SHOWN BY SYMBOL DUE TO NEW DRIVEWAY, RETAIN EXISTING LANTERN AND OPTIC SETTING, TRANSFER EXISTING DNO SUPPLY
- 3 EXISTING DEEMED TO COMPLY COLUMN (FOR INFORMATION ONLY)
- 3R & L PROPOSED 6 METRE NOMINAL HEIGHT TUBULAR LIGHTING COLUMN PAINTED AIRCRAFT GREY (BS381693), COMPLETE POST TOP MOUNTED LANTERN (AIRCRAFT GREY) (WRTL PHILIPS SS CHIP, MICRO LUMA 2.2x1.12 NW LEDS WITH DNO10 REFLECTOR AT 0 DEGREE TILT (14W)) - ORDER CODE - MC155122 2DWSNWDCTPTMFMNM1.5
- 5 X EXISTING COLUMN TO BE REMOVED

- ALL COLUMNS TO BE TUBULAR GALVANISED STEEL PAINTED AIRCRAFT GREY (BS381693) INSTALLED AT BACK EDGE OF PATH UNLESS STATED OTHERWISE
- ALL LANTERNS TO BE PAINTED AIRCRAFT GREY (BS381693)
- ALL NON-ILLUMINATED SIGNS TO BE MOUNTED ON NEW 78MM ROUND POST UNLESS STATED OTHERWISE, SIGN TO BE INSTALLED TO GIVE 2.1M HEIGHT CLEARANCE
- ALL NEW ILLUMINATED SIGNS TO BE INSTALLED ON NEW 3M WIDE BASED POLE SIGN TO BE INSTALLED TO GIVE 2.1M HEIGHT CLEARANCE
- ALL ILLUMINATED EQUIPMENT TO BE FED VIA DNO LOW VOLTAGE MAINS NETWORK (UNLESS OTHERWISE STATED)
- ALL PRIVATE CABLE TO BE INSTALLED IN 100MM ORANGE DUCTING
- ALL PRIVATE CABLE ROUTES TO BE SHOWN ON AS-BUILT DRAWING
- ALL PRIVATE BOLLARDS TO BE FED FROM PLOTS AND TO BE THE RESPONSIBILITY OF THE DEVELOPER
- LIGHTING COLUMNS TO BE INSTALLED AS PER STANDARD DETAILS SSEL/SD01, SSEL/SD02, SSEL/SD016 & SSEL/SD017 AND IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS

ENGINEERING KEY

- S1 Adoptable S.W. Sewer & Manhole
- F1 Adoptable F.W. Sewer & Manhole
- (10.25) S. Water Drag-Out and Invert
- 10.25 S. Water Drag-Out and Invert
- Adoptable Road Gully
- Street Name Plate

ENGINEERING LAYOUT NOTES

1. All adoptable drainage works have been designed and are to be constructed in accordance with 'Sewers for Adoption, 6th Edition', and United Utilities 'Guidelines for Sewer for Adoption 6th Edition'. Where specification conflicts, UU guidelines shall take precedence.
- United Utilities Standard details to be used are:
SIND/19/001A Manhole Type 1
SIND/19/002A Manhole Type 2 and Invert Access Detail
SIND/19/003A Shallow Manhole Detail for Small Diameter Pipes (Type 4)
SIND/19/004A Shallow Surface Water Manhole Detail - Restricted Headroom (less than 2.0m) - For Pipe Sizes 4500mm and Above
SIND/19/005A Flow Control Manhole Detail
SIND/19/007A External Borehole Detail
SIND/19/008A Pipe Bedding Detail
SIND/19/010A Variable Manhole - Guidance Notes
SIND/19/011A Headwall Type 1 and Typical Outlet Grille Detail
SIND/19/012A Typical Outfall Details Type 2 & Type 3
2. All clay pipe work shall be Extra Strength Clayware to BS 295 and BS 65 (SW pipes only).
3. All precast concrete pipework shall be to Class 120 in accordance with BS5911 Part 1, BS EN 1916 and bear the BS Mark.
4. All adoptable drainage to be bedded in Class S granular surround unless otherwise stated.
5. All concrete manholes and soakways rings, concrete cover slabs and Con to be manufactured to BS EN 1917 and BS 5911 Part 3.
6. Rising Mains to be Black Polyethylene Pipes complying to BS EN 13244-2. Polyethylene fittings, including fusion joints, and electro-fusion fittings shall comply with BS EN 13244-2.
7. All levels relate to Ordnance Datum. Contractor to ensure that this drawing is read in conjunction with the site specific Topographical Survey provided by Barratt Manchester and the Benchmark information provided.
8. This drawing is to be read in accordance with all other relevant drawings.
9. The contractor shall be responsible for ensuring that any existing invert levels indicated on the drawings are correct before work commences.
10. All proposed connections to the sewer shall be 1500 unless stated otherwise.
11. All private house drainage shall be 1000 and all drop-out connections shall be 1500 at a minimum gradient of 1:80 unless otherwise stated and laid in accordance with Part H of the Building Regulations.
12. Runoff from private surfaces shall not discharge across the highway. Gullies or channels shall be provided as appropriate to prevent this.
13. Pram crossings shall be provided at the inner tangent points of all junctions.
14. Pipes shall be protected from concentrated loading by construction traffic during the construction period when insufficient cover to the pipe may make them vulnerable to damage.
15. Install CBR tests of the road formation level are to be carried out to determine the depth of pavement construction required. This is to be approved by the adopting authority prior to construction of the road pavements.
16. Groundwater to ensure that plot drainage be within the curtilage of the plot they serve where possible and inspection covers kept within handstandings where possible.
17. Contractor to provide United Utilities with sufficient notice prior to commencement of Sewer works on their inspections telephone number. Tel 0845 602 0406.
18. Contractor to obtain all necessary Highway opening notices from the relevant Local Authority, obtain approval to work on United Utilities Sewerage System, obtain approval to method statement from the Environment Agency for any works affecting a watercourse.

WARNING TO HOUSE-PURCHASERS
Property Misdescriptions Act 1991

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X	Polystorm crates amended to be outside 8m standoff to watercourse.	20.09.18	DK
W	Plot drainage routes changed on plots 7-8, 25-28, 53 & 56 to suit architect drawing.	28.08.18	LB
V	Overflow Area levels revised. Culvert 8m stand-off added. Lighting Bollards 0/s plot 18-18 repositioned to avoid culvert Standoff.	27.07.18	SPG
U	Planning Layout updated to Rev Q	28.06.18	SPG
T	Dragout levels for F1,F2,F10,F12,F13 amended to avoid clashes with SW.	07.06.18	DK
S	Street lighting column (number 8) relocated. R&L column added to footpath access way to the north-east of the site. Existing columns to be removed also shown - private street lighting key updated to suit.	17.04.18	FB
R	Dragout to plot 79 from F3 removed. Plot drainage amended to suit.	22.03.18	DK
Q	Overflow areas amended. Planning layout rev P used.	12.03.18	DK
P	Culvert diversion removed. Overflow area added to POS. Drainage revised to suit. Street lighting bollards added to the south of the site.	16.02.18	SPG
N	Staggered Barriers added.	11.01.18	FB
M	L Plot 24 FFL amended to 24.45.	10.01.18	DK
L	K Road & drainage lifted 100mm to suit higher surveyed invert than originally designed.	02.01.18	DK
J	Driveway splay added & gully positions revised to suit LA Highways comments.	08.11.17	DK
H	Street lighting & street lighting key added.	05.10.17	FB
G	ACO drains added to driveways where they fall towards adoptable highway. Plot drainage for plots 44-46 corrected.	05.07.17	DK
F	Plot Garages 19, 30, 76 FFLs changed.	28.06.17	BM
E	Plot drainage amended for plots 01-05, 28 garage, 29-43 & 71-72.	27.06.17	FB
D	SW outfalls amended to tie in with Betts watercourse modelling.	21.06.17	DK
C	Road & Sewer design amended to suit latest planning layout.	09.05.17	DK
B	Plot 25-26 FFL raised 150mm to tie in with road contour level. Drainage levels amended to suit.	22.03.17	FB
A	Private drainage added for whole site.	24.02.17	FB

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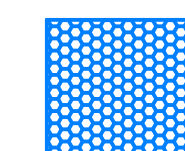
Job		Waterpark Drive Knowsley	
Title		Engineering Layout	
Design By	Date	Drawing Number	Rev
DK	17.01.17	463/ED/02	X
CAD By	Scale @ A1		
DK	1:500		



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KEY



Extent of SUDS to be covered under the Operation & Maintenance Plan.

REV	DESCRIPTION	DATE	DRAW



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4 Brindley Road
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M16 9HQ
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Fax: 0161 855 2828

Job Waterpark Drive Knowsley			
Title SUDS Operation & Maintenance Plan			
Design By SPG	Date 07/01/20	Drawing Number 463/ED/32	Rev -
C.A.D By SPG	Scale @ A1 1:500		

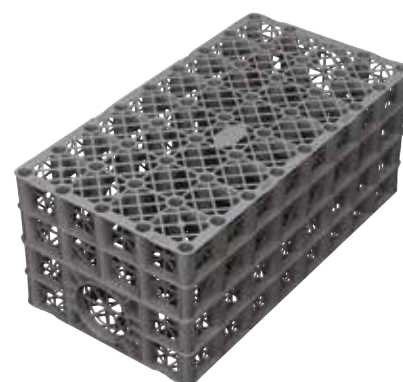
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REV	DESCRIPTION	DATE	DRAWN
 BARRATT HOMES MANCHESTER Barratt Homes Manchester (A division of BDW Trading Ltd) 4 Brindley Road City Park Manchester M16 9HQ Tel: 0161 872 0161 Fax: 0161 855 2828			
Job Waterpark Drive Knowsley			
Title Polystorm Crate Details			
Design By DK	Date 07.02.19	Drawing Number 463-ED-29	Rev -
C.A.D By DK	Scale @ A1 As Shown		

Product code: PSM1

The Polystorm cell made of virgin material, has a 44 tonnes/m² compressive strength. It is ideally suited for retention, attenuation or infiltration under trafficked or loaded areas at greater depths, such as car parks, housing and commercial developments. An efficient and versatile solution for SuDS compliance, it is hard-wearing, lightweight and provides a 95% void ratio for maximum water capture.



Key Benefits

- Compressive strength of 44 tonnes/m²
- Ideal for retention, attenuation or infiltration applications with a suitable geomembrane or geotextile
- Designed for trafficked and loaded conditions
- BBA approved
- Visual and maintenance access can be achieved when used in conjunction with Polystorm Access & Inspect
- Can be used as part of a value engineered hybrid system with Polystorm Xtra & Polystorm Lite
- Integrated inlet and outlet
- 3D flow throughout the structure
- 95% void ratio
- 100% recyclable
- 50 years creep limited life expectancy

Technical Support

Detailed guidance and assistance is available.

For further information, please contact our Technical Team on **+44 (0) 1509 615100** or email civils@polypipe.com



ELEMENT	VALUE
PHYSICAL PROPERTIES	
Length	1m
Width	0.5m
Depth	0.4m
Total volume	0.2m ³
Unit weight	9kg
Unit storage volume	0.19m ³ (190 litres)
Void ratio	95%
SHORT TERM COMPRESSIVE STRENGTH	
Vertical	Maximum 440kN/m ² **
Lateral	Maximum 63kN/m ² **
SHORT TERM DEFLECTION	
Vertical	83kN/m ² per mm
Lateral	4.2kN/m ² per mm
OTHER PROPERTIES	
Maximum burial depths:	
Light trafficked	3.7m***
Non-trafficked	3.8m***

* Each unit includes 4 Clips and 2 Shear Connectors.

** Compressive strength at yield, maximum recommended value for design purposes.

*** Based on ground conditions being dense sand and gravel with no groundwater present using the calculation methodology detailed within CIRIA C680 (2008). Where ground conditions differ please consult our water management solutions technical department on +44 (0) 1509 615100.

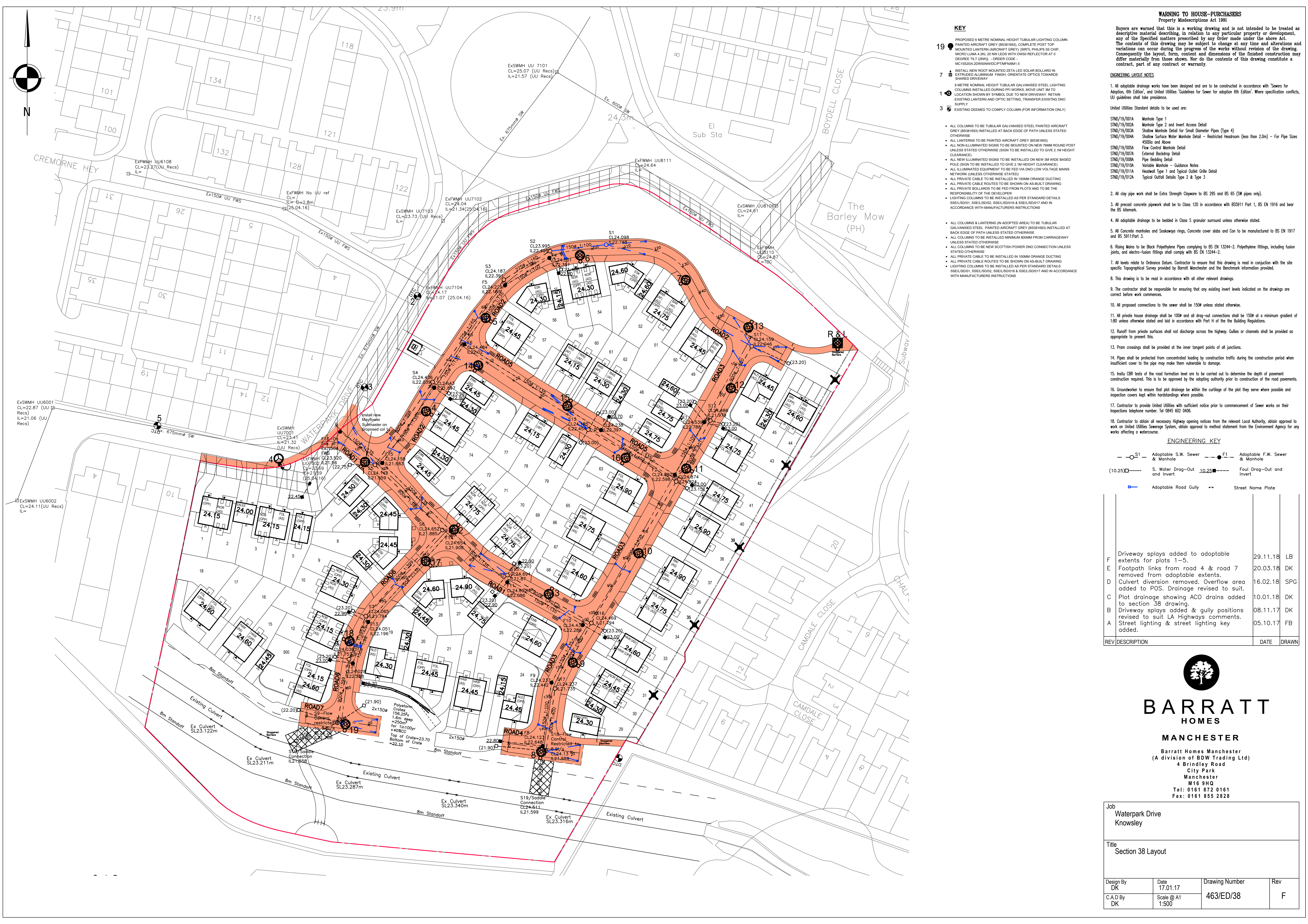
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www.polypipe.com/wms



KEY

- 19 PROPOSED 6 METRE NOMINAL HEIGHT TUBULAR LIGHTING COLUMN
PAINTED AIRCRAFT GREY (BS38189), COMPLETE POST TOP
MOUNTED LANTERN (AIRCRAFT GREY) (MFL PHILIPS SS CHIP,
MICRO LUMA 4.24, 20 W/WS LED WITH Ø160 REFLECTOR AT 0
DEGREE TILT (ØW)) - ORDER CODE -
MC16S204 20W50WDCPTMFMN6M 1.5
- 7 INSTALL NEW ROOT MOUNTED ZETA LED SOLAR BOLLARD IN
EXTRUDED ALUMINIUM FINISH, ORIENTATE OPTICS TOWARDS
SHARED DRIVEWAY
- 6 METRE NOMINAL HEIGHT TUBULAR GALVANISED STEEL LIGHTING
COLUMNS INSTALLED DURING PFI WORKS, MOVE UNIT 3M TO
LOCATION SHOWN BY SYMBOL DUE TO NEW DRIVEWAY, RETAIN
EXISTING LANTERN AND OPTIC SETTING, TRANSFER EXISTING DNO
SUPPLY
- 3 EXISTING DEEMED TO COMPLY COLUMN (FOR INFORMATION ONLY)
- ALL COLUMNS TO BE TUBULAR GALVANISED STEEL PAINTED AIRCRAFT
GREY (BS38189) INSTALLED AT BACK EDGE OF PATH UNLESS STATED
OTHERWISE
- ALL LANTERNS TO BE PAINTED AIRCRAFT GREY (BS38189)
- ALL NON-ILLUMINATED SIGNS TO BE MOUNTED ON NEW 76MM ROUND POST
UNLESS STATED OTHERWISE (SIGN TO BE INSTALLED TO GIVE 2.1M HEIGHT
CLEARANCE)
- ALL NEW ILLUMINATED SIGNS TO BE INSTALLED ON NEW 3M WIDE BASED
POLE (SIGN TO BE INSTALLED TO GIVE 2.1M HEIGHT CLEARANCE)
- ALL ILLUMINATED EQUIPMENT TO BE FED VIA DNO LOW VOLTAGE MAINS
NETWORK (UNLESS OTHERWISE STATED)
- ALL PRIVATE CABLE TO BE INSTALLED IN 100MM ORANGE DUCTING
- ALL PRIVATE CABLE ROUTES TO BE SHOWN ON AS-BUILT DRAWING
- ALL PRIVATE BOLLARDS TO BE FED FROM PLOTS AND TO BE THE
RESPONSIBILITY OF THE DEVELOPER
- LIGHTING COLUMNS TO BE INSTALLED AS PER STANDARD DETAILS
SSEL/SD01, SSEL/SD02, SSEL/SD016 & SSEL/SD017 AND IN ACCORDANCE
WITH MANUFACTURERS INSTRUCTIONS

- ALL COLUMNS & LANTERNS (IN ADOPTED AREA) TO BE TUBULAR
GALVANISED STEEL PAINTED AIRCRAFT GREY (BS38189) INSTALLED AT
BACK EDGE OF PATH UNLESS STATED OTHERWISE
- ALL COLUMNS TO BE INSTALLED MINIMUM 800MM FROM CARRIAGEWAY
UNLESS STATED OTHERWISE
- ALL COLUMNS TO BE NEW SCOTCH POWER DNO CONNECTION UNLESS
STATED OTHERWISE
- ALL PRIVATE CABLE TO BE INSTALLED IN 100MM ORANGE DUCTING
- ALL PRIVATE CABLE ROUTES TO BE SHOWN ON AS-BUILT DRAWING
- LIGHTING COLUMNS TO BE INSTALLED AS PER STANDARD DETAILS
SSEL/SD01, SSEL/SD02, SSEL/SD016 & SSEL/SD017 AND IN ACCORDANCE
WITH MANUFACTURERS INSTRUCTIONS

WARNING TO HOUSE-PURCHASERS
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any of the Specified matters prescribed by any Order made under the above Act.
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variations can occur during the progress of the works without revision of the drawing.
Consequently the layout, form, content and dimensions of the finished construction may
differ materially from those shown. Nor do the contents of this drawing constitute a
contract, part of any contract or warranty.

ENGINEERING LAYOUT NOTES

1. All adoptable drainage works have been designed and are to be constructed in accordance with 'Sewers for
Adoption, 6th Edition', and United Utilities 'Guidelines for Sewer for adoption 6th Edition'. Where specification conflicts,
UU guidelines shall take precedence.

United Utilities Standard details to be used are:

- STND/19/001A Manhole Type 1
STND/19/002A Manhole Type 2 and Invert Access Detail
STND/19/003A Shallow Manhole Detail for Small Diameter Pipes (Type 4)
STND/19/004A Shallow Surface Water Manhole Detail - Restricted Headroom (less than 2.0m) - For Pipe Sizes
400dia and Above
STND/19/005A Flow Control Manhole Detail
STND/19/007A External Backdrop Detail
STND/19/008A Pipe Bedding Detail
STND/19/010A Variable Manhole - Guidance Notes
STND/19/011A Headwall Type 1 and Typical Outlet Grille Detail
STND/19/012A Typical Outfall Details Type 2 & Type 3

2. All clay pipe work shall be Extra Strength Clayware to BS 235 and BS 65 (SW pipes only).
3. All precast concrete pipework shall be to Class 120 in accordance with BS5911 Part 1, BS EN 1916 and bear
the BS kilomark.
4. All adoptable drainage to be bedded in Class S granular surround unless otherwise stated.
6. Rising Mains to be Black Polyethylene Pipes complying to BS EN 13244-2. Polyethylene fittings, including fusion
joints, and electro-fusion fittings shall comply with BS EN 13244-2.
7. All levels relate to Ordnance Datum. Contractor to ensure that this drawing is read in conjunction with the site
specific Topographical Survey provided by Barratt Manchester and the Benchmark information provided.
8. This drawing is to be read in accordance with all other relevant drawings.
9. The contractor shall be responsible for ensuring that any existing invert levels indicated on the drawings are
correct before work commences.
10. All proposed connections to the sewer shall be 150W unless stated otherwise.
11. All private house drainage shall be 100W and all drag-out connections shall be 150W at a minimum gradient of
1:80 unless otherwise stated and laid in accordance with Part H of the Building Regulations.
12. Runoff from private surfaces shall not discharge across the highway. Gullies or channels shall be provided as
appropriate to prevent this.
13. From crossings shall be provided at the inner tangent points of all junctions.
14. Pipes shall be protected from concentrated loading by construction traffic during the construction period when
insufficient cover to the pipe may make them vulnerable to damage.
15. Insitu CBR tests of the road formation level are to be carried out to determine the depth of pavement
construction required. This is to be approved by the adopting authority prior to construction of the road pavements.
16. Groundwater to ensure that plot drainage be within the curtilage of the plot they serve where possible and
inspection covers kept within handstandings where possible.
17. Contractor to provide United Utilities with sufficient notice prior to commencement of Sewer works on their
Inspections telephone number: Tel 0845 602 0406.
18. Contractor to obtain all necessary Highway opening notices from the relevant Local Authority, obtain approval to
work on United Utilities Sewerage System, obtain approval to method statement from the Environment Agency for any
works affecting a watercourse.

ENGINEERING KEY

- Adoptable S.W. Sewer & Manhole
- Adoptable F.W. Sewer & Manhole
- S. Water Drag-Out and Invert
- Foul Water Drag-Out and Invert
- Adoptable Road Gully
- Street Name Plate

REV	DESCRIPTION	DATE	DRAWN
F	Driveway spays added to adoptable extents for plots 1-5.	29.11.18	LB
E	Footpath links from road 4 & road 7 removed from adoptable extents.	20.03.18	DK
D	Culvert diversion removed. Overflow area added to POS. Drainage revised to suit.	16.02.18	SPG
C	Plot drainage showing ACO drains added to section 38 drawing.	10.01.18	DK
B	Driveway spays added & gully positions revised to suit LA Highways comments.	08.11.17	DK
A	Street lighting & street lighting key added.	05.10.17	FB



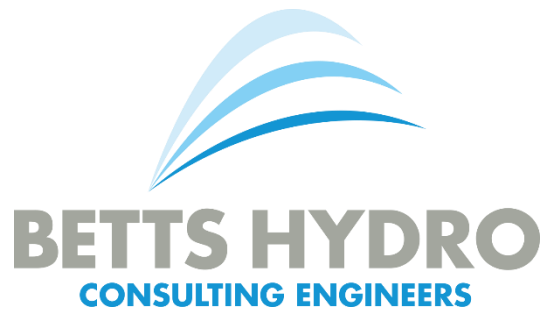
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Job Waterpark Drive Knowsley			
Title Section 38 Layout			
Design By DK	Date 17.01.17	Drawing Number 463/ED/38	Rev F
C.A.D By DK	Scale @ A1 1:500		

Appendix A



LAND OFF WATERPARK DRIVE KNOWSLEY

FLOOD RISK ASSESSMENT AND DRAINAGE MANAGEMENT STRATEGY



For

Barratt Homes
4 Brindley Road
City Park
Manchester
M16 9HQ



JANUARY 2018

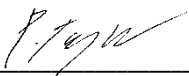
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**WATERPARK DRIVE
KNOWSLEY**

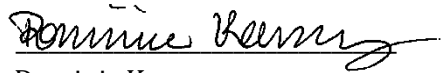
**FLOOD RISK ASSESSMENT AND
DRAINAGE MANAGEMENT STRATEGY**

Document Tracking Sheet

Document Reference: HYD104.WATERPARK.DRIVE.KNOWSLEY_FRA&DMS
Revision: 3
Date of Issue: 25th January 2018
Report Status: FINAL

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Director

Revision History:

Rev.:	Date:	Status:	Prepared by:	Checked by:	Issued by
3	25.01.18	Final	PT	KW/DK	PT
2.	24.01.17	Final	PT	KW/DK	PT
1.	16.01.17	Final	PT	KW/DK	PT
0.	02.11.16	Draft	PT	KW/DK	PT



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EXECUTIVE SUMMARY

This Flood Risk Assessment and Drainage Management Strategy was commissioned by Barratt Homes, referred to hereafter as 'the client'. This report has been prepared to support a planning application for the construction of a residential development on land east of Waterpark Drive in Knowsley.

Flood Risk

The site lies solely within Flood Zone 1 based on the Environment Agency Flood Map for Planning and covers 2.906ha. 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 when 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. The River Alt is the nearest main river to the site and is culverted through the southern portion of the site. Consultations with the Environment Agency, United Utilities and Knowsley Metropolitan Borough Council did not identify any historical incidents of flooding onsite associated with River Alt, therefore the flood risk from this source is considered to be low.

Overall the site is considered to be at 'low' flood risk from the majority of flood sources reviewed. The primary flood risk is considered to be from surface water flooding, this risk varies from 'low' to 'high' within the site and is associated with the existing topography onsite. The risk associated with surface water flooding will be reduced as part of the proposals following the implementation of mitigation measures proposed within this assessment and inclusion of a sustainable surface water management regime.

Drainage Strategy

Due to the low flood risk identified, the principle focus of this report is on the effective management of surface water drainage. Based on the ground conditions identified online it is unlikely that infiltration will be a viable drainage solution for the surface water run-off generated by the development. In accordance with the LPA and UU's requirements, Soakaway Testing to BRE365 will still likely be required, to evidence that discharge to ground will not be a viable solution prior to pursuing other options identified in the hierarchical approach.

Under the hierarchical approach, if infiltration is not feasible (following testing), the next option should be discharge to a watercourse. The proposals are therefore to discharge the surface water run-off generated by the development to the culverted River Alt which crosses the southern portion of site.

Detailed design will be required to confirm the feasibility of this strategy following more in-depth review of layout and levels. Consent for outfall to the Main River will be required from the Environment Agency and the discharge rates should be discussed at an early stage with both the Environment Agency and Knowsley Borough Council (Lead Local Flood Authority) to secure a positive outfall solution.

The proposals are to consider the whole developable area as greenfield and the discharge rate from the site is proposed to mimic the existing greenfield rates. Two outfalls are proposed to satisfy the drainage and indicative layout with an overall discharge rate of 11.5l/s in the 1 in 1 year period event, a rate of 22.3l/s in the 1 in 30year and 27.4l/s in the 1 in 100 year event.

Should intrusive investigations and/or discussion with the relevant parties identify a more stringent discharge rate is required then this will be addressed during detailed drainage design. The restricted flow will generate a storage requirement during the extreme events. The stormwater storage figures quoted are estimates only based on the restricted discharge rates. During the 1 in 100yr event with a 40% allowance for climate change the estimate attenuation onsite will be between 497cu.m to 712cu.m.

Opportunities should be taken to provide soft landscaping where at all possible on site to assist in minimising surface water run-off. It would be beneficial to implement SuDS features into the designs and if designed appropriately these features could aid in the attenuation requirements for the proposals.

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

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Specialist Software

-  Flood Estimation Handbook FEH CD-ROM (v.3.0) – Determination of Catchment Descriptors and depths of rainfall.
-  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
FZ	Flood Zone
KMBC	Knowsley Metropolitan Borough Council
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

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 and how planning should facilitate and promote sustainable patterns of development, avoiding flood risk and accommodating the impacts of climate change.
- 1.1.2 Government policy with respect to development in flood risk areas is contained within the NPPF and the supporting Planning Practice Guidance (refer to extracts in **Appendix A**).
- 1.1.3 This Flood Risk Assessment and Drainage Management Strategy (FRA and DMS) has been completed in accordance with NPPF/PPG to review all sources of flood risk both to and from the proposed development. Furthermore, to identify the potential drainage strategy options including the implementation of Sustainable Drainage Systems (SuDS) in line with the recent changes to national policy.
- 1.1.4 The proposals are understood to be solely 'residential' in nature and as such is classified as 'more vulnerable' in Table 2: Flood Risk Vulnerability Classification within PPG. The PPG confirms that this type of land use is appropriate for Flood Zones 1, providing there is no increase in flood risk elsewhere due to the proposals.

1.2 Site Context

- 1.2.1 This report has been prepared to support a planning application for the construction of a residential development with private amenity areas. The proposals will be complete with access road, footpaths, car parking, external works and lighting, landscaping, boundary walls and fencing, external services and drainage on land off of Waterpark Drive, Knowsley (Merseyside).
- 1.2.2 Aerial imagery shows the site is predominately undeveloped at present, comprising of low density vegetation, trees and a short access road to an existing electrical substation. Existing sewer assets are understood to be located within site and the nearest EA designated Main River (River Alt) bisects the site adjacent to the southern boundary (culverted at present).

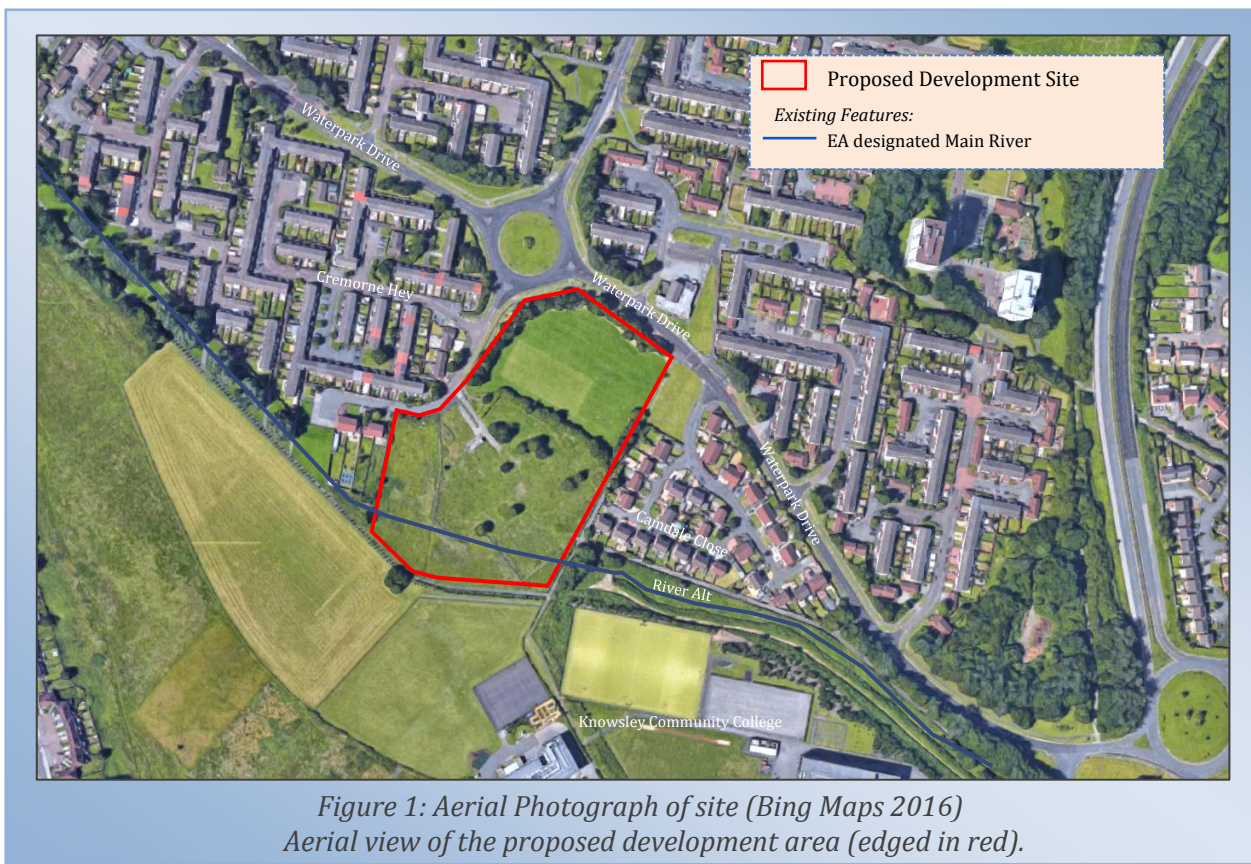
1.3 Consultation

- 1.3.1 The preparation of this report has been undertaken in consultation with the Environment Agency (EA), United Utilities (UU) and Knowsley 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 This site is directly accessed off Waterpark Drive in Knowsley (Merseyside). The Ordnance Survey National Grid Reference (OS NGR) for the site is 342767 (Easting), 392938 (Northing) and the nearest postcode is L28 3QD. The site location plan is shown in **Appendix E**.
- 2.1.2 The **site is 2.906ha** in size and edged in red in **Figure 1**. The site is bounded to the north and west by Waterpark Drive with residential dwellings adjacent to the western boundary, to the east by residential dwellings accessed via Camdale Close and to the south by school playing fields and undeveloped land.



2.2 Existing and Historical Land Use

- 2.2.1 The preparation of this report has identified that the southern portion of the development site, previously housed a school, which has since been demolished in 2011. At present an existing electricity substation and access road are located on the western boundary. The remainder of the site is undeveloped having been previously utilised for agriculture.

2.3 Topography

- 2.3.1 The existing ground levels on site generally fall from 25.04mAOD in the north-western boundary with Waterpark Drive to 23.27mAOD in the western corner as illustrated in **Figure 2**. The area adjacent to the southern boundary features rough ground at a higher elevation (24.62mAOD), a topographical survey has been completed and is included in **Appendix F**.

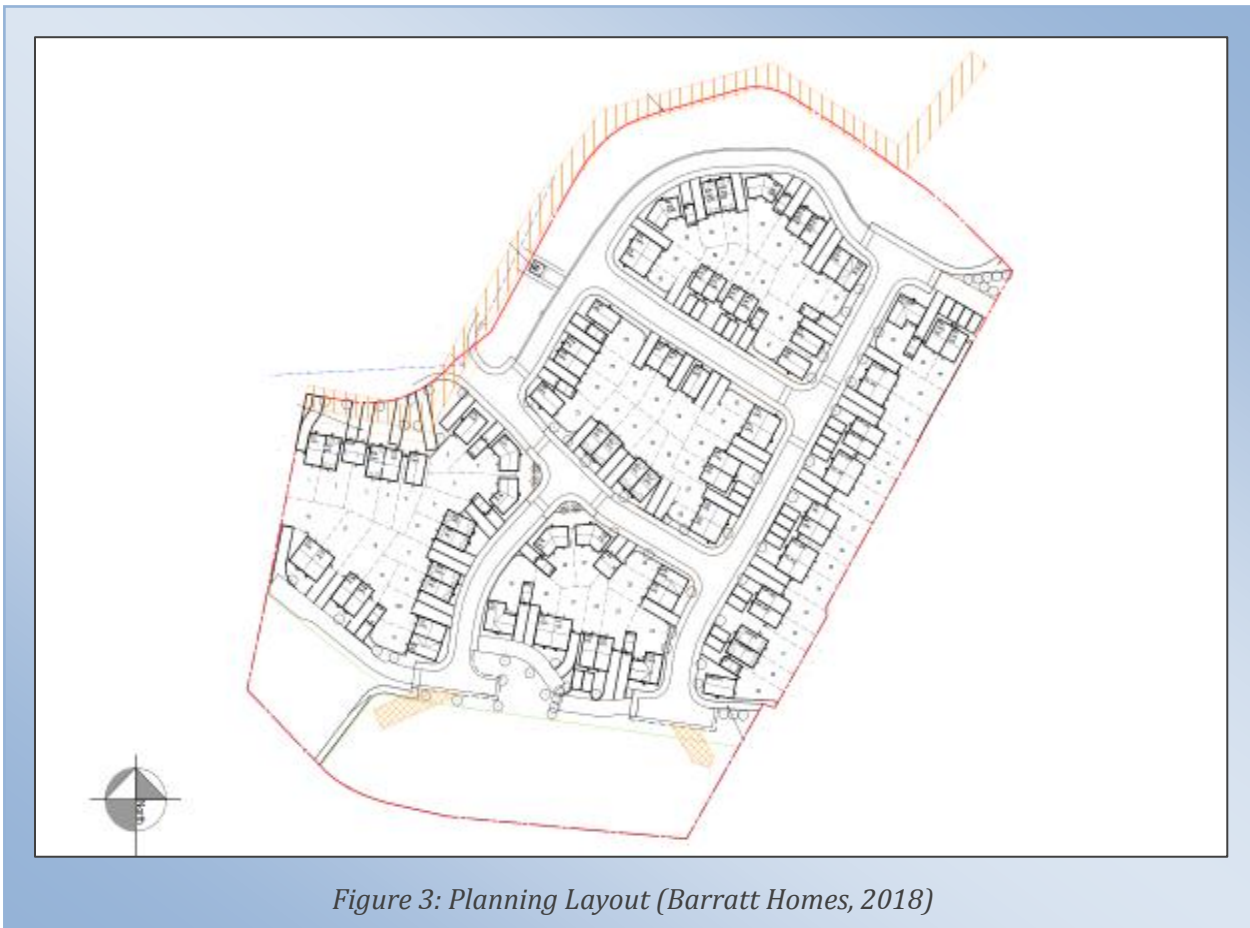


Figure 2: General Topographic Fall Overlay (Google Maps 2016)

3.0 DEVELOPMENT PROPOSALS

3.1 Nature of the development

- 3.1.1 This planning application is for the construction of a residential development on land adjacent to Waterpark Drive in Knowsley. A planning layout has been provided for review as part of this assessment (**Figure 3/Appendix G**) which shows development will be complete with access roads, footpaths, car parking, external works and lighting, landscaping, boundary walls and fencing, external services and drainage.



- 3.1.2 The total site covers 2.906ha with the proposed development area being 2.300ha in size, this excludes those areas of site which are proposed to remain undeveloped as part of the proposals. The site is considered to be less than 2% impermeable at present. In light of the nature and scale of the proposals, the post-development impermeable areas will increase to approximately 54% of the development area (based on the proposals illustrated above).
- 3.1.3 A previously approved planning application on the site (17/00053/FUL) proposed to open up the existing River Alt culvert crossing the south of the site. Hydraulic modelling undertaken as part of this proposal evidenced that there was no increased flood risk due to de-culverting. These proposals for de-culverting however have since been omitted due to unsuitable ground conditions following further intrusive onsite investigations and other engineering constraints.

- 3.1.4 As the River Alt is a Main River, there will be a requirement to provide an easement in accordance with EA guidance, typically an 8m easement from the centre line of the culvert is required. United Utilities (UU) sewer records identify a public foul water (Manhole ref: 7002/225mm dia.) and a separate surface water system (Manhole Ref: 7001/675mm dia.) located on the western boundary of site. Furthermore, a public foul water sewer system runs parallel to the northern boundary, running west. There will be a requirement to provide easements from these assets and early discussion with UU is advised.
- 3.1.5 Typically there is a requirement to consider the incorporation of phases of water treatment within the surface water management strategy in accordance with national policy. SuDS are often an efficient method for improving water quality onsite and Public Open Space (POS) areas are often key locations where SuDS methods can be efficiently incorporated into residential schemes. Detailed drainage design to determine feasibility of including SuDS within the drainage strategy where feasible.

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 4**, which illustrates that the site is located solely 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).

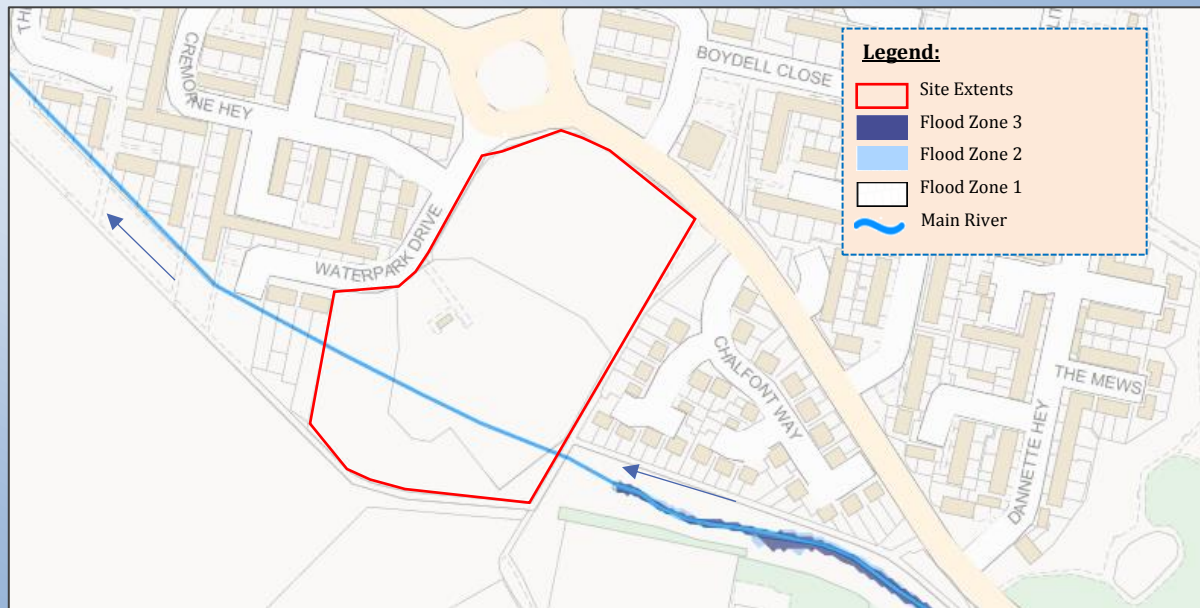


Figure 4: Fluvial/Tidal Flood Planning Map Extract (Environment Agency 2018)

- 4.1.2 The nearest Main River to the development site is the River Alt located within the south of the site. The flood risk from this is considered to be 'low' as the River Alt is culverted at present within the southern portion of the site, as represented in the Governments Long-Term Flood Risk Mapping (see **Appendix B**).
- 4.1.3 The previously approved application on the site proposed that the River Alt culvert, which crosses the site, be opened within site to form a 150m long open channel reach. To support the previous application, hydraulic Modelling was undertaken which considered the existing situation (culvert in place) and the proposed scenario at that time (de-culverting). Modelling of the existing situation indicated that flows up to the 1 in 1000 year return period (0.1% Annual Exceedance Probability) period remain within the river banks for the 2km open channel section upstream of the site, there is therefore limited risk of overland flow to the development site.
- 4.1.4 The existing culvert is 3.675m x 1.875m in size and correspondence with the Environment Agency and Knowsley Metropolitan Borough Council (LLFA) did not identify any historical flood risk associated with the River Alt culvert onsite, including a risk of blockage. Although the new proposals are to retain the existing culverted length the conclusions of the previous hydraulic assessment, where it discusses the existing

situation will remain the same, which is that the flood risk associated with the culverted River Alt crossing site is low.

- 4.1.5 There will be a requirement to provide a maintenance easement from the Main River in accordance with the Environment Agency's guidance, this maintenance easement should provide 8m clear unimpeded access from the centreline of the culvert.
- 4.1.6 The nearest Ordinary Watercourse to site is an unnamed tributary of the River Alt located 900m to the north of the site, risk from this source is also considered low due to the distance from the site and change in elevation from the watercourse towards the site. Review of the Flood Estimation Handbook (FEH) CD-ROM identifies the catchment to be 6.5km (sq.). This is a conservative figure including the whole catchment with the flood risk from this source to be considered to be 'low'.

Safe Access and Egress

- 4.1.6 The proposed access road for the site will be via Waterpark Drive to the west of the site, this is located within Flood Zone 1. Safe access and egress will be maintained via the new proposed access road.

4.2 Tidal Flood Risk

- 4.2.1 The coastline is located over 10km to the west of the site and the Mersey estuary is located approximately 9km away therefore the risks to the development site from tidal related flooding is considered to be 'very low', which is illustrated in the EA's mapping (**Appendix B**).

4.3 Flood Risk Vulnerability Classification and Flood Zone Compatibility

- 4.3.1 The proposals are considered to be solely 'residential' in nature and as such is classified as 'more vulnerable' in Table 2: Flood Risk Vulnerability Classification within the Planning Practice Guidance to the NPPF. Table 2: 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 5**).

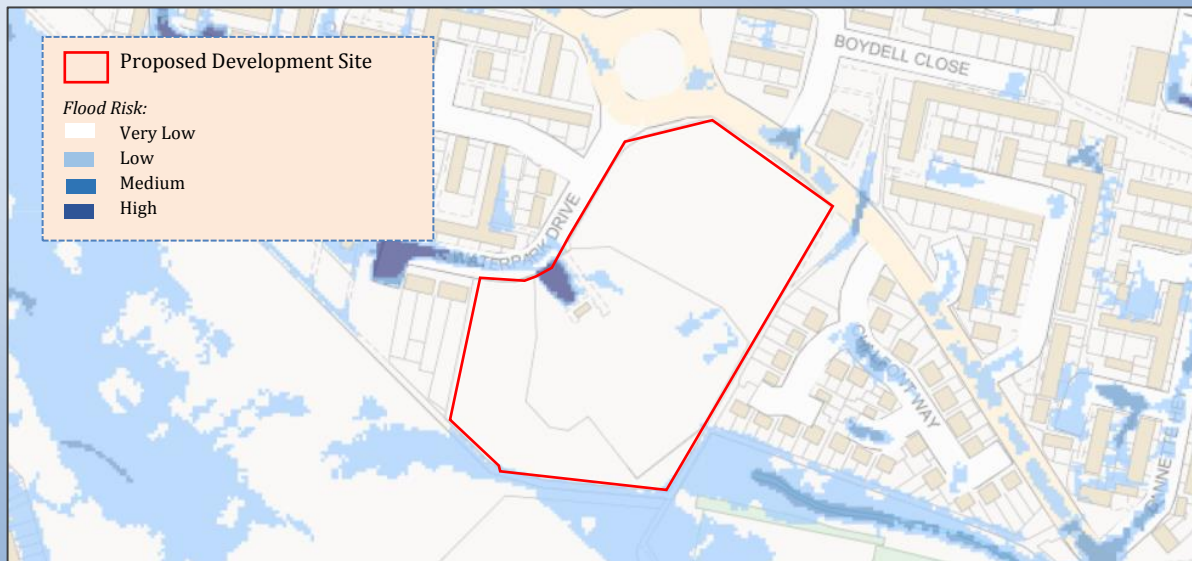


Figure 5: Surface Water Flood Map Extract (Environment Agency 2018)

4.4.2 As indicated in **Figure 5**, the site is shown to be predominantly at 'very low' risk from surface water flooding, with an isolated area of 'low' to 'high' flood risk as illustrated above. A review of existing topography shows this can be attributed to the impermeable surface and low lying topography in this area, resulting in it being more susceptible to ponding in extreme storm events. Areas of low surface water flood risk are also to the east of the site, again associated with existing depressions surrounded by elevated land.

4.4.3 The risk to the proposals from surface water will be reduced, post-development through levels design and sustainable surface water drainage. In order to mitigate any potential residual flood risk from surface water following the implementation of onsite formal drainage infrastructure, it is advised that finished floor levels are raised above the external levels (following any re-grade of the site) to provide overland flood routes for excess surface water run-off.

Pluvial (Overland run-off) Flood Risk

4.4.4 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 proposed development site is surrounded by other development in the form of residential and highways infrastructure. There would be little potential for overland (pluvial) run-off to impact on the development site.

4.4.5 Any overland flows generated by the development must be carefully controlled as the volume and rate of overland flow from land can be exacerbated if development increases the percentage of impermeable area. Safe avenues directing overland flow away from the proposed dwellings and existing adjacent development is advised (**Appendix H**).

Sewer Flood Risk

- 4.4.6 In urban areas, rainwater is frequently drained into surface water sewers or sewers containing both surface and wastewater known as 'combined sewers'. Foul water flooding can result when the sewer is overwhelmed by heavy rainfall and will continue until the water drains away. It can also occur when the sewer becomes blocked or is of inadequate capacity, this could lead to there being a high risk of internal property flooding with contaminated water.
- 4.4.7 Consultation with United Utilities identified no record sewer flooding issues within the vicinity of the proposed development site, as well as no record of flooding incidents within the surrounding areas see **Appendix C** for correspondence.
- 4.4.9 United Utilities (UU) sewer records identify a public foul water (Manhole ref: 7002/225mm dia.) and a separate surface water system (Manhole Ref: 7001/675mm dia.) located on the western boundary of site. Furthermore, a public foul water sewer system runs parallel to the northern boundary, running west as indicated in **Appendix C**. There will be a requirement to provide easements from these assets and discussion with UU is required to confirm their requirements.

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. The site has not been identified in Knowsley Metropolitan Borough Council's PFRA, as being in an area susceptible to groundwater flooding, consultation with interested parties has not highlighted any historical groundwater issues onsite.
 - 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 mapping data for groundwater shows that the site is underlain by 'Principal' Bedrock geology with 'Secondary (undifferentiated)' superficial deposits identified. The site is located within a 'High vulnerability zone to a major aquifer', based on the EA mapping (**Appendix B**).
- 4.5.4 No historical groundwater flooding of the site has been identified during consultation with the various interested parties; however, following any re-grade setting Finished Floor Levels a minimum of 150mm above the external levels should mitigate risk of flooding from this source.

4.6 Artificial Sources of Flood Risk

- 4.6.1 National Planning Policy states that a FRA should consider the potential risks from a variety of sources including the flood risks associated with artificial sources (such as risk from reservoirs and canals).

Reservoirs

- 4.6.2 The EA's online reservoir flood map is included in **Appendix B**, which shows the extents of flooding associated with EA's recognised reservoirs, an extract of such is in **Figure 6**. The EA recognises reservoirs as bodies of water over 25,000 cu.m. (details in **Table 1** on the subsequent page).
- 4.6.3 Based on the mapping the site is considered to be at risk of flooding associated with a failure in the neighbouring reservoir(s) (**Table 1**). The reservoirs Act 1975 means that the Environment Agency ensure reservoirs (over 25,000cu.m) are regularly inspected and safety work is carried out thus meaning a failure or breach in one of these assets is considered highly unlikely.

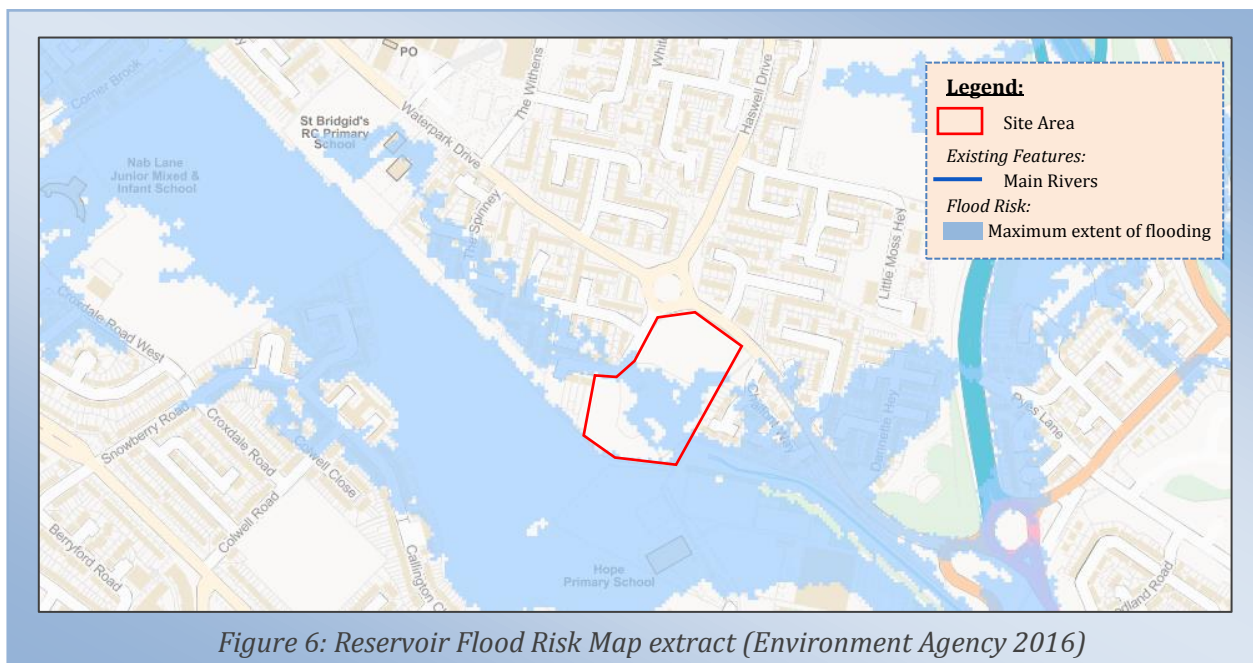


Figure 6: Reservoir Flood Risk Map extract (Environment Agency 2016)

- 4.6.4 It is understood that should a failure occur in an upstream reservoir; a large body of water would potentially escape at once and flooding would occur with little warning. Although reservoir flooding is ‘extremely unlikely’, if a failure was to occur there would be little warning, therefore preparedness is key.

Reservoir	Owner	Lead Local Flood Authority	Grid Reference
Prescot No.4	United Utilities	St Helens	SJ470909112

Table 1: Nearest Reservoir Summary Table (Environment Agency 2018)

- 4.6.5 As the estimated depths and speed of flooding are based on the worst case scenario (a reservoir failing and releasing over 25,000cu.m of water) it is considered unlikely that any flooding due to a reservoir would be this large. The predicted depths from this source of flooding range between 0 to 2 metres within site, with the majority of flood depth below 0.3 metres. The predicted velocity of flows is below 0.5m/s within site.
- 4.6.6 Due to the distance of site in comparison to the identified upstream reservoirs the risk of reservoir flooding to the development should be considered as residual.
- 4.6.7 It is highly recommended that all future owners/tenants are made aware of the risk and advised to prepare a Flood Management Plan should a failure occur in the future; access to the LPA emergency plan is recommended to improve preparedness and resilience.

Canals

- 4.6.8 The nearest identified canal system to the proposed development site is the ‘Leeds and Liverpool Canal’ approximately 6.5km north-west of site. Due to the distance between this source and the site, combined with the understanding of the catchment characteristics, the associated flood risk to site is considered to be **‘low’**.
- 4.6.9 Review of the Preliminary and Strategic Flood Risk Assessments did not indicate any historic flooding within the vicinity of site, due to artificial sources.
- 4.6.10 No previous flooding due to such has been recorded at or surrounding the development site. It is advised that external levels fall away from any existing/proposed buildings (where feasible) to minimise the flood risk. By keeping the Finished Floor Levels elevated, an overland flood flow route will be created in the event of any source of flooding leading to overland flow.

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 site. Review of Knowsley Metropolitan Borough Council Strategic Flood Risk Assessment (SFRA) and Preliminary Flood Risk Assessment (PFRA) did not highlight any historic flooding to the site and the surrounding area (general mapping data is included in **Appendix I**).
- 4.7.2 Consultations have been undertaken with EA, UU and KMBC (see **Appendix B, C and D** respectively). Consultations failed to identify any historical flooding directly to the site.

4.8 Flood Risk Mitigation Measures & Residual Risks

- 4.8.1 The development site is identified on the EA flood mapping to be located within Flood Zone 1, due to the uncertainties of future climate change some mitigation measures are discussed below to assist with safeguarding the proposals for their design life.

Mitigation Measures

- 4.8.2 As with any development it is also advised that external levels fall away from properties to minimise the flood risk from a variety of source, in accordance with the standard guidance the Finished Floor Levels onsite should be raised a minimum of 150mm above the external levels (following any re-grades) to mitigate any residual risks associated with groundwater and surface water flooding.
- 4.8.3 There will be a requirement to provide a maintenance easement from the Main River in accordance with the Environment Agency's guidance, this maintenance easement should provide 8m clear unimpeded access from the centreline of the culvert.
- 4.8.4 Any overland flows generated by the proposed development must be carefully controlled, safe avenues directing overland flow from any existing and proposed buildings are advised.
- 4.8.5 To minimise the flood risk to the proposed dwellings and neighboring property it is proposed that surface water run-off generated by the development be managed effectively with the peak rates of run-off being restricted to the equivalent of the pre-development situation.
- 4.8.6 The development and its drainage systems should be designed to cope with intense storm events up to and including the 100 year return period rainfall event with an allowance for Climate Change (CC), based on the design life of the proposed development based on the design life this allowance for CC is in the form of 40% increase in rainfall intensity.
- 4.8.7 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.
- 4.8.8 United Utilities (UU) sewer records identify public sewer infrastructure within/near to the site. There will be a requirement to provide easements from these assets and discussion with UU is required to confirm their requirements.

Residual Risks

- 4.8.9 Safe access and egress will be maintained as the development will not be located within the extents of the floodplain. 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 planning layout 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 site is 2.906ha in size and is considered to be undeveloped at present (less than 2% impermeable at present). The peak rates and volumes of run-off generated by the development area have been calculated for the peak events and are shown in **Table 2** (full details in **Appendix J**).
- 5.1.2 Areas of land proposed not to be residentially developed (i.e. public open space to the south and the northern boundary with waterpark drive) have been excluded from the development area of 2.300ha and subsequent surface water management calculations. The surface water run-off rates have been calculated using IH124 Greenfield run-off method, utilising rainfall catchment characteristics from the Flood Estimation Handbook (FEH), details of which are included **Appendix K**.

Development Area	Run-Off Rates				Run-Off Volumes	
	1 In 1 Year Storm Event	1 In 30 Year Storm Event	1 In 100 Year Storm Event	QBAR	1 In 1 Year Storm Event	1 In 100 Year Storm Event
Greenfield (2.300ha)	11.5l/s	22.3l/s	27.4l/s	13.2l/s	224.6cu.m	699.1cu.m

Table 2: Pre-Development Development Area Surface Water Run-Off Rates and Volumes

5.2 Post-Development Surface Water Run-off

- 5.2.1 The nature of the development proposals means that there will be an increase in the impermeable areas of the site, resulting in increased levels in both the volume and the peak rates of run-off if flows are unrestricted.
- 5.2.2 The proposed impermeable area is estimated to cover approximately 54% of the development area, which would equate to 1.233ha. The post-development run-off rates and volumes have been calculated and detailed in **Table 3**.

Site Area	Run-Off Rates			Run-Off Volumes	
	1 In 1 Year Storm Event	1 In 30 Year Storm Event	1 In 100 Year Storm Event +CCA	1 In 1 Year Storm Event	1 In 100 Year Storm Event +CCA
Brownfield (1.233ha)	46.7l/s	107.7l/s	188.9l/s	164.0cu.m	1024.3cu.m

Table 3: Post-Development Un-Restricted Run-Off Rates and Volumes

5.3 Sustainable Drainage Systems (SuDS)

- 5.3.1 Sustainable Drainage Systems (SuDS) have the ability to address four core 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 system specified, all core objectives can be satisfied, this in turn reduces 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 of buried sewers wherever possible and practical.

- 5.3.3 It is noted that current policy states the typical requirement is to provide at least two phases of water treatment prior to discharge of surface water from site. On residential schemes it is often typical to incorporate SuDS features within POS areas which can if designed appropriately provide multiple benefits to a scheme.
- 5.3.4 Multiple benefits to SUDS implementation are present including the improvement of bio-diversity and visual aesthetics along with increasing ecology and water quality. The photographs in **Figure 7** illustrates similar residential schemes which have utilised SuDS as part of the surface water management strategy.

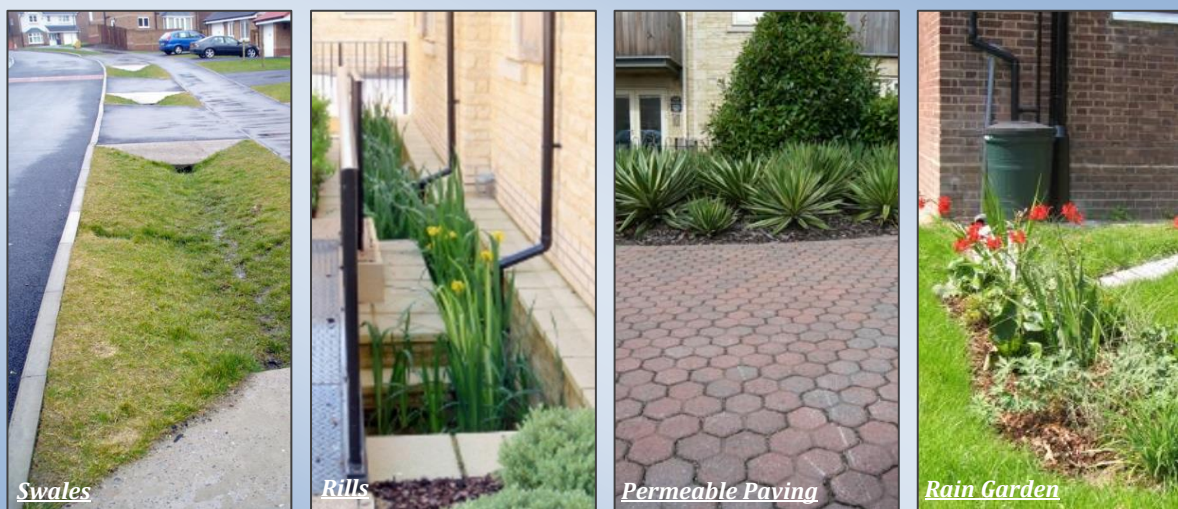


Figure 7: SuDS Photographs (SusDrain 2012)

- 5.3.5 Opportunities should be taken to provide soft landscaping where at all possible on site to assist in minimising surface water run-off, furthermore there may be the opportunity to incorporate some smaller scale SuDS features such as swales, rills, and bio-retention to provide a degree of treatment before flows are carried offsite. It would be recommended that permeable paving be considered in private (non-adopted areas) where at all feasible: if infiltration is proven not feasible then the permeable paving should be lined with a positive connection into the proposed main drainage for the site.
- 5.3.6 Detailed design will be required to confirm whether the site would be suitable for incorporation of SuDS and where the most appropriate locations within site would be (following more detailed analysis of levels and a final layout). At present proposals include a degree of soft landscaping to the north and south of the site. It is recommended to include SuDS methods adjacent to the reinstated watercourse to the south of site to form a blue-green corridor, providing water treatment before surface water discharge offsite.

5.4 Methods of Surface Water Management

- 5.4.1 The development area covers 2.30ha of the wider site and the proposed impermeable area is anticipated to increase from 2% to 54%. 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.
- 5.5.2 The British Geology Survey (BGS) mapping data indicates that ground conditions are as follows:-
-  **Bedrock Geology:** Chester Formation- Sandstone.
 -  **Superficial Deposits:** Till, Devensian - Diamicton
- 5.5.3 The Cranfield Soil and Agrifood Institute Soilscape soil type viewer identifies the soils as “slowly permeable, seasonally wet acid loamy and clayey soils”. Drainage is described as “Impeded to the local stream networks”.
- 5.5.4 Based on the ground conditions identified above it is unlikely that infiltration will be a full viable drainage solution for the surface water generated by the site. In accordance with the LPA and UU’s requirements, Soakaway Testing to BRE365 will likely be required to evidence that discharge to ground will not be a viable solution.

5.6 Discharge to Watercourse

- 5.6.1 Under the hierarchical approach for discharge, if infiltration is not feasible as a drainage strategy, then the next option to be explored should be discharge to a watercourse. The River Alt is culverted through the southern portion of the site. There will be a requirement to provide a maintenance easement from the Main River in accordance with the Environment Agency’s guidance, this maintenance easement should provide 8m clear unimpeded access from the top of bank.
- 5.6.2 The surface water run-off generated by the development is proposed to discharge to the culverted Main River bisecting the southern portion of site (as illustrated in **Figure 8**). Detailed design will be required to confirm the feasibility of this strategy following more detailed levels review.
- 5.6.3 Consent will be required from the EA for any new outfall structures on the Main River, furthermore points of connection and discharge rates should be discussed with the LLFA at an early stage.



Figure 8: Preliminary Drainage Strategy (Betts Hydro 2018)

- 5.6.4 In order to comply with the guidance to minimise flood risk to the proposed dwellings and the neighbouring property, the surface water run-off generated by the proposals will be required to mimic the existing situation. The proposed discharge from site will be restricted to mimic the pre-development greenfield rates. A flow restriction will be most likely in the form of a Hydrobrake or similar approved flow control device. The development area is considered to be 100% permeable for the purpose of calculating these greenfield rates.
- 5.6.5 The restricted flow will generate a storage requirement during the extreme events. The storm water storage figures quoted in **Table 4/Appendix N** are estimates only based on varied rates and detailed drainage design will determine with accuracy the storm water storage requirements following identification of any additional restrictions.

Impermeable Area (1.233ha)	1 In 1 Year Storm Event	1 In 30 Year Storm Event	1 In 100 Year Storm Event + CCA (40%)
Restricted Run-Off Rate	11.5l/s	22.3l/s	27.4l/s
Estimated Stormwater Storage Volume	87cu.m-149cu.m	227cu.m-349cu.m	497cu.m-712cu.m

Table 4: Estimated Stormwater Storage Requirements (Betts Hydro 2018)

- 5.6.6 The proposed onsite surface water drainage system will need to be sized to prevent overland run-off offsite from storm events up to and including the 100 year return period storm event with a 40% allowance for climate change.
- 5.6.7 It would be beneficial to implement SuDS features into the design and if designated appropriately these features could aid in the attenuation requirements for the proposals. At present there is no inclusion of SuDS into the proposals.
- 5.6.8 The proposals are required to consider the existing sewer infrastructure and account for such within the design. Based on the indicative proposals it is understood that the existing infrastructure is considered, confirmation of UU's required easements from the existing assets should be sought at an early stage so that the proposed planning layout can account for such. Should any existing public sewer assets require diversion or abandonment to suit the proposals, then it is strongly advised that discussions with asset owners take place to secure timescales and outfall options.

5.7 Discharge to Sewer

- 5.7.1 Should infiltration not be feasible (following further investigation) then the proposals are to utilise the watercourse network within the development site for the management of surface water run-off. There are no proposals at this time to discharge surface water generated at the site to the public sewer network.

5.8 Climate Change

- 5.8.1 There are indications that the climate in the UK is changing significantly and it is widely believed that the nature of climate change will vary greatly by region. 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. It is believed that the impact of climate change means there is likely to be a long term increase in the average sea levels, with an expectation that sea levels will rise gradually. An increase in flood water levels means that future flooding events will occur more frequently and will have a greater impact.
- 5.8.2 In light of 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. 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.
- 5.8.3 In accordance with the updated Climate Change projections providing estimated changes to rainfall intensity (**Table 5**) 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 5: Change to Extreme Rainfall Intensity Compared to 1961-1990 Baseline (Environment Agency, 2016)

6.0 FOUL WATER MANAGEMENT

- 6.1 The foul water flows generated by the development are proposed to discharge to the United Utilities (UU) public foul water sewer system (225mm dia.) within the site boundary (manhole ref: 7002), running along Waterpark Drive, west of the site.
- 6.2 Detailed design will be required to confirm the overall drainage strategy proposed, based on assessment of levels, layout and other engineering constraints. At present existing levels onsite generally fall to the south and western boundary and it is assumed a gravity solution in part will be feasible.
- 6.3 United Utilities confirm foul water flows generated by the development will be allowed to drain freely in to the adjacent public foul sewerage system. Due to the existing levels onsite, it is likely that a gravity will be feasible.
- 6.4 Based on planning proposals the approximate peak foul water flows generated by approximately 79no. residential units would be 3.7l/s (based on based on 4000 litres per dwelling per 24 hours in accordance with the guidance within Sewers for Adoption (SfA).

7.0 SUMMARY AND CONCLUSIONS

- 7.1 This report has been prepared to support a planning application for the construction of a residential development on land adjacent to Waterpark Drive, Knowsley. The total site covers 2.906ha in size and is located within Flood Zone 1 based on the Flood Map for Planning.

Flood Risk

- 7.2 The proposals are 'residential' in nature and as such classified as 'more vulnerable' in Table 2: Flood Risk Vulnerability Classification within the Planning Practice Guidance (PPG). This development is confirmed to be appropriate within Flood Zone 1, providing there is no increase in flood risk elsewhere due to the proposals.
- 7.3 The site is located within Flood Zone 1 based on the Flood Map for Planning and the nearest watercourse is the River Alt, currently culverted within the southern portion of site. The River Alt is the nearest main river to the site and is culverted through the southern portion of the site. Consultations with the Environment Agency, United Utilities and Knowsley Metropolitan Borough Council did not identify any historical incidents of flooding onsite associated with River Alt, therefore the flood risk from this source is considered to be low.
- 7.4 Overall the site is considered to be at 'low' flood risk from the majority of flood sources reviewed. The primary flood risk is considered to be from surface water flooding, this risk varies from 'low' to 'high' within the site and is associated with the existing topography onsite. The risk associated with surface water flooding will be reduced as part of the proposals following the implementation of mitigation measures proposed within this assessment and inclusion of a sustainable surface water management regime.
- 7.5 In accordance with best practice the finished floor levels of the proposed residential development should be at least 150mm above external levels to mitigate residual risk associated with various flood sources including surface water, ground water and sewer flooding

Drainage Strategy

- 7.6 In light of the relatively low flood risk identified, the principle focus of this report is on the effective management of surface water. Based on the ground conditions identified online it is unlikely that infiltration will be an unlikely solution for the surface water run-off generated by the development site. In accordance with the LPA and UU's requirements, Soakaway Testing to BRE365 will still be required to evidence that discharge to ground will not be a viable solution prior to pursuing other options identified in the hierarchical approach.
- 7.7 Under the hierarchical approach, if infiltration is not feasible as a drainage strategy, then the next option should be to discharge surface water run-off generated by the proposals to the culverted River Alt crossing the southern portion of site. Detailed design will be required to confirm the feasibility of this strategy following more in-depth review of layout and levels. Consent for outfall to the Main River will be required from the Environment Agency, the discharge rates should be discussed at an early stage with both

the Environment Agency and Knowsley Borough Council (Lead Local Flood Authority) to secure a positive outfall solution.

- 7.8 The proposals are to consider the whole developable area as greenfield and the discharge from site is proposed to mimic the existing greenfield rates. Two outfalls are proposed to satisfy the drainage and indicative layout with an overall discharge rate of 11.5l/s in the 1 in 1 year period event, a rate of 22.3/s in the 1 in 30year and 27.4l/s in the 1 in 100 year event.
- 7.9 Should intrusive investigations and/or discussion with the relevant parties identify a more stringent discharge rate is required then this will be addressed during detailed drainage design. The restricted flow will generate a storage requirement during the extreme events. During the 1 in 100yr event with a 40% allowance for climate change the estimated attenuation onsite will be between 497cu.m to 712cu.m.
- 7.10 It would be beneficial to implement SuDS features into the design and if designed appropriately these features could aid in the attenuation requirements for the proposals. Opportunities should be taken to provide soft landscaping where at all possible on site to assist in minimising surface water run-off, furthermore there may be the opportunity to incorporate some SuDS features in areas to the north and south of site.
- 7.11 This report has been prepared in consultation with the relevant interested parties and incorporates their comments where possible. The FRA and DMS is considered to be commensurate with the development proposals and in summary, the development can be considered appropriate in accordance with the NPPF.

8.0 RECOMMENDATIONS

- 8.1 In accordance with best practice the finished floor levels of the proposed residential development onsite should be at least 150mm above the existing ground levels. As the site is located within Flood Zone 1.
- 8.2 There will be a requirement to provide a maintenance easement from the Main River in accordance with the Environment Agency's guidance, this maintenance easement should provide 8m clear unimpeded access. This should be applied 8m from the centreline on both sides of the culvert.
- 8.3 Any overland flows generated by the proposed development must be directed away from existing and proposed buildings; safe avenues directing overland flow away from any existing and proposed buildings are advised. As with any development it is also advised that external levels fall away from property to minimise the flood risk from a variety of sources.
- 8.4 Opportunities should be taken to provide soft landscaping and SuDS where at all possible on site to assist in minimising surface water run off, methods such as permeable paving and bio-retention units may offer some benefit in non-adopted areas onsite (subject to further investigation as part of the design process).
- 8.5 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 to the equivalent of the pre-development situation.
- 8.6 Detailed drainage design will be required to confirm feasibility of the drainage strategy following more in depth levels and layout review. Consideration is recommended into the stormwater attenuation requirements and further discussion with the Environment Agency at an early stage will be required to identify any additional capacity constraints.
- 8.7 The proposed onsite surface water drainage system will need to be sized to prevent overland run-off offsite from storm events up to and including the 100 year return period storm event with 40% allowance for climate change and not cause flooding onsite during the 1 in 30 year return period.
- 8.8 United Utilities (UU) sewer records identify public sewer infrastructure within/near to the site. There will be a requirement to provide easements from these assets and discussion with UU is required to confirm their requirements
- 8.9 As with any drainage system blockages within either the foul or surface water sewer systems have the potential to cause flooding or disruption. 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.

BIBLIOGRAPHY & REFERENCES

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Web-based References

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British Geological Survey – <http://www.bgs.ac.uk/opengeoscience/home.html>
Chronology of British Hydrological Events – www.dundee.ac.uk/
CIRIA – <http://www.ciria.org/>
Cranfield University – <http://www.landis.org.uk/soilscapes/>
Environment Agency – www.environment-agency.gov.uk/
FloodProBE – <http://www.floodprobe.eu/>
Flood Forum – <http://www.floodforum.org.uk/>
Flood London – <http://www.floodlondon.com/>
Google Maps – <http://maps.google.co.uk/>
Streetmap – <http://www.streetmap.co.uk/>
United Utilities – <https://www.unitedutilities.com/>

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APPENDIX A: NPPF EXTRACTS

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Table 1: Flood zones

(Note: These flood zones refer to the probability of river and sea flooding, ignoring the presence of defences)

Zone 1 - low probability Definition This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%). Appropriate uses All uses of land are appropriate in this zone. Flood risk assessment requirements For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be incorporated in a flood risk assessment. This need only be brief unless the factors above or other local considerations require particular attention. Policy aims In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage systems².
Zone 2 - medium probability Definition This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year. Appropriate uses Essential infrastructure and the water-compatible, less vulnerable and more vulnerable uses, as set out in table 2, are appropriate in this zone. The highly vulnerable uses are <i>only</i> appropriate in this zone if the Exception Test is passed. Flood risk assessment requirements All development proposals in this zone should be accompanied by a flood risk assessment. Policy aims In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage systems.
Zone 3a - high probability Definition This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year. Appropriate uses The water-compatible and less vulnerable uses of land (table 2) are appropriate in this zone. The highly vulnerable uses should not be permitted in this zone. The more vulnerable uses and essential infrastructure should only be permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood. Flood risk assessment requirements All development proposals in this zone should be accompanied by a flood risk assessment. Policy aims In this zone, developers and local authorities should seek opportunities to: • reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems;

- relocate existing development to land in zones with a lower probability of flooding; and
- create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.

Zone 3b - the functional floodplain

Definition

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. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But land which would flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood in an extreme (0.1%) flood, should provide a starting point for consideration and discussions to identify the functional floodplain.

Appropriate uses

Only the water-compatible uses and the essential infrastructure listed in table 2 that has to be there should be permitted in this zone. It 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.

Essential infrastructure in this zone should pass the Exception Test.

Flood risk assessment requirements

All development proposals in this zone should be accompanied by a flood risk assessment.

Policy aims

In this zone, developers and local authorities should seek opportunities to:

- reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems;
- relocate existing development to land with a lower probability of flooding.

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 stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use³. • Installations requiring hazardous substances consent⁴. (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")⁵.
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 waste⁶. • Sites used for holiday or short-let caravans and camping, <i>subject to a specific warning and evacuation plan</i>.⁷
Less vulnerable • Police, ambulance and fire stations which are <i>not</i> required to be operational during flooding. • Buildings used for shops, financial, professional and other services,
restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in "more vulnerable", 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 <i>not</i> 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, <i>subject to a specific warning and evacuation plan</i>.

APPENDIX B: EA INFORMATION & CORRESPONDENCE

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Fluvial Flood Level Map:
Waterpark Drive, Knowsley

Produced: 17 October 2016
Our Ref: CL25137
NGR: SJ 42760 93037

Key

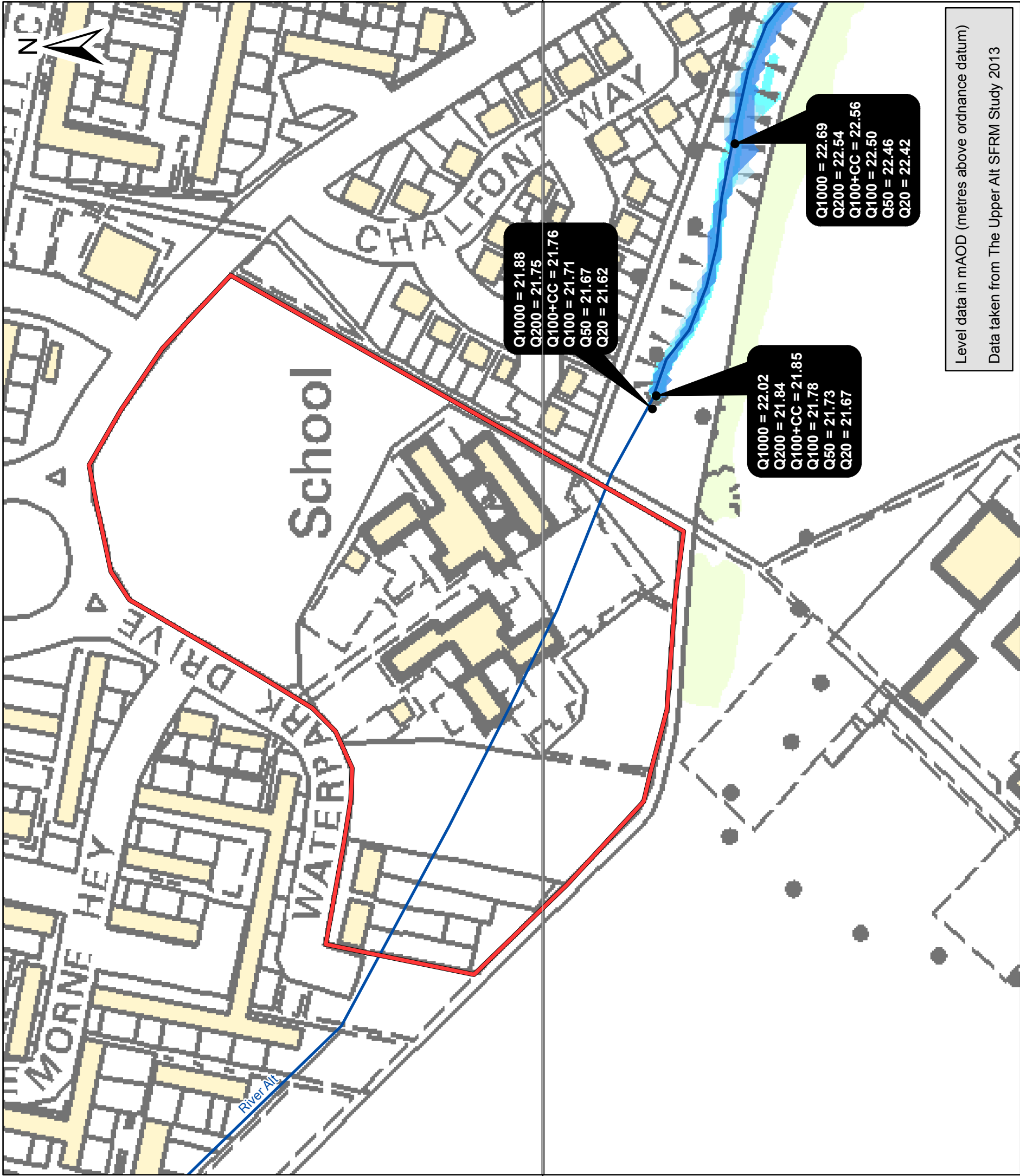
- Main River
- Flood Zone 3
- Flood Zone 2

Flood Zone 3 shows the area that could be affected by flooding:

- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

ABDs (Areas Benefiting from Defences) show the area benefiting from defences during a 1 in 200 tidal, or 1 in 100 fluvial flood event.



Patrick Taylor

From: Patrick Taylor
Sent: 05 October 2016 09:39
To: 'Inforequests.gmmc@environment-agency.gov.uk'
Subject: Waterpark. Knowsley.
Attachments: HYD104-LOCATION PLAN.pdf

To whom it may concern,

Waterpark Drive, Knowsley.

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 above site (location plan attached), including details of historical flooding and water levels; this would be greatly appreciated. Please do not hesitate to contact me on the details below to discuss further should you require additional information or clarification.

Kind Regards

Patrick Taylor 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

patricktaylor@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



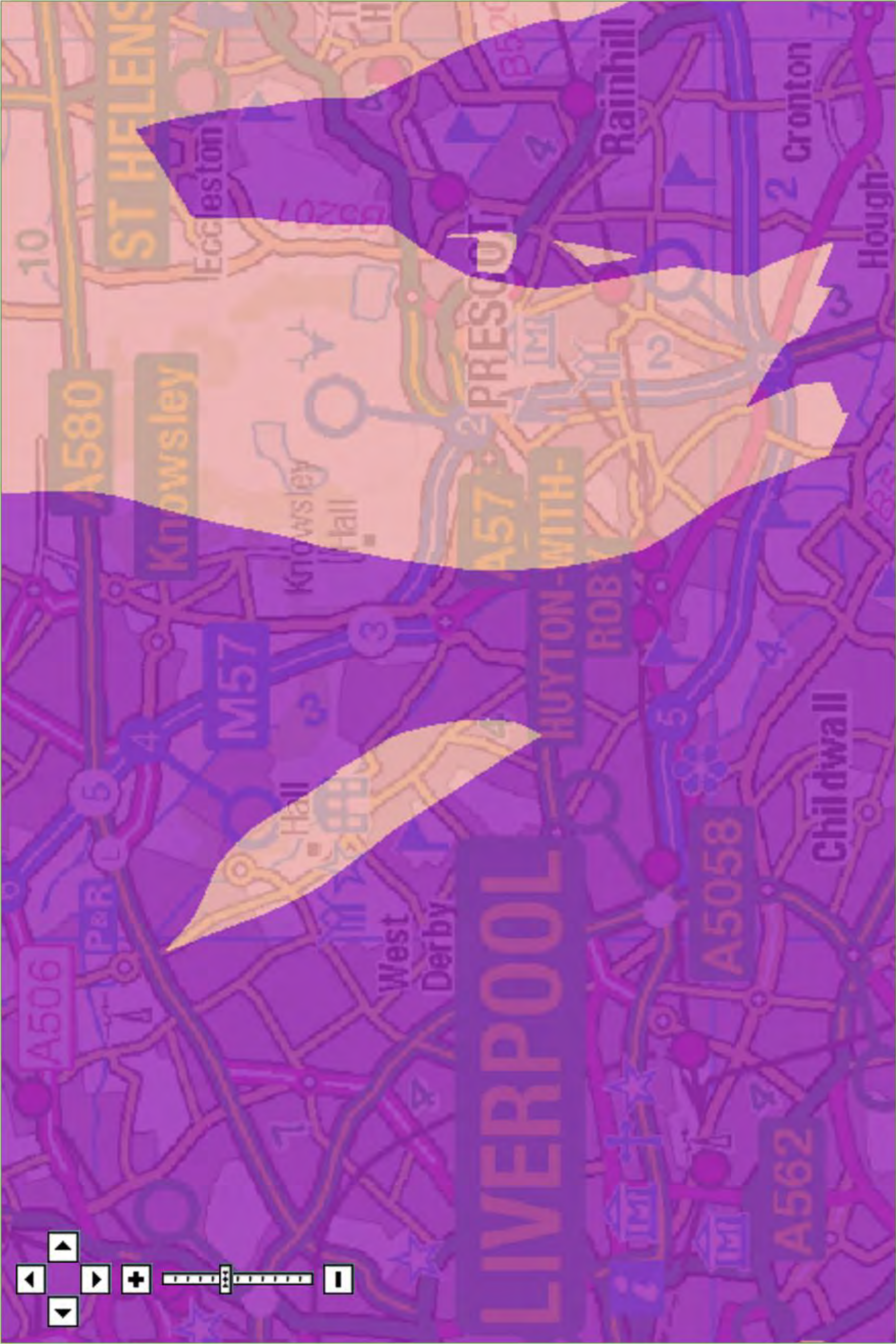
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X: 342,980;Y: 392,943 at scale 1:75,000

Other maps Data search Text only version



Map legend

☒ Groundwater source protection zones [i](#)

☒ BGS Aquifer Maps - Superficial Deposits Designation [i](#)

☒ BGS Aquifer Maps - Bedrock Designation [i](#)

☒ Principal

☒ Secondary A

☒ Secondary B

☒ Secondary (undifferentiated)

☒ Groundwater Vulnerability Zones [i](#)

☒ Other national environmental organisations [i](#)

Map legend

Groundwater source protection zones

BGS Aquifer Maps - Superficial Deposits Designation

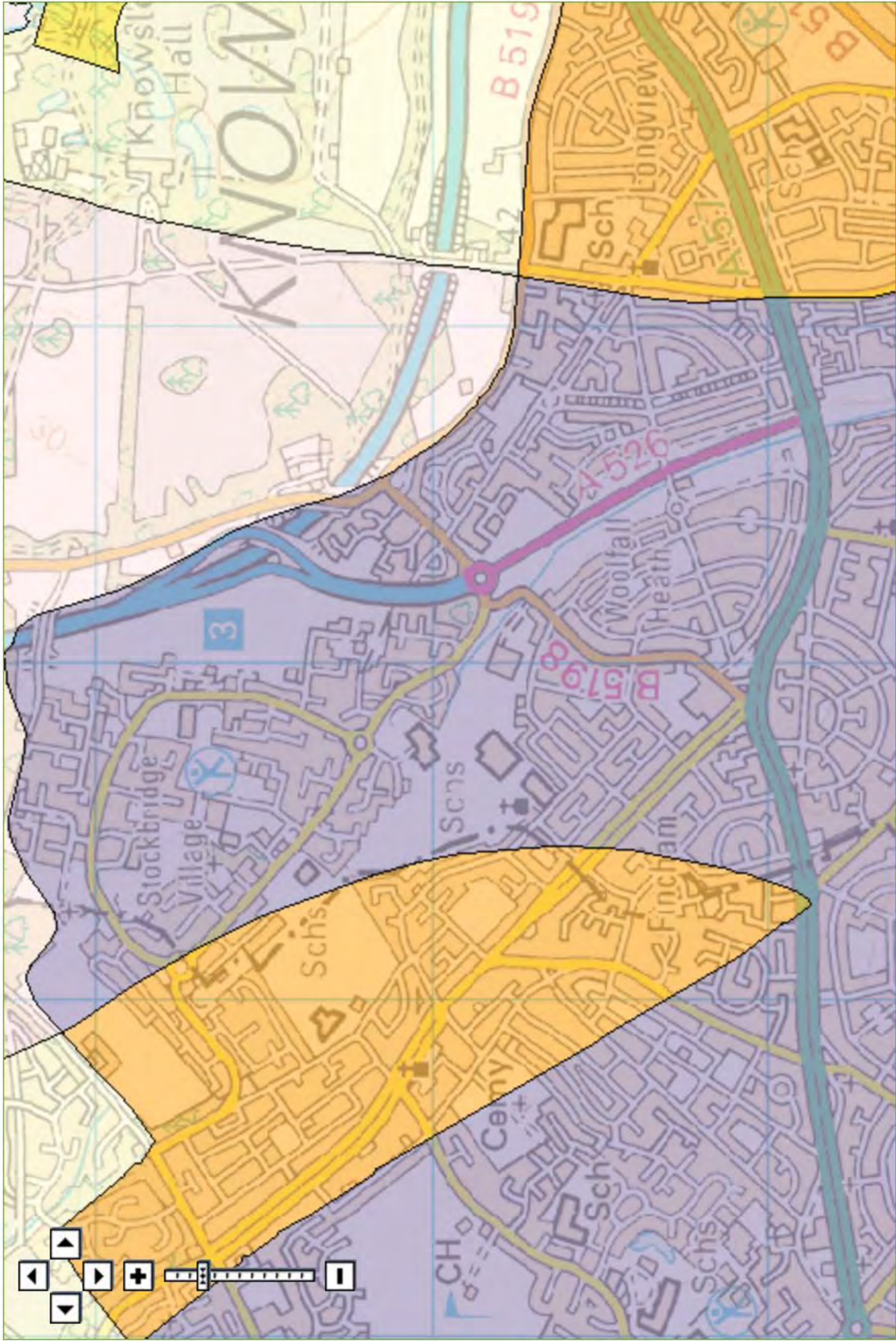
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- Secondary A
- Secondary B
- Secondary (undifferentiated)
- Unknown (lakes and landslip)

BGS Aquifer Maps - Bedrock Designation

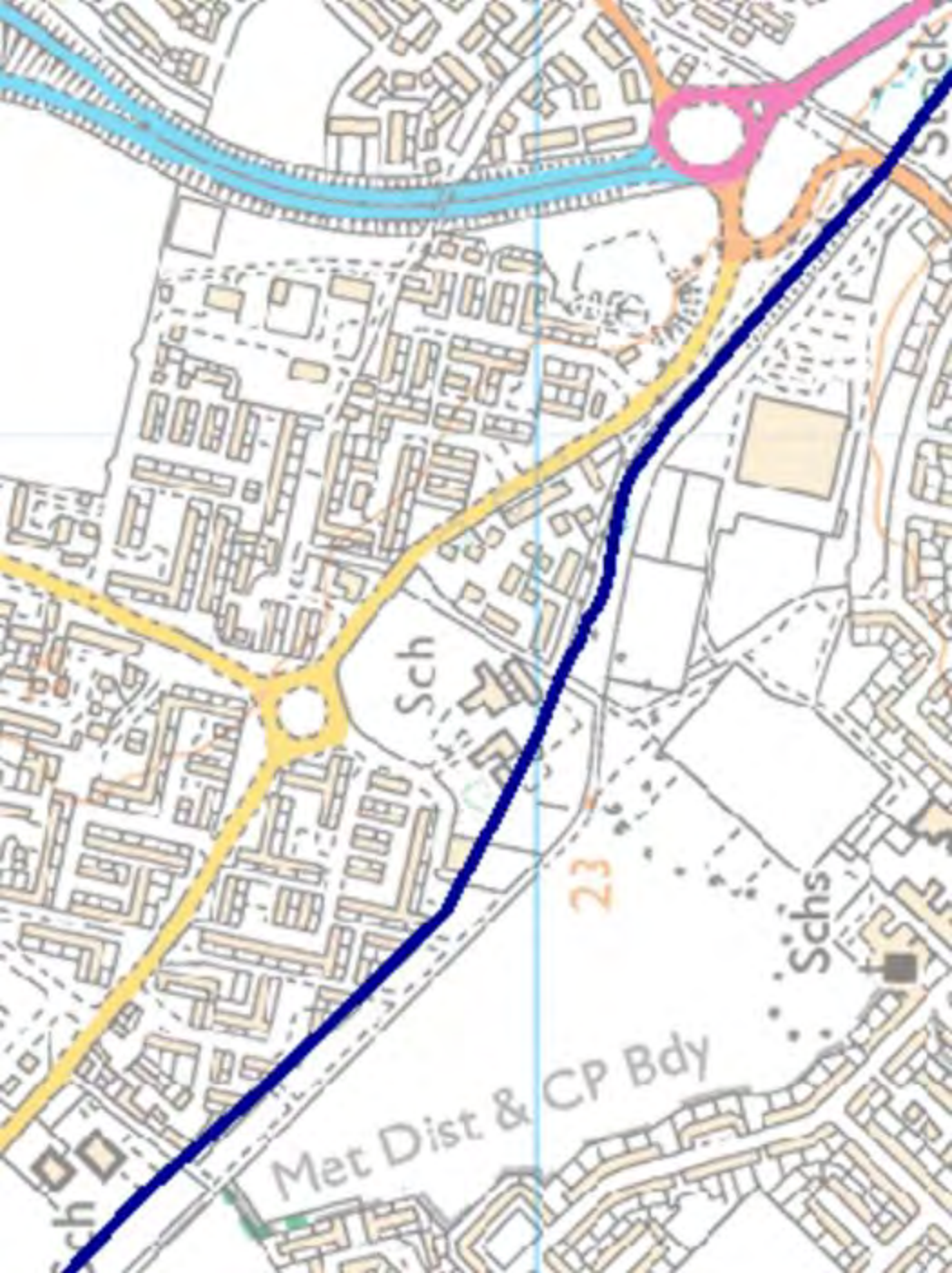
- Principal
- Secondary A
- Secondary B
- Secondary (undifferentiated)

Groundwater Vulnerability Zones

- Major Aquifer High
- Major Aquifer Intermediate
- Major Aquifer Low
- Minor Aquifer High
- Minor Aquifer Intermediate
- Minor Aquifer Low



Customers in Wales - From 1 April 2013 Natural Resources Wales (NRW) has taken over the responsibilities of the Environment Agency in Wales.
© Environment Agency copyright and database rights 2016. © Ordnance Survey Crown copyright. All rights reserved. Environment Agency, 100026380.
Contains Royal Mail data © Royal Mail copyright and database right 2016.
This service is designed to inform members of the public, in line with our terms and conditions. For business or commercial use, please contact us.



Flood risk

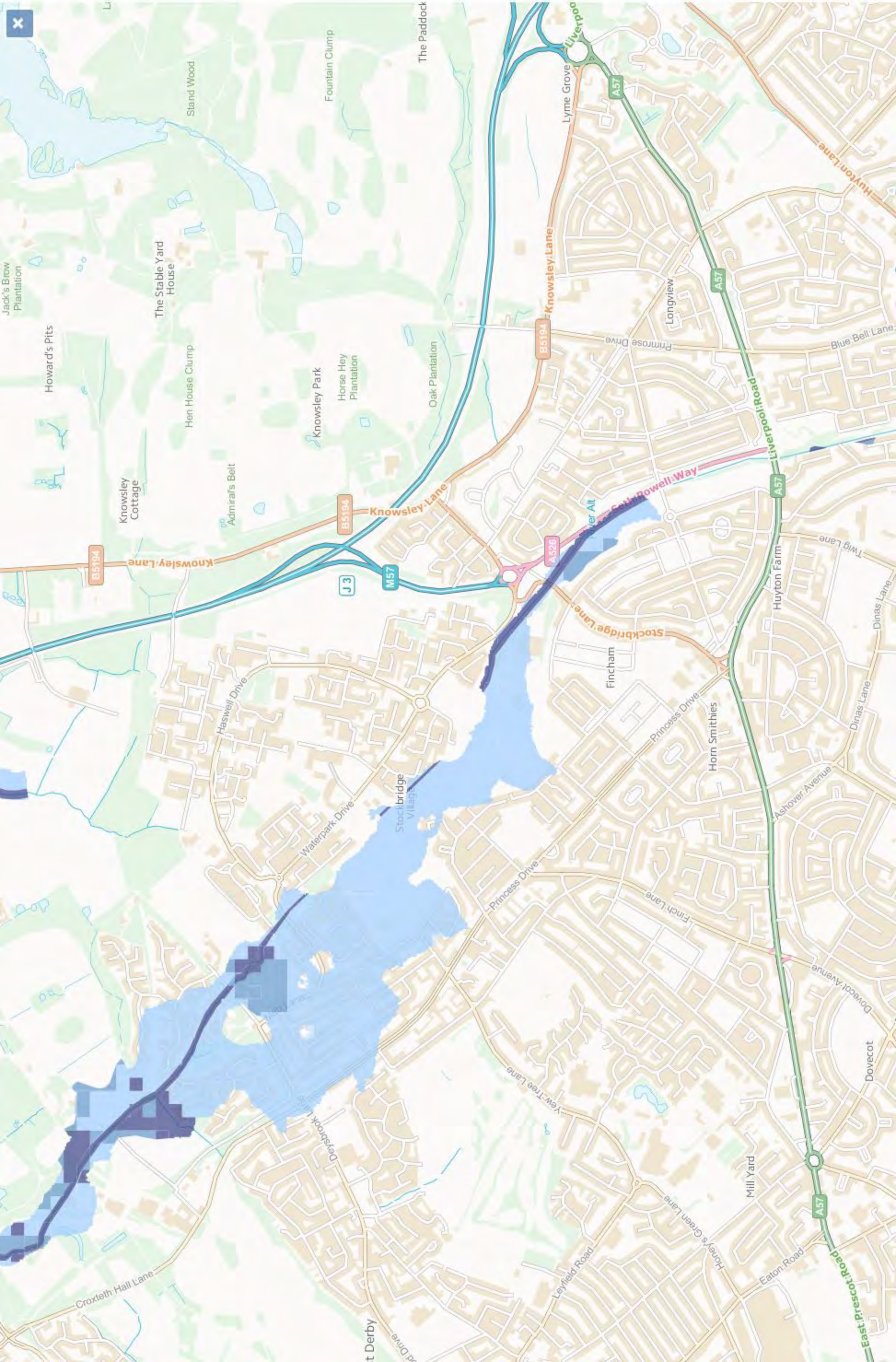
High

Medium

Low

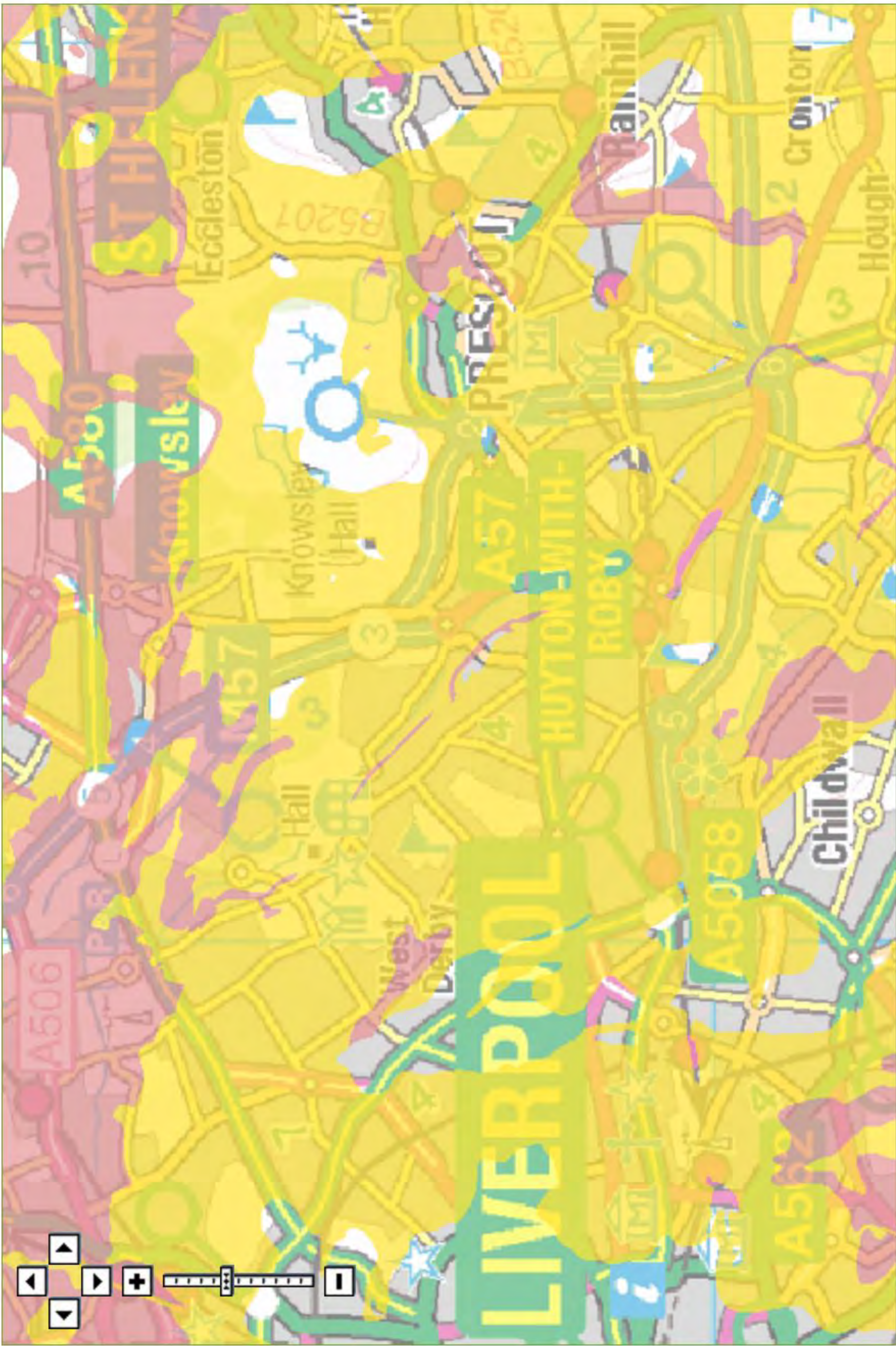
Very low

Location of the postcode you entered



X: 342,980;Y: 392,943 at scale 1:75,000

Other maps Data search Text only version



Map legend

☒ Groundwater source protection zones

☒ BGS Aquifer Maps - Superficial Deposits Designation

- Principal
- Secondary A
- Secondary B
- Secondary (undifferentiated)
- Unknown (lakes and landslip)

☒ BGS Aquifer Maps - Bedrock Designation

- Principal
- Secondary A
- Secondary B
- Secondary (undifferentiated)

☒ Groundwater Vulnerability Zones

☒ Other national environmental organisations



Flood risk from rivers or the sea



Extent of flooding



Flood risk from surface water



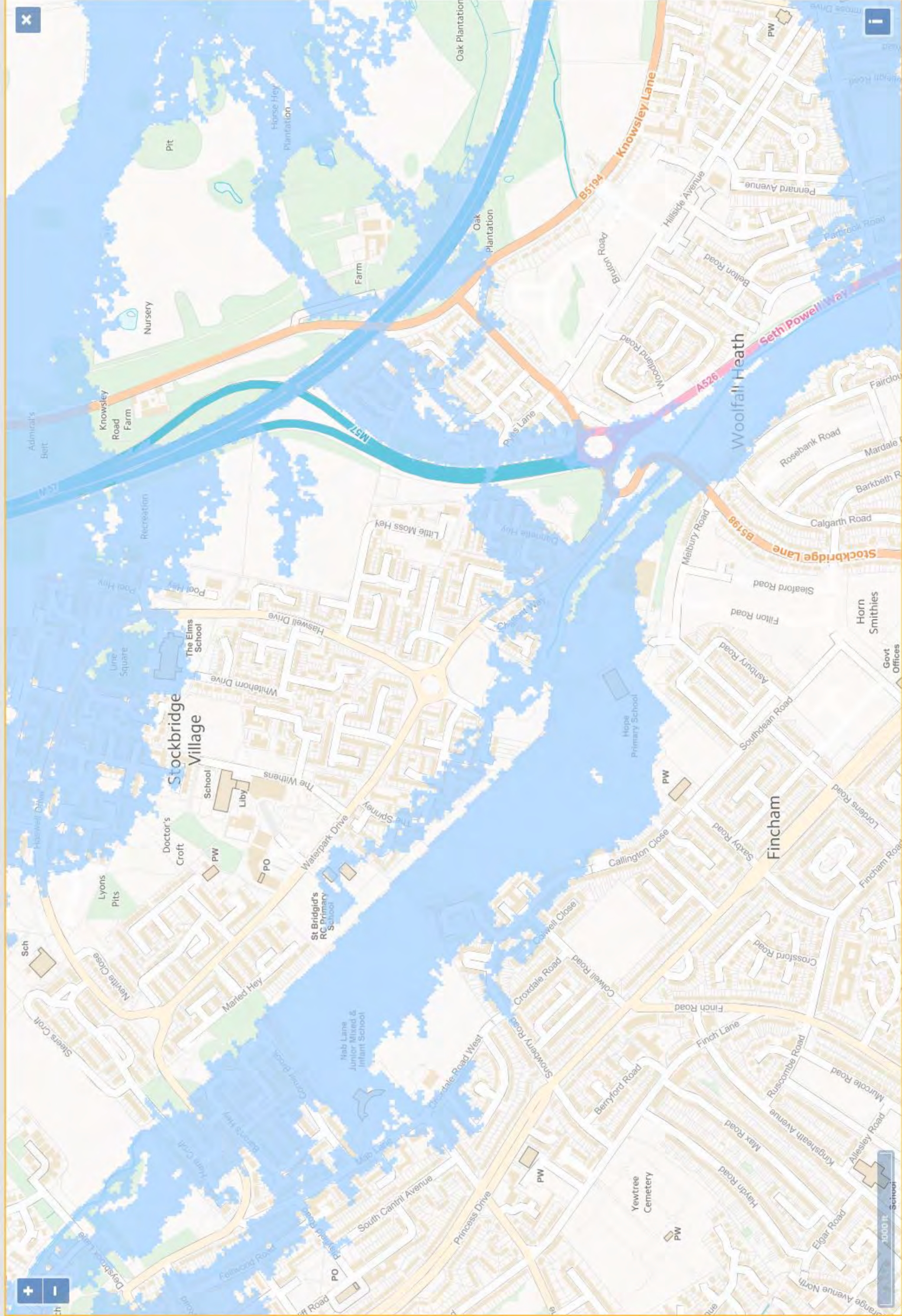
Extent of flooding



Flood risk from reservoirs



Extent of flooding



The map displays the area around Stockbridge Village and Fincham, showing the extent of flooding from various sources. The legend indicates the following categories:

- Flood risk from rivers or the sea:** Represented by a blue line.
- Extent of flooding:** Represented by a blue circle.
- Flood risk from surface water:** Represented by a blue line.
- Extent of flooding:** Represented by a blue circle.
- Flood risk from reservoirs:** Represented by a blue line.
- Extent of flooding:** Represented by a blue circle.

The map also includes a scale bar (0 to 1000 ft) and a compass rose. The legend is located in the bottom left corner, and the map controls (zoom in, zoom out, and location) are in the bottom right corner.



Flood risk



Maximum extent of flooding



Location of the postcode you entered

Flood risk from rivers or the sea

Extent of flooding

Flood risk from surface water

Extent of flooding

Flood risk from reservoirs

Extent of flooding



High

Medium

Low

Very low

Location of the postcode you entered

APPENDIX C: UU CORRESPONDENCE

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Patrick Taylor

From: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Sent: 05 October 2016 11:57
To: Patrick Taylor
Subject: RE: Waterpark. Knowsley.

Dear Sir/Madam

I can confirm that there are no recorded historical sewer flooding issues within the vicinity of the proposed development site.

Please note that United Utilities Water plc (UW) 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 UW 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



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 11 July 2016 the fee for the administration of a Building Over Agreement will be £261.00 (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: Patrick Taylor [mailto:patricktaylor@betts-associates.co.uk]
Sent: 05 October 2016 09:40
To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: Waterpark. Knowsley.

To whom it may concern,

Waterpark Drive, Knowsley.

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 above site (location plan attached), including details of historical flooding and water levels; this would be greatly appreciated. Please do not hesitate to contact me on the details below to discuss further should you require additional information or clarification.

Kind Regards

Patrick Taylor 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

patricktaylor@betts-associates.co.uk

www.betts-associates.co.uk

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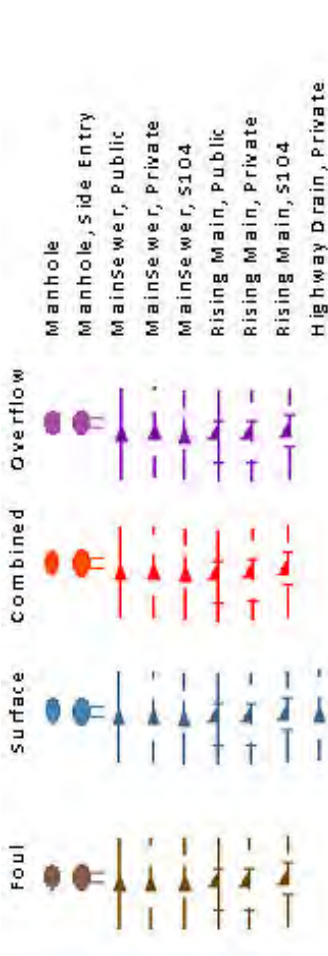
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United Utilities Group PLC, Haweswater House, Lingley Mere

WASTE WATER SYMBIOLOGY



ABANDONED PIPE
Main Sewer
Flow Meter
Gully
Head of System
Hydrobrake/Vortex
Inlet
Bifurcation
Catchpit
Contaminated Surface Water
Sludge Pumping Station
Sewer Overflow
T Junction/Saddle
Lamp Pole
Olinator
Penstock
Pump
Riddling Eye
Soakaway
Summit
Valve
Valve Chamber
Washout Chamber
Dropshaft
WW Treatment Works
Septic Tank
Vent Column
Network Storage Tank
Office Pit
Vortex Chamber
Penstock Chamber
Blind Manhole
Screen Chamber
Discharge Point
Outfall

LEGEND

MANHOLE FUNCTION

FO Foul

SW Surface Water

CO Combined

SEWER SHAPE

CI Circular

EG Egg

AR Arch

BA Barrel

HO Horseshoe

RE Rectangular

UN Unspecified

SQ Square

SEWER MATERIAL

AC Asbestos Cement

BR Brick

PE Polyethylene

RP Reinforced Plastic Matrix

CS Concrete

CSB Concrete Segment Bolted

CC Concrete Box Culverted

PSC Plastic/Steel Composite

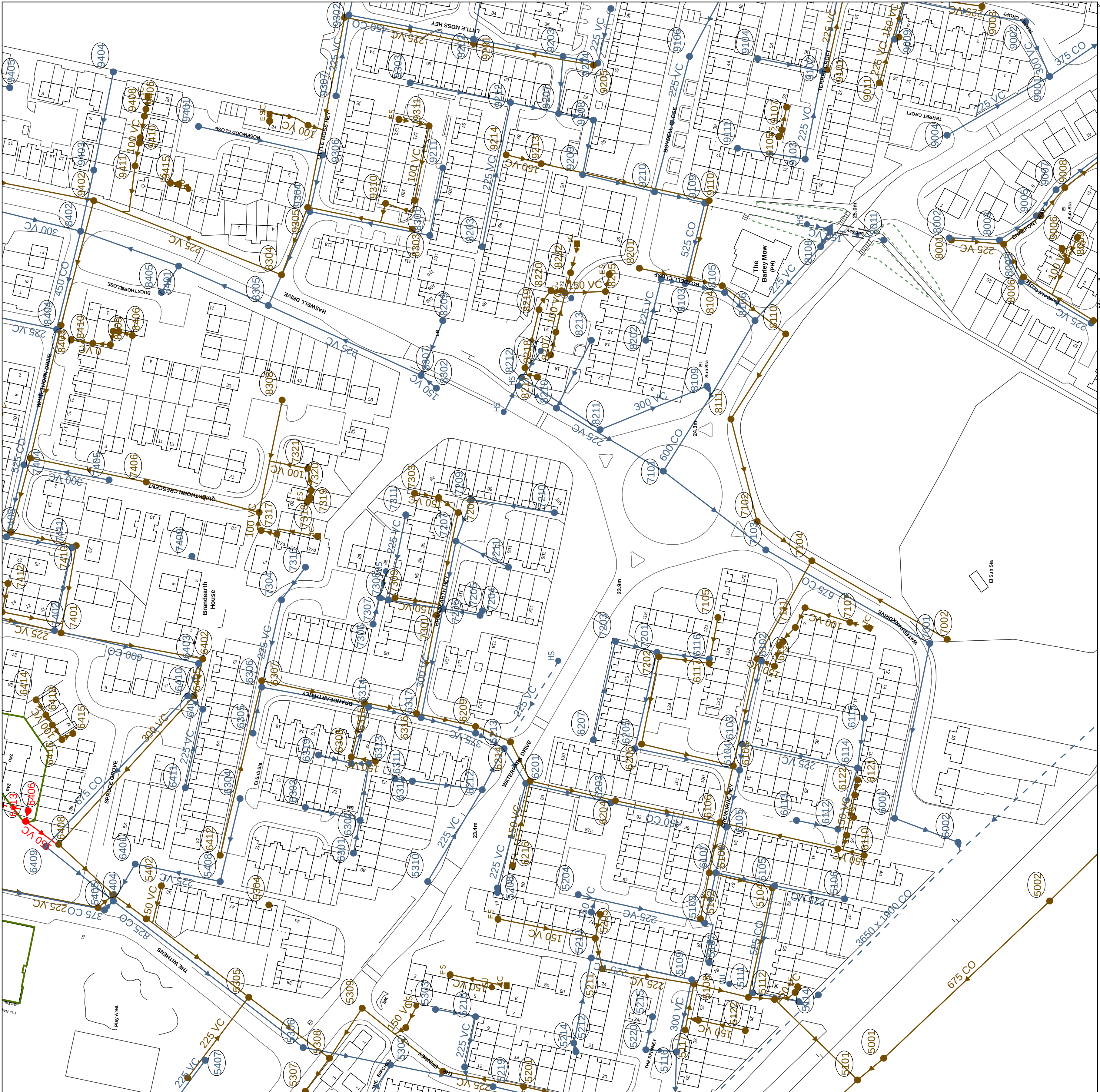
GRC Glass Reinforced Concrete

GP Glass Reinforced Plastic

U Unspecified

OS Sheet No: SJ4293SE
Scale: 1: 1250 Date: 11/12/2015

338 Nodes
Sheet 1 of 2



APPENDIX D: LPA/LLFA CORRESPONDENCE

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Austin Mc Gowan
Highways Projects Team Lead
Highways and Transportation

Tel: (0151)- 443 2234| Mobile: 0758 4370993

Email: Austin.mcgowan@knowsley.gov.uk

Knowsley Council | Yorkon Buildings | Archway Road | Huyton | L36 9YU

 *Save a tree . . . please do not print this e-mail unless you really need to.*

From: Patrick Taylor [<mailto:patricktaylor@betts-associates.co.uk>]

Sent: 05 October 2016 09:46

To: Highways Enquiries and Complaints

Subject: Waterpark. Knowsley.

To whom it may concern,

Waterpark Drive, Knowsley.

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 above site (location plan attached), including details of historical flooding and water levels; this would be greatly appreciated. Please do not hesitate to contact me on the details below to discuss further should you require additional information or clarification.

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APPENDIX E: LOCATION PLAN

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