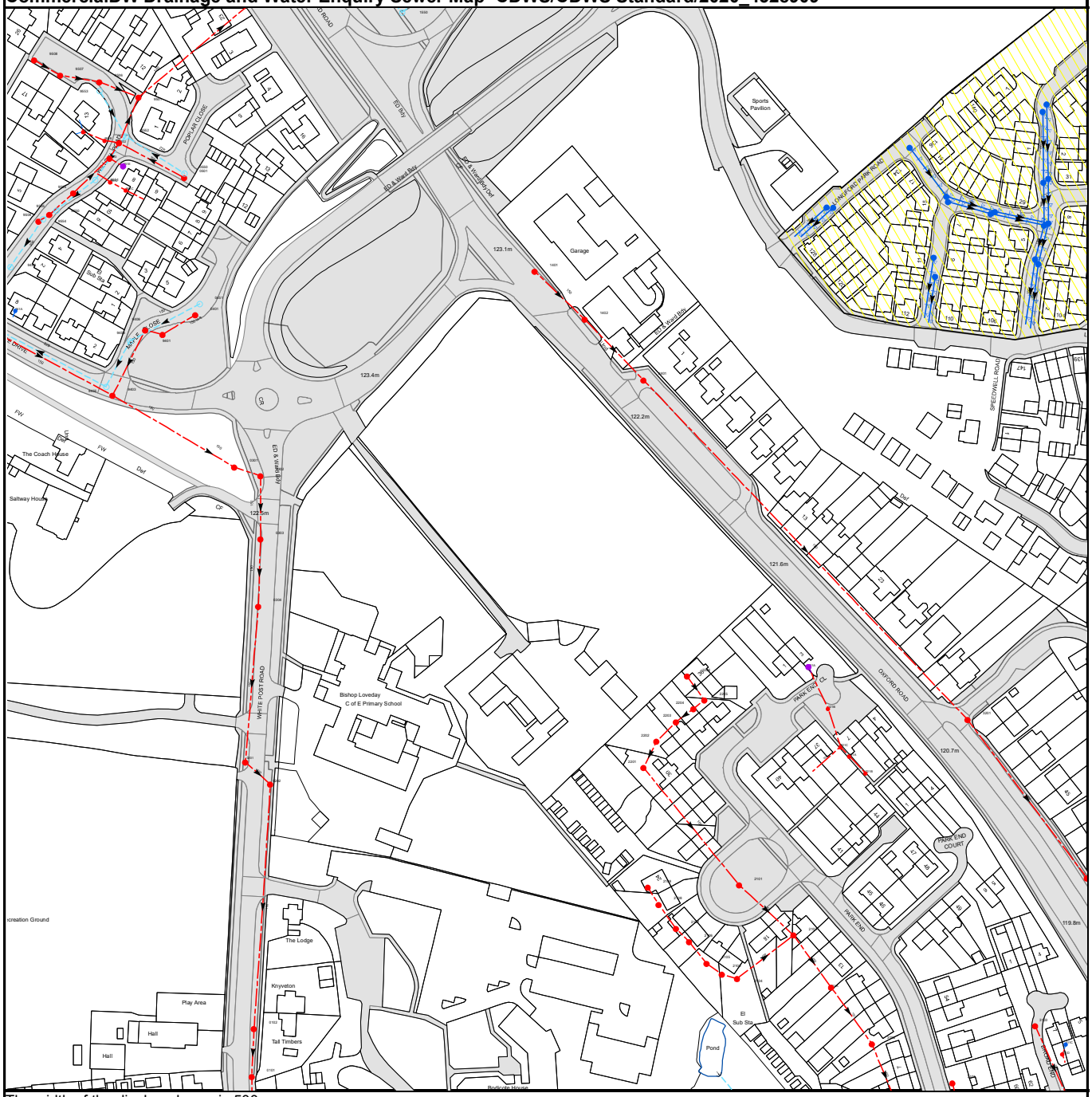
APPENDIX C – THAMES WATER SEWER MAPS

CommercialDW Drainage and Water Enquiry Sewer Map- CDWS/CDWS Standard/2020_4328909



The width of the displayed area is 500m

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

APPENDIX D – SURFACE WATER CALCULATIONS, ADOPTABLE POROUS PAVING, 100 YEAR + 40% CLIMATE CHANGE

GEOMAN

44 Elmwood Avenue, Belfast BT9 6AZ | 02890 664 941 | www.geoman.co.uk

Preliminary Permeable Paving Design

Oxford Rd, Bodicote

Location Address:	Oxford Rd, Bodicote
Designed:	Geoman Ltd.
Date:	12/05/2021
Design Reference Number/Version:	21-5566
Type of Design:	Infiltration Permeable Paving Design
Tobermore **Sales Executive Contact:**	Adam Preece

Technical Support and Back Up

If you have any questions relating to this design, please contact the people listed below:

Contact:	Contact Number:	Email Address:
Cleona Cunningham (Geoman Ltd.)	+44(0)2890664941	geoman@geoman.co.uk
Adam Preece (Tobermore Ltd.)	+44(0)7974243397	A.Preece@tobermore.co.uk

Contents

1.0 Proposed Section

It is proposed to install Tobermore Hydropave as the surfacing to approximately **1990m²** of the development to create a permeable paving system on site. This includes the permeable paving areas at the proposed Oxford Rd, Bodicote as shown on PHG Consulting Engineers dwg no.100 – Engineering Layout.

We have assumed it is proposed to store water in the coarse graded aggregate (CGA) subbase and allow infiltration into the subgrade below. For the permeable paving areas it is assumed they will need to accommodate loading as per Loading Category 6 (<70 standard axles per day). Please advise if a more onerous loading is to be considered.

A permeable membrane should be provided at sub-base formation level. A plan showing the assumed hydropave areas are indicated on Geoman's drawing no SK21-5566-01. Indicative proposed sections of the Hydropave infiltration system are shown on Geoman Ltd. drawing SK21-5566-02 for Category 6.

For preliminary design purposes we have made the following assumptions:

1. The proposed formation level CBR will be at least 3%. This should be confirmed via in-situ testing prior to construction. If lower values are recorded this design will need to be reviewed.
2. A minimum infiltration rate of 0.05m/hr has been assumed. Please advise if a lower infiltration rate is required, as the design will have to be revised. If the infiltration rate is lower than we have assumed, then the depth of course graded aggregate will have to increase.

1.1 Infiltration – Hydropave Summary

Category Type:	Category 6 (<70 standard axles per day)
Paving Block:	**Tobermore Hydropave** (200x100x80mm deep)
Laying Course:	50mm thickness of 6.3-2mm grit to BS EN13242:2002
Dense Bitumen Macadam:	N/A
Coarse Graded Aggregate:	Category 6- Minimum 420mm depth for storage.
Geotextiles:	Please contact us for further info
Impermeable Liner:	1800 gauge permeable geotextile
Drawing Number:	SK21-5566-02

1.2 Tobermore Hydropave Product to be used on Scheme

Product Name:	Tobermore Hydropave
Size:	200x100x80mm deep
Color:	TBC
Finish:	Standard
Strength:	> 3.6MPa or 250 N/m
Manufactured to:	BS EN 1338:2003
Installed to:	BS EN 7533-3:2005
Laying pattern:	Herringbone

3.1 Site Levels

If there is a fall in the subbase formation level, there will be a considerable loss in effective storage within the CGA when compared to a flat site. We would therefore recommend that the subbase formation level is kept virtually flat, with only a slight fall (1:250). If the formation level cannot be provided infiltration trenches must be used. The sizes and dimensions of infiltration trenches are to be confirmed at detailed design stage.

The paved Hydropave surface should have no slopes steeper than 1:20 to ensure that water can infiltrate through the joints.

It is assumed that any fall greater than 1:20 will run off into an area with a max 1:20 fall and infiltrate into the permeable subbase.

Site levels should be confirmed prior to construction.

3.0 Hydraulic Design

The thickness of a permeable pavement's crushed rock base has to be calculated on the basis of the need to store water and also on structural requirements. In this section, the thickness calculation based on the storage of water is set out.

The thickness of the sub-base necessary for water storage depends upon the factor r, which is the ratio of the 60-minute storm rainfall depth to the 2-day maximum rainfall depth. This factor varies across the UK and implies a 5-year storm return period. For greater return periods a correction factor, Z2, given in Table 4 should be applied to the five-year return period rainfall value and the sub-base calculated in accordance with Table 2.

3.1 Table 01: Hydraulic Design Parameters

Town/ City	M560 (mm)	r Value	SAAR (mm)	WRAP	Soil Index	Return Period		Climate Change	
Bodicote	20.10	0.42	650.00	4.00	0.45	100	years	Factor	1.30

The method undertaken to vary the storm return period for any duration is as follows:

It is assumed that the depth of rainfall occurring during a 60-minute storm recurring every 5 years is 20.10mm in the area. The depth of rainfall occurring every five years over storm durations other than 60-minutes is obtained as follows:

The design rainfall depth for any given return period and storm duration can be found by multiplying 20.10mm by a factor Z1, which requires knowledge of 'r', the ratio of 60-minute to 2-day rainfalls for a 5-years return period.

The $M_5$60 storm for Bodicote may be taken as 20.10mm, with an 'r' value of 0.42. The relevant Z1 factors may be taken and multiplied by the rainfall to give a quantity for each storm duration, shown in Table 2.

3.2 Table 02: Z1 Factored Storm Durations

	Storm Duration									
	Minutes					Hours				
	5	10	15	30	60	2	4	6	10	24
Z1	0.38	0.53	0.64	0.81	1.00	1.20	1.42	1.57	1.74	2.16
M5 – D rainfall	7.64	10.65	12.86	16.28	20.10	24.12	28.54	31.56	34.97	43.42

Z2 factors are then applied to vary storm return period. This preliminary design considers a 1 in 100-year storm, plus 40% to account for climate change. The rainfall multiplied by the Z2 factor is return dependent.

3.3 Table 03: Rainfalls for 1 in 100 Year Storm

Return Period:	Storm Duration									
100	Minutes					Hours				
	5	10	15	30	60	2	4	6	10	24
Rainfall (mm)	13.67	20.46	25.16	32.57	40.79	48.57	56.56	61.77	67.51	80.87
x CC Factor	17.77	26.60	32.71	42.34	53.03	63.14	73.53	80.31	87.76	105.13

3.4 Site Analysis Parameters

Category 6 (<70 standard axles per day)

- Total area of Tobermore Hydropave approximately **1990m²** (to include permeable paving areas)
- Total Catchment Area approximately **2390m²** (this includes the Hydropave areas + 20% of the additional Hardstanding area).
- It was assumed that a minimum depth of 420mm of coarse graded aggregate for storage will be included below the Category 6.

For preliminary design purposes we have made the following assumptions:

1. The proposed formation level CBR will be at least 3%. This should be confirmed via in-situ testing prior to construction. If lower values are recorded this design will need to be reviewed.
2. A minimum infiltration rate of 0.05m/hr has been assumed. Please advise if a lower infiltration rate is required, as the design will have to be revised. If the infiltration rate is lower than we have assumed, then the depth of course graded aggregate will have to increase.

Please check these areas and which, if any, of the other surrounding areas are to be included. Please also check that the assumed minimum infiltration rate is appropriate and CBR can be achieved.

3.5 Critical Storm Duration Calculation

The following table indicates the Factors of Safety for the proposed Hydropave system for storm durations up to 24 hours. The void ratio of the coarse graded aggregate was assumed to be is 0.32, with the minimum depth of the CGA for water storage to be 420mm under the Hydropave blocks. See the proposed sections on drawing SK21-5566-02 for Category 6.

Category 6 (<70 standard axles per day)

Storm Duration	Depth of rainfall (mm) 100 year storm	Volume entering Hydropave (m^3)	Outflow to Storm Sewer (m^3)	Infiltration to Subgrade (m^3)	Storage Required (m^3)	Storage Capacity (m^3)	Factor of Safety
5 minutes	17.77	42.46	0.00	0.83	41.63	267.59	6.43
10 minutes	26.60	63.54	0.00	1.66	61.88	267.59	4.32
15 minutes	32.71	78.14	0.00	2.49	75.65	267.59	3.54
30 minutes	42.34	101.14	0.00	4.98	96.16	267.59	2.78
1 hour	53.03	126.70	0.00	9.96	116.74	267.59	2.29
2 hours	63.14	150.83	0.00	19.91	130.92	267.59	2.04
4 hours	73.53	175.66	0.00	39.82	135.84	267.59	1.97
6 hours	80.31	191.85	0.00	59.73	132.12	267.59	2.03
10 hours	87.76	209.66	0.00	99.55	110.11	267.59	2.43
24 hours	105.13	251.16	0.00	238.92	12.24	267.59	21.87

The critical storm duration therefore 4 hours.

4.0 Structural Design & Summary

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2. A minimum infiltration rate of 0.05m/hr has been assumed. Please advise if a lower infiltration rate is required, as the design will have to be revised. If the infiltration rate is lower than we have assumed, then the depth of course graded aggregate will have to increase.

Please inform Geoman if this is incorrect as we will need to revise the preliminary design.

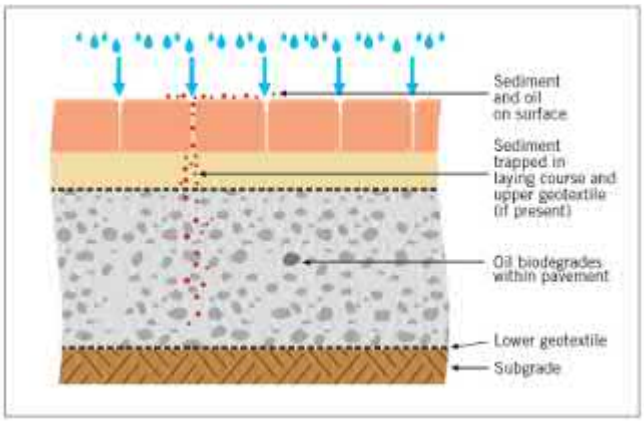
We normally highlight that all our proposals for permeable paving are marked 'Feasibility only – not for construction'. Clients should review the proposals and issue comments where appropriate. Proposals are based on information received from a salesperson or site team and may not have been checked by the parties to the construction contract. Geoman Ltd has not checked these proposals.

Instructions to proceed and issue drawings 'for construction' can only come from the Client, Scheme Architect or Scheme Engineer. This can only happen once they have checked the proposal and the assumptions and only if all their requirements have been taken into account will they instruct the contractor to proceed.

4.1 Petrol Interceptor requirements

Permeable pavements are effective at removing pollution from runoff and as a consequence oil separators are not required. The following is an extract from the Interpave Guidelines which demonstrates this:

"Concrete block pavements are very effective at removing pollution from runoff, unlike attenuation tanks. The pollutants may either remain on the surface (particularly with zero gradients) or may be flushed into the underlying pavement layers where many of the pollutants are filtered and trapped or degrade over time.



Hydrocarbons may degrade but other contaminants, such as heavy metals, do not break down and remain within the pavement structure for a long period of time, making permeable pavements ideal for areas where vehicles are stored or maintained. Further information on pollution removal is provided in CIRIA Reports C 697, C 609 and C 582 (CIRIA 2007, 2004 and 2001). The research that has been undertaken demonstrates the effectiveness of permeable pavements in reducing pollution. They can for example remove between 60% and 95% of total suspended solids (i.e. silt) and 70% to 90% of hydrocarbons. When subjected to low level oil drips, such as in car parks, the pavements can continue to biodegrade the hydrocarbons indefinitely.

'Pollution Prevention Guideline' PPG 3 (Environment Agency, 2006) identifies the beneficial performance of permeable pavements in removing pollution from runoff. It states that: *"Techniques thatcontrol pollution close to the source, such as permeable surfacesor infiltration trenches, can offer a suitable means of treatmentfor runoff from low risk areas such as roofs, car parks, and nonoperationalareas."*

Oil separators are not required when permeable pavements are used. Indeed permeable pavements are more effective at removing a wider range of pollutants from runoff than oil separators (CIRIA,
2004). If additional treatment is required for higher risk areas it is normally more effective to use green SUDS methods such as swales or wetlands, as these also treat a wider range of pollutants."

4.2 Construction Considerations

Sub-base material (coarse graded aggregate) should be placed in layers not exceeding 150mm in thickness or twice the nominal maximum aggregate size. Unlike traditional pavement construction, the open-graded materials should not be fully compacted to eliminate any voids, as this will compromise the performance of the system.

It is likely that excessive compaction will result in the displacement of the open graded aggregate by the compaction equipment. The open-graded material should be compacted such that its maximum density is achieved for the particular aggregate type and grading without compromising the final void percentage offered by the material.

Each layer should be suitably compacted before the next layer is placed to prevent any potential settlement of the pavement after completion.

Due to the nature of both the sub-layers and the block paving, care should be taken during the construction process to prevent dirt or detritus contaminating the sub-base and compromising the permeability of the system. For example, the trafficking of the sub-base as a site access route should not be undertaken. Should other construction or maintenance work take place close to the pavement which may affect the infiltration of the pavement, suitable protective measures should be implemented.

Edge restraints should be sufficiently robust to resist the lateral displacement from imposed loadings placed upon the pavement. The edge restraint may take the form of associated fittings, walls or buildings or be formed from precast concrete, clay or natural stone kerb systems, either existing or newly constructed features. The restraint must provide a consistent vertical face to a level below the laying course material.

Appendix A – Aggregates

Please Refer to BS7533-13 2009 Guide for the design of permeable pavements constructed with concrete paving blocks and flags, natural stone slabs and setts and clay pavers.

Laying Course and jointing material

- Laying course requires 6.3-2mm sized grit to BSEN 13242:2002. In particular, the material should be categorised as LA20 according to Table 9, SZ18 according to Table 10 and MDE15 according to Table 11 within this standard. The grit should be insoluble in dilute hydrochloric acid and should be naturally occurring material. In our experience, incorrect use of aggregates is one of the most common reasons for failure of a permeable paving design.

Course Graded Aggregate (CGA)

- Requires 32% of voids spacing for the storage of water. CGA should comply with the requirements of BSEN 13242:2002. The material should be designated Type 4/20 (4mm minimum and 20mm maximum particle size). In our experience, incorrect use of aggregates is one of the most common reasons for failure of a permeable paving design.

Capping

- Capping material is included in order to achieve a firm-working platform so that the overlying layers can be correctly installed. The permeable paving designs are normally designed for 5% CBR, If not then the appropriate increase in capping material should be used. All capping materials should meet the requirements of either 6F1 or 6F2 of Table 6.1 of Highways Agency's '*Specification for Highway Works-Series 600-Earthworks'*

Please note: If you obtain the appropriate technical information for the aggregates which you plan to use on a permeable paving scheme please send them to us so we can give feedback on if they meet BS 7533-13:2009 and BSEN 13242:2002 requirements. Depending on the project size we would strongly advise customers that aggregates used in the construction of a permeable paving system should be tested to ensure conformity during the construction of the project.

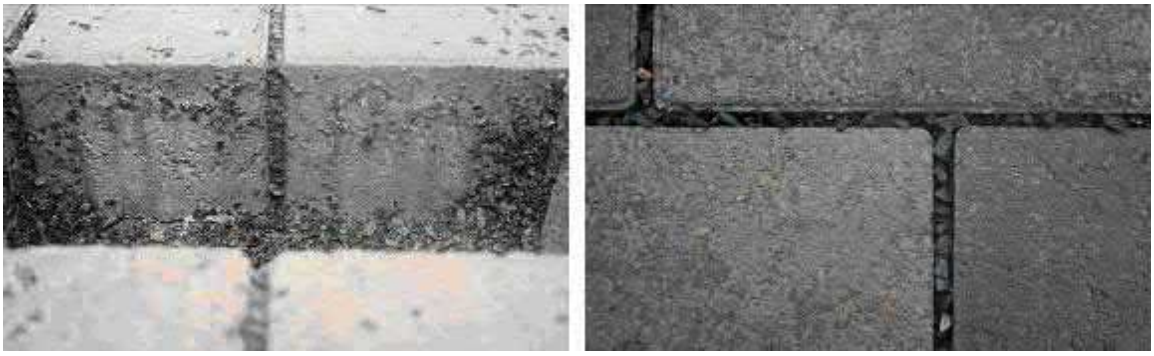
Appendix B – Installation

Paving should be installed to BS7533-3:2005.

i. A permeable paving design relies heavily on using the correct aggregates. Prior to installation, we would ask you to test both the 4/20mm coarse graded aggregate and also the 6.3-2mm bedding and jointing grit as per the relevant British Standard specification (BS EN 13242:2002). In particular, the material should be categorized as LA20 according to Table 9, SZ18 according to Table 10 and MDE15 according to Table 11 within this standard. The grit should be insoluble in dilute hydrochloric acid and should be naturally occurring material. In our experience, incorrect use of aggregates is one of the most common reasons for failure of a permeable paving design.

ii. All joints must be filled to the top with 6.3-2mm grit. Joints which are not fully filled can lead to possible movement of the blocks after use. We recommend that after a few weeks use that any joints, which have settled and are not full, are topped up with grit. Joints should be kept filled at all times. You need approximately 1 ton of grit for every 100m2 of 80mm paving.

iii. Care should be taken that the permeable joints do not become contaminated as work on the scheme is completed. Special care needs to be taken when soft landscaping is carried out so that soil does not enter the joints.



All joints must be filled to the top with 6.3-2mm grit.

Appendix C – Geoman Services

Geoman Ltd offers design services in relation to permeable paving products in general accordance with the Interpave design guide:

Where certain information is not provided assumptions will be made in order to produce an answer. The project team should check any assumptions in a site investigation or using tests at the construction stage.

Often the project team will update and make changes to our proposal based on their detailed knowledge of the scheme and its requirements.

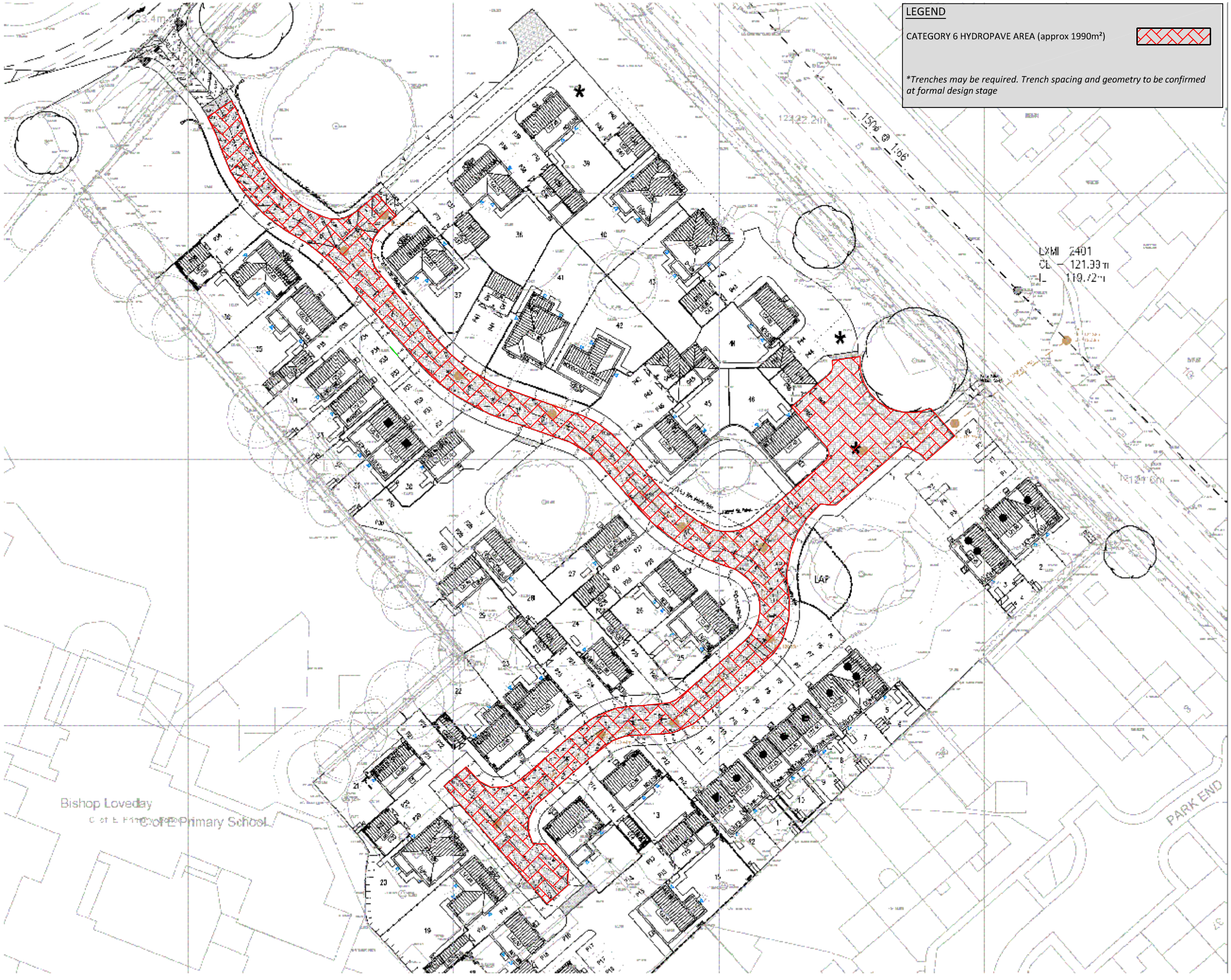
Our deliverable documents include a design signed off by a chartered engineer recording all the information provided. The project team should check that all the information used is current. The Project Consulting Engineer still has a duty to check the design provided.

This service excludes supervision of the works. Responsibility for supervision of the works remains with the Resident Engineer, usually a representative of the Project Consulting Engineer. If this supervisory service is required, Geoman should be given a brief and asked to formally quote for it by the project team. Invoices will be made direct to the project team or client for this supervisory service.

Occasionally some projects have the specialized aspects of the works billed as contractor design or a form of warranty may be required. Geoman Ltd can offer an indemnified design as above and in addition will make visits as we see fit in order to check that the works are being undertaken correctly. Often this service will consist of one or two visits, occasionally we are requested to supervise full time. Good liaison is required with the Principal Contractor and if defects are not correct we reserve the right to report any concerns direct to the project team.

The Principal Contractor still has a duty to install the system correctly and make any changes advised.

Any site supervisory staff still has a duty to record and notify Geoman of any activities that give rise to concern in our absence. If this supervisory service is required, Geoman should be given a brief and asked to formally quote for it by the project team. Invoices will be made direct to the project team, Principal Contractor or client for this supervisory service.



NOTES

1. A permeable paving design relies heavily on using the correct aggregates. Prior to installation, we would ask you to test both the 4/20 mm coarse graded aggregate and also the 6.3-2 mm bedding and jointing grit as per the relevant British Standard specification (BS 7533-13:2009), in particular, the material should be categorised as LA30, FI20 and MDE20 according to Table A.3, within this standard. The grit should be Insoluble in dilute hydrochloric acid and should be naturally occurring material. In our experience, Incorrect use of aggregates is one of the most common reasons for failure of a permeable paving design.

2. All joints must be filled to the top with 6.3-2 mm grit. Joints which are not fully filled can lead to possible movement of the blocks after use. We recommend that after a few weeks use that any joints, which have settled and are not full, are topped up with grit. Joints should be kept filled at all times. You need approximately 1 ton of grit for every 100 m^2 of 80mm paving.

3. Care should be taken that the permeable joints do not become contaminated as work on the scheme is completed. Special care needs to be taken when soft landscaping is carried out so that soil does not enter the joints.

4. All dimensions in mm's unless otherwise specified.

5. All paving should be installed in accordance with BS 7533-3:2005 by a competent experienced paving contractor.

6. All aggregates should be Installed In accordance with the material specifications table.

7. Base of sub-base/soakaways to be constructed on competent horizon with a CBR value in excess of 3%.

8. A minimum Infiltration rate of 0.05m/hr was assumed for the purposes of this design. Please advise is a lower Infiltration rate is required, as the design will have to be revised .

9. The maximum storm return period assumed In the preliminary analysis was 1 in 100 years, plus an additional 40% rainfall for climate change.

This drawing must be used in conjunction with Geoman Ltd. design document 21-5566.

10. This design is to be used with Tobermore products only and is not valid for any other manufacture.

INSTALLATION METHODOLOGY

GENERAL
Works to be carried out In accordance with BS 7533-13:2009 guide for the design of permeable pavements .

SUB-GRADE
Sub-grade preparation is to be carried out in accordance with Specification for Highway Works Clause 616 - preparation and surface treatment of format ion. remove all soft spo ts and fill with suitable replacement mater ial before compaction. Sub-grade design CBR taken as greater than or equal to 3% and is the responsibility of the Project Designer for the overall project.

KERBS/EDGINGS
Kerb haunching must extend a minimum of 150mm below the base of the kerb to provide a firmly restrained pavement.

CAPPING
Capping is to be provided in accordance with the BS requirements. Structural capping requirements and site traffic loading are the responsibility of the Principal Designer.

PERMEABLE GEOTEXTILE
The permeable separation geotextile should be laid on the subgrade/capping with a minimum 3% CBR. Refer to manufacturer's specification on installation , but min. 300mm overlapping joints to be provided. The geotextile should be brought up to the top of kerbing/edgeing and cut flush with paving surface.

SUB-BASE
The 4/20 coarse graded aggregate sub-base should be placed In maximum 150mm layers and compacted to clause 802 requirements. The final compaction pass should be undertaken without vibration. Compaction should not crush the individual particles or reduce the void ratio below 32% minimum design value.

LAYING COURSE
Lay and screed to level approx. 50mm deep of 2-6.3mm grit in accordance with BS 7533-13:2009. A small trial area should be laid prior to construction to determine accuracy of final levels.

BLOCK LAYING
Herringbone pattern with 2 no. rows of stretcher course around perimeter. Paving to be plate vibrated prior to infilling of jointing material. Brush in jointing material between joints and carry out final plate vibration.

FOR COMMENT

Issue / Revision:		Drawn:	Date:
Rev. 0		CC	12.05.21

Designer:

GEOMAN
44 Elmwood Avenue, Belfast, BT9 6AZ 02890 664941 geoman@geoman.co.uk

Project Title:

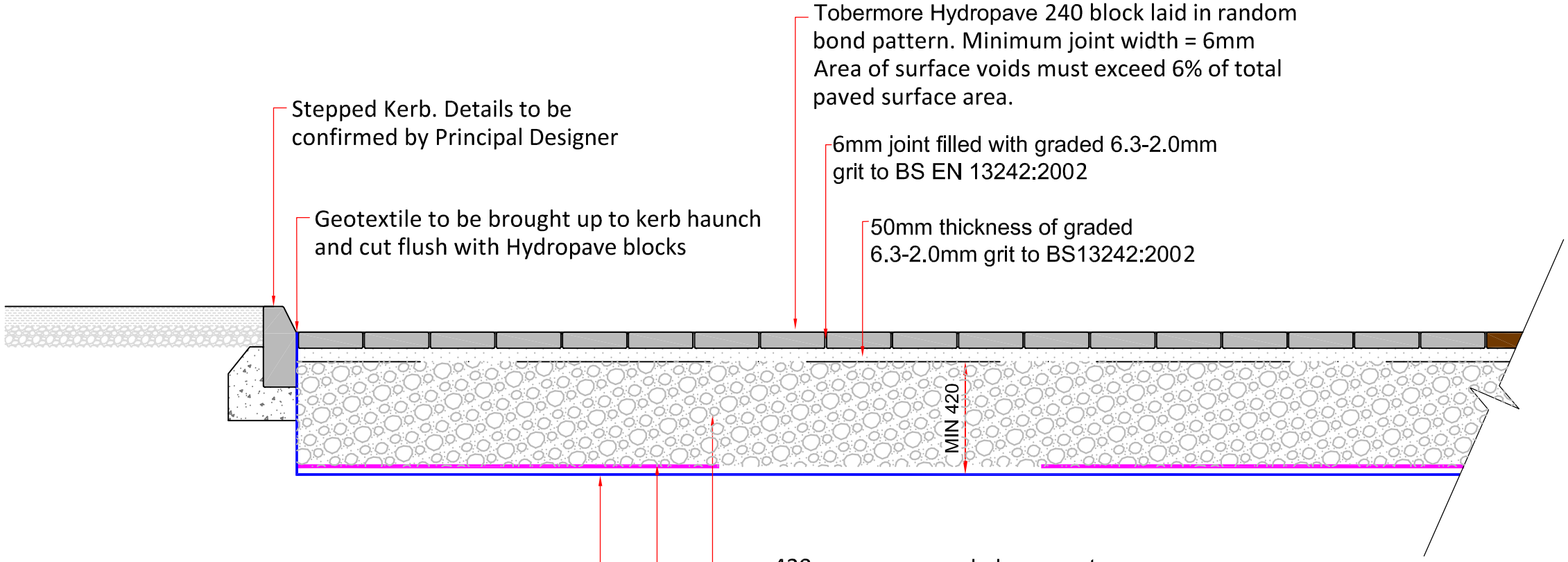
Oxford Rd, Bodicote

Tobermore

Drawing Title:

Infiltration System
Part 1/2

Designed:		Date:	Project No: 21-5566
Drawn:	CC	Date: 12.05.21	Scale: 1:700
Approved:		Date:	
Drawing No:	SK21-5566-01		Revision: 0



TYPICAL SECTION THROUGH TOBERMORE HYDROPAVE INFILTRATION SYSTEM
Category 6 **only** (1:20)

Please note for a Formal Hydropave design the Design Warranty must be completed and returned to Geoman prior to construction

NOTES

1. A permeable paving design relies heavily on using the correct aggregates. Prior to installation, we would ask you to test both the 4/20 mm coarse graded aggregate and also the 6.3-2 mm bedding and jointing grit as per the relevant British Standard specification (BS 7533-13:2009). In particular, the material should be categorised as LA30, FI20 and MDE20 according to Table A.3, within this standard. The grit should be Insoluble in dilute hydrochloric acid and should be naturally occurring material. In our experience, Incorrect use of aggregates is one of the most common reasons for failure of a permeable paving design.

2. All joints must be filled to the top with 6.3-2 mm grit. Joints which are not fully filled can lead to possible movement of the blocks after use. We recommend that after a few weeks use that any joints, which have settled and are not full, are topped up with grit. Joints should be kept filled at all times. You need approximately 1 ton of grit for every 100 m^2 of 80mm paving.

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KERBS/EDGINGS
Kerb haunching must extend a minimum of 150mm below the base of the kerb to provide a firmly restrained pavement.

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PERMEABLE GEOTEXTILE
The permeable separation geotextile should be laid on the subgrade/capping with a minimum 3% CBR. Refer to manufacturer's specification on installation , but min. 300mm overlapping joints to be provided. The geotextile should be brought up to the top of kerbing/edgeing and cut flush with paving surface.

SUB-BASE
The 4/20 coarse graded aggregate sub-base should be placed in maximum 150mm layers and compacted to clause 802 requirements. The final compaction pass should be undertaken without vibration. Compaction should not crush the individual particles or reduce the void ratio below 32% minimum design value.

LAYING COURSE
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FOR COMMENT

Issue / Revision:	Drawn:	Date:
Rev. 0	CC	12.05.21

Designer:

GEOMAN
44 Elmwood Avenue, Belfast, BT9 6AZ 02890 664941 geoman@geoman.co.uk

Project Title:

Oxford Rd, Bodicote

Tobermore

Drawing Title:

Infiltration System
Part 2/2

Designed:		Date:	Project No: 21-5566
Drawn:	CC	Date: 12.05.21	Scale: As Shown at A3
Approved:		Date:	
Drawing No:	SK21-5566-02		Revision: 0

GEOMAN

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DESIGN WARRANTY

This agreement is made the (DATE) between (Element Designer) Geoman Ltd whose address is 44 Elmwood Avenue, Belfast BT9 6AZ and (Client)… whose address is on behalf of (Principal Designer)….. whose address is …..

Copyright in Our Design

This design has been produced for the site stated in the design document only. All advise is specific to this development. The completed design, including all calculations, drawings, specifications and any advice produced on behalf of Geoman is subject to the law of copyright. Geoman will retain exclusive retain copyright and other intellectual property rights. This design and advise is not to be used for any other project with prior written consent from Geoman. For these purposes "Design" means the design attached to these conditions. This includes any design included in the specification and/ or any other design or technical advice provided by Geoman in connection with the Project, including any revisions, amendments and updates made by Geoman to these design and/or design advice. "Development" means the client's specified project location (where "client" include any contractor, architect, specifier or agent who is identified as the client) in connection with which the design is supplied.

Now it is hereby agreed in consideration of the payment of …… excluding VAT by ….. to Geoman Ltd, receipt of which Geoman Ltd hereby acknowledges:

1. Geoman Ltd (The Element Designer) warrants that it has exercised reasonable care and diligence in the performance of its services to ……. (The Client) under the appointment.
2. In the event of any breach of this agreement:
    a. Subject to sub-clauses (b) and (c), The element designer shall be liable for the reasonable costs of repair, renewal and/or reinstatement of any part or parts of the development to the extent that the purchaser reasonably incurs such costs and the purchaser becomes liable or by way of financial contribution for such costs. The element designer shall not be liable for other losses incurred by the purchaser.
    b. Without prejudice to any other exclusion or limitation of liability, damages, loss, expense or costs the element designer's liability for such costs of the repair, renewal or reinstatement in question shall be further limited to that proportion thereof as it would be just and equitable to require the element designer to pay having regard to the extent of the element designer's responsibility for the same and on the assumptions that:
        i. all other element designers, consultants and advisors, contractors and subcontractors involved in the development have provided contractual undertakings on terms no less onerous than those set out in clause 1 to the purchaser in respect of the carrying out of their obligations in connection with the development and;
        ii. that there are no exclusions of or limitations of liability nor joint insurance or co-insurance provisions between the purchaser and any other party referred to in this clause 2 and any such party who is responsible to any extent for such costs is contractually liable to the purchaser for the same and
        iii. all the parties referred to in this clause 2 have paid to the purchaser such proportion of such costs that it would be just and equitable for them to pay having regard to their responsibilities for the same.
    c. The element designer shall be entitled in any actions or proceedings by the purchaser to rely in any limitation or exclusion in the appointment and to raise the equivalent rights in defence of liability as it would have against the client under appointment.
    d. The obligations of the element designer under or pursuant to this agreement shall not be released or diminished by the appointment of any person by the purchaser to carry out any independent enquiry into any relevant matter.
3. The element designer has exercised reasonable skill and care to see that, unless authorised by the client in writing, or where such authorisation is given orally, confirmed by the element Designer to the client in writing, materials specified by it for use in the development are in accordance with the guidelines contained in the edition of the publication 'Good Practice in Selection of Construction Materials' (Ove Arup & Partners) current at the date of its specification.
4. The purchaser shall have no authority to issue any direct or instruction to the element designer in relation to the appointment.
5. The element designer shall not be liable for any use by the purchaser, the client, the principal designer or its appointee of any of the documents for any purpose other than that for which the same were prepared by or on behalf of the element designer.
6. This design and advise provided to the principal engineer by the element designer is specific to the development stated in this design document. The client acknowledge that to complete this design, the element designer have relied upon the information, supplied by the client and any professional advisors working on this development. Geoman (the element designer) can take no responsibility for any failure or defect arising for incomplete, inaccurate or misleading information we have received for you or arising from any other third party engaged in this development. This design and advise have been provided on the basis that the element designer approved products will be used in construction. If any other products other than the element designers approved products are used for construction, the element designer can no accept responsibility for the preformance of those products. This design and/or advise will not be valid for the use of any other products other than the element designer's approved products.
7. The element designer shall maintain professional indemnity insurance in an amount each year of not less than (…) pounds in the aggregate for the period of insurance in respect of each and every occurrence or series of occurrences arising out of one event for a period of five years from the date of practical completion of the design under this agreement and provided that such insurance is available at commercially reasonable rates. The element designer shall inform the purchaser if such insurance ceases to be available at reasonable commercial rates in order that the element designer and purchaser can discuss the best means of protecting their respective positions. The element designer shall on reasonable request provide evidence that such insurance is being maintained.
8. The purchaser may assign by way of absolute legal assignment only the benefit of this agreement to a third party who also takes an assignment of the purchaser's interest in the premises (The 'first assignee'). The First Assignee may assign by way of absolute legal assignment only the benefit of this agreement to a third party who also takes an assignment of the First Assignee's interest in the premises. Any such assignment shall only be effective if written notice thereof is given to the element designer. No further or other assignment of this agreement shall be permitted.
9. Any notice to be given by the element designer shall be deemed to be duly given if it is delivered by hand or sent by recorded (signed for) or special delivery to the purchaser at the above mentioned address; and any notice given by the purchaser shall be deemed to be duly given if it is delivered by hand or sent by recorded (signed for) or special delivery to the element designer at the above address. Any such notices shall be deemed to have been received 48 hours after being posted (subject to proof to the contrary).
10. No action or proceedings for any breach of this agreement shall be commenced against the element designer after the expiry of five years from the date of practical completion of the relevant part of the premises or, in the event that practical completion is not achieved, the date that the element Designer finished its services under the appointment.
11. Nothing in this agreement confers or purports to confer on any third party any benefit or any right to enforce any term of this agreement pursuant to the Contracts (rights of third parties) Act 1999.
12. This agreement is subject to the law of England and Wales and the parties hereto subject to the jurisdiction of the courts of England and Wales.

As witness the hands of the parties hereto:

Signed by or on behalf of the Element Designer

For and on behalf of Geoman Ltd

Signed by or on behalf of the Client

For and on behalf of … Ltd

APPENDIX E – SURFACE WATER CALCULATIONS, TYPICAL PRIVATE DOMESTIC CELL, 100 YEAR + 40% CLIMATE CHANGE

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 589 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	122.637	0.387	0.2	5.5	O K
30 min Summer	122.751	0.501	0.2	7.1	O K
60 min Summer	122.865	0.615	0.2	8.8	O K
120 min Summer	122.948	0.698	0.2	9.9	O K
180 min Summer	122.990	0.740	0.2	10.5	O K
240 min Summer	123.012	0.762	0.2	10.9	O K
360 min Summer	123.023	0.773	0.2	11.0	O K
480 min Summer	123.013	0.763	0.2	10.9	O K
600 min Summer	122.999	0.749	0.2	10.7	O K
720 min Summer	122.983	0.733	0.2	10.4	O K
960 min Summer	122.947	0.697	0.2	9.9	O K
1440 min Summer	122.876	0.626	0.2	8.9	O K
2160 min Summer	122.787	0.537	0.2	7.7	O K
2880 min Summer	122.716	0.466	0.2	6.6	O K
4320 min Summer	122.608	0.358	0.1	5.1	O K
5760 min Summer	122.530	0.280	0.1	4.0	O K
7200 min Summer	122.476	0.226	0.1	3.2	O K
8640 min Summer	122.435	0.185	0.1	2.6	O K
10080 min Summer	122.403	0.153	0.1	2.2	O K
15 min Winter	122.684	0.434	0.2	6.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	150.129	0.0	19
30 min Summer	98.442	0.0	34
60 min Summer	61.699	0.0	64
120 min Summer	36.503	0.0	122
180 min Summer	26.840	0.0	182
240 min Summer	21.541	0.0	242
360 min Summer	15.719	0.0	360
480 min Summer	12.501	0.0	430
600 min Summer	10.429	0.0	488
720 min Summer	8.972	0.0	552
960 min Summer	7.044	0.0	682
1440 min Summer	4.968	0.0	954
2160 min Summer	3.485	0.0	1364
2880 min Summer	2.716	0.0	1760
4320 min Summer	1.932	0.0	2548
5760 min Summer	1.534	0.0	3288
7200 min Summer	1.304	0.0	4032
8640 min Summer	1.152	0.0	4752
10080 min Summer	1.042	0.0	5448
15 min Winter	150.129	0.0	19

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	122.813	0.563	0.2	8.0	O K
60 min Winter	122.942	0.692	0.2	9.9	O K
120 min Winter	123.039	0.789	0.2	11.2	O K
180 min Winter	123.090	0.840	0.2	12.0	O K
240 min Winter	123.118	0.868	0.2	12.4	O K
360 min Winter	123.139	0.889	0.2	12.7	O K
480 min Winter	123.133	0.883	0.2	12.6	O K
600 min Winter	123.114	0.864	0.2	12.3	O K
720 min Winter	123.094	0.844	0.2	12.0	O K
960 min Winter	123.051	0.801	0.2	11.4	O K
1440 min Winter	122.958	0.708	0.2	10.1	O K
2160 min Winter	122.835	0.585	0.2	8.3	O K
2880 min Winter	122.735	0.485	0.2	6.9	O K
4320 min Winter	122.586	0.336	0.1	4.8	O K
5760 min Winter	122.480	0.230	0.1	3.3	O K
7200 min Winter	122.408	0.158	0.1	2.2	O K
8640 min Winter	122.355	0.105	0.1	1.5	O K
10080 min Winter	122.319	0.069	0.1	1.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	98.442	0.0	33
60 min Winter	61.699	0.0	62
120 min Winter	36.503	0.0	120
180 min Winter	26.840	0.0	178
240 min Winter	21.541	0.0	236
360 min Winter	15.719	0.0	348
480 min Winter	12.501	0.0	456
600 min Winter	10.429	0.0	554
720 min Winter	8.972	0.0	576
960 min Winter	7.044	0.0	724
1440 min Winter	4.968	0.0	1036
2160 min Winter	3.485	0.0	1472
2880 min Winter	2.716	0.0	1900
4320 min Winter	1.932	0.0	2680
5760 min Winter	1.534	0.0	3456
7200 min Winter	1.304	0.0	4176
8640 min Winter	1.152	0.0	4840
10080 min Winter	1.042	0.0	5448

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 446181 238355 SP 46181 38355
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.020

Time (mins) From:	To:	Area (ha)
0	4	0.020

Model Details

Storage is Online Cover Level (m) 123.350

Cellular Storage Structure

Invert Level (m) 122.250 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.05148 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.05148

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	15.0	15.0	1.100	0.0	31.0
1.000	15.0	31.0			

APPENDIX F – EA FLOOD MAP

FRA - Flood Map for Planning (Rivers and Sea) Legend

Application Boundary

Flood_Map_for_Planning_Rivers_and_Sea_Flood_Zone_2

Flood_Map_for_Planning_Rivers_and_Sea_Flood_Zone_3

Flood Zone 3 - the best estimate of the areas of land at risk of flooding, when the presence of flood defences are ignored and covers land with a 1 in 100 (1%) or greater chance of flooding each year from Rivers; or with a 1 in 200 (0.5%) or greater chance of flooding each year from the Sea.

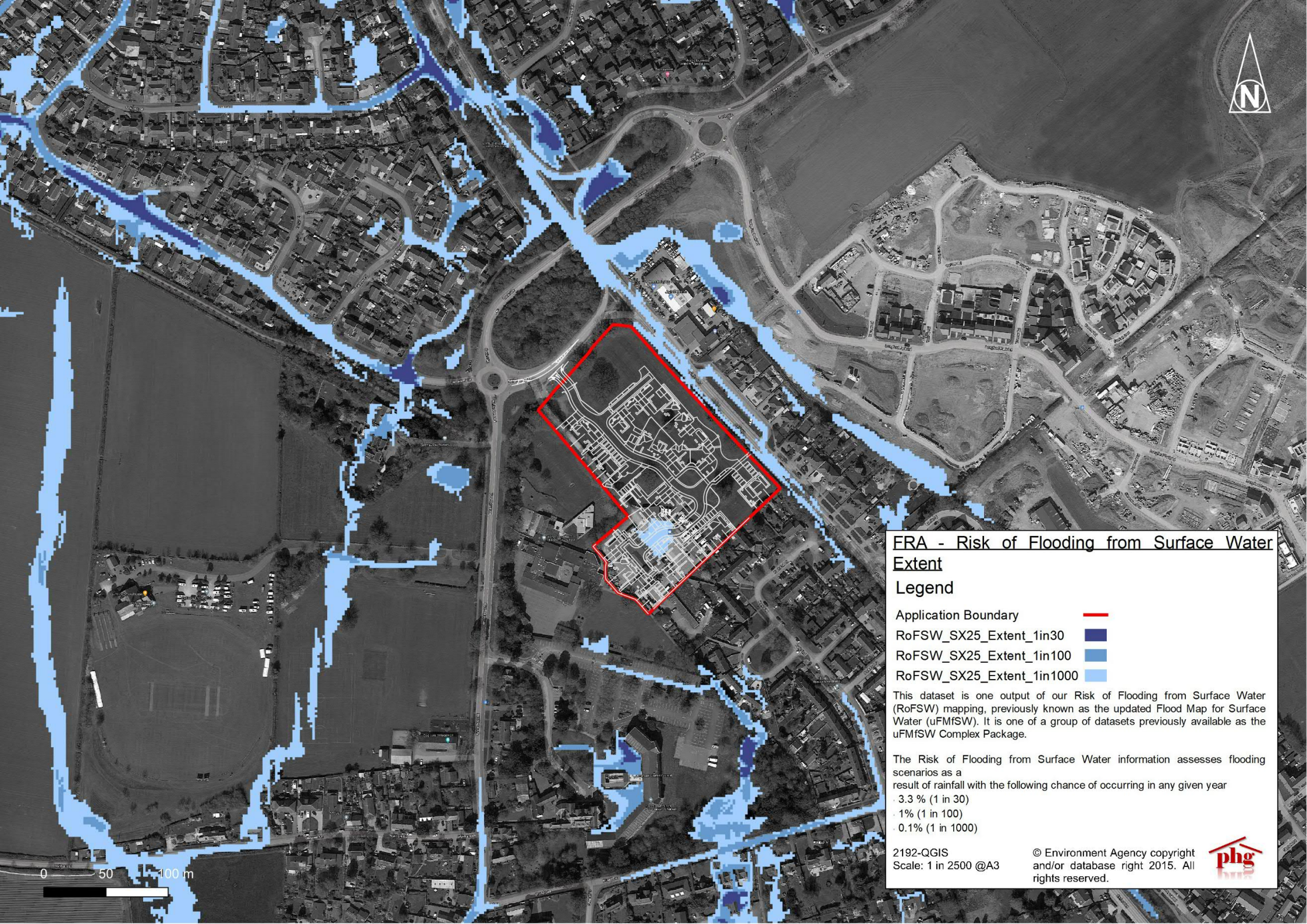
Flood Zone 2 - the best estimate of the areas of land at risk of flooding, when the presence of flood defences are ignored and covers land between Zone 3 and the extent of the flooding from rivers or the sea with a 1 in 1000 (0.1%) chance of flooding each year. This dataset also includes those areas defined in Flood Zone 3.

This dataset is designed to support flood risk assessments in line with Planning Practice Guidance; and raise awareness of the likelihood of flooding to encourage people living and working in areas prone to flooding to find out more and take appropriate action.

2192-QGIS
Scale: 1 in 10000 @A3

Environment Agency Dataset

phg



FRA - Risk of Flooding from Surface Water Extent

Legend

- Application Boundary
- RoFSW_SX25_Extent_1in30
- RoFSW_SX25_Extent_1in100
- RoFSW_SX25_Extent_1in1000

This dataset is one output of our Risk of Flooding from Surface Water (RoFSW) mapping, previously known as the updated Flood Map for Surface Water (uFMfSW). It is one of a group of datasets previously available as the uFMfSW Complex Package.

The Risk of Flooding from Surface Water information assesses flooding scenarios as a result of rainfall with the following chance of occurring in any given year

- 3.3 % (1 in 30)
- 1% (1 in 100)
- 0.1% (1 in 1000)

2192-QGIS
Scale: 1 in 2500 @A3

phg

Flood map for planning

Your reference	Location (easting/northing)	Created
BODI01	**446183/238339**	**18 May 2021 13:24**

Your selected location is in flood zone 1, an area with a low probability of flooding.

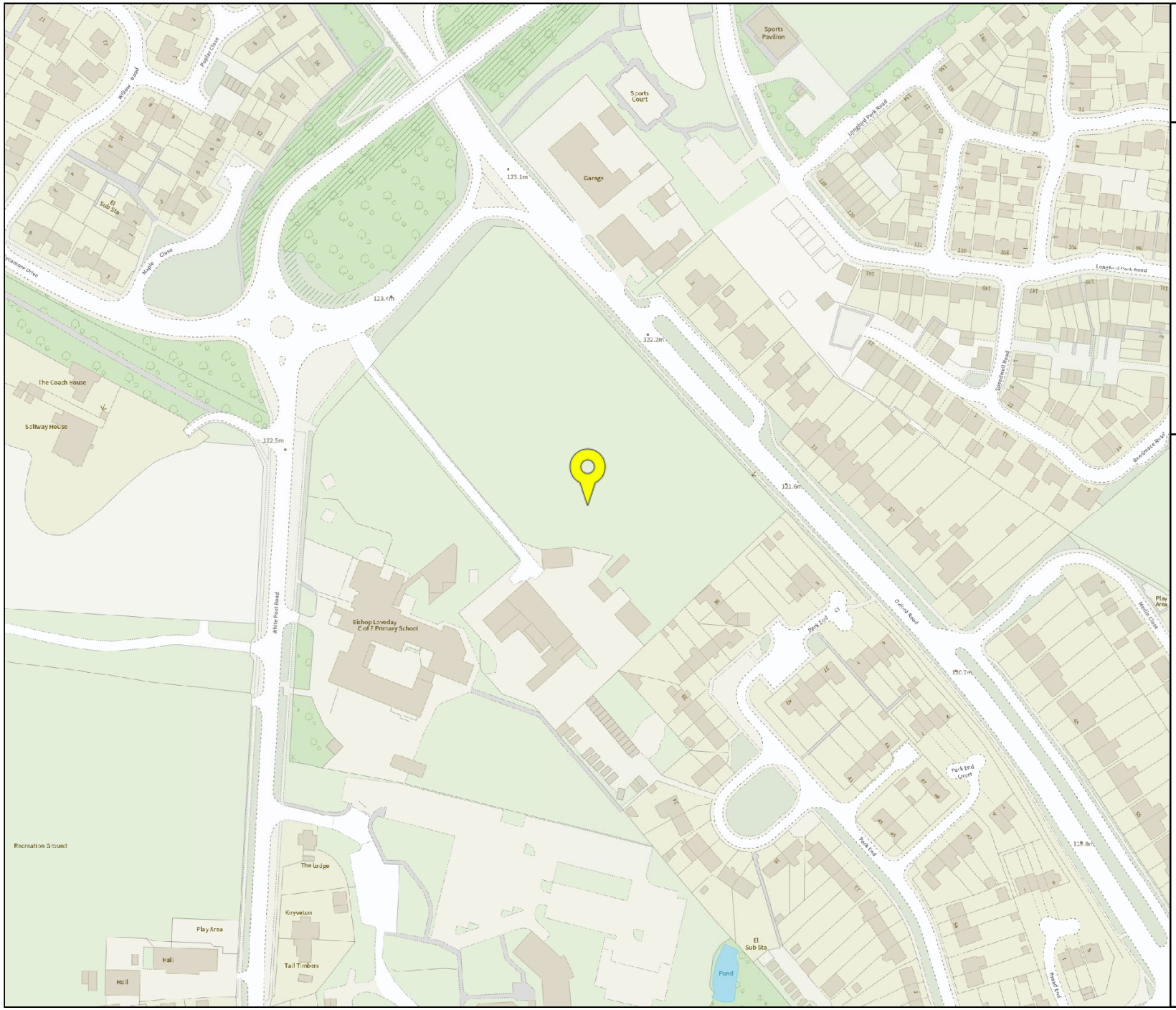
This means:

- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

The flood map for planning shows river and sea flooding data only. It doesn’t include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.



Environment Agency

Flood map for planning

Your reference
BODI01

Location (easting/northing)
446183/238339

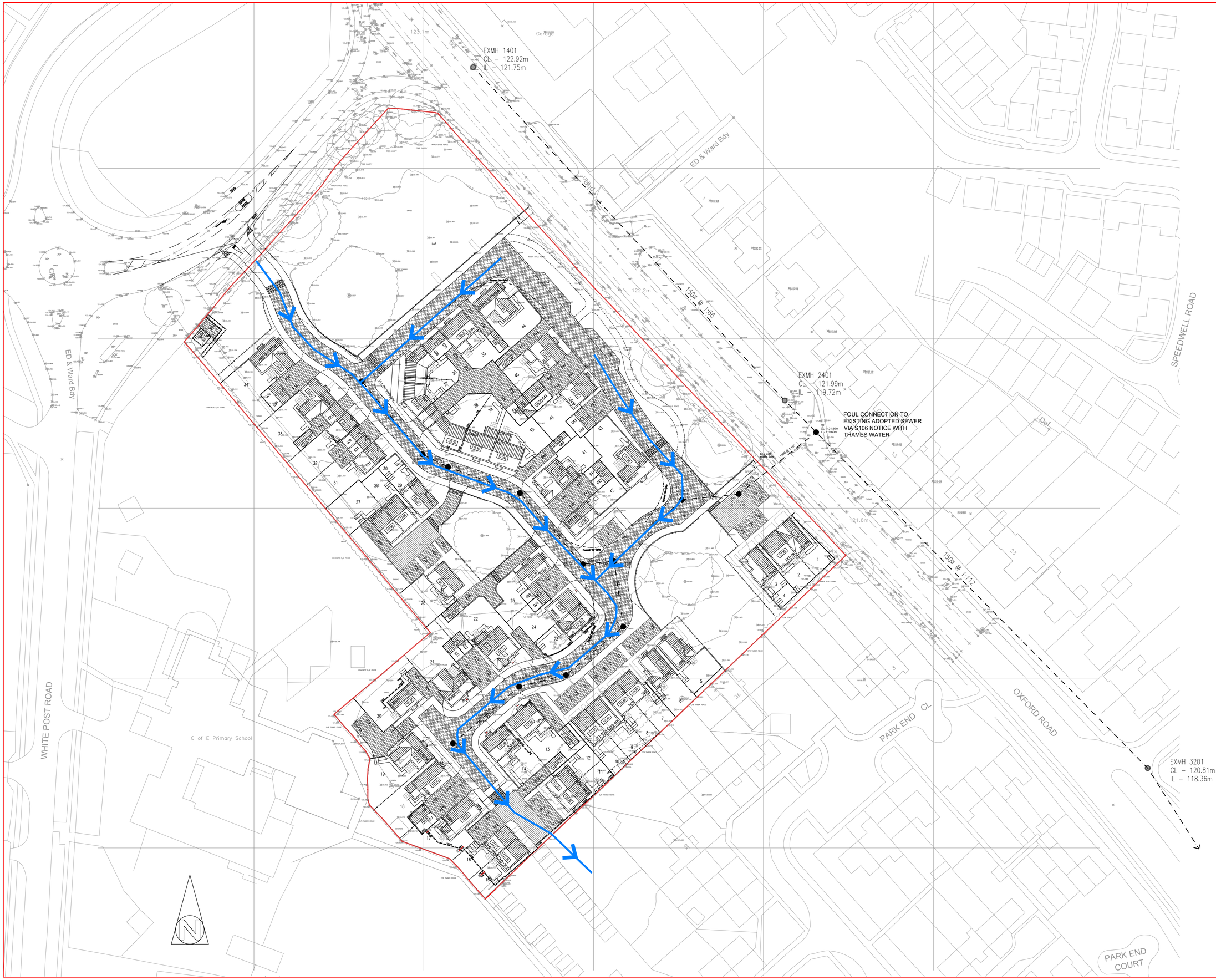
Scale
1:2500

Created
18 May 2021 13:24

- Selected point
- Flood zone 3
- Flood zone 3: areas benefitting from flood defences
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Flood storage area

0 20 40 60m

APPENDIX G – FLOOD EXCEEDANCE PLAN



GENERAL NOTES

1. Do Not Scale.
2. The contractor is to check and verify all buildings and site dimensions all levels, including sewer invert levels, before works start on site. The contractor is to comply in all aspects with the current building legislation, British Standards, building regulations etc.
3. Positions of existing services/statutory undertakers apparatus adjacent to or crossing proposed excavations are to be checked by the contractor prior to starting work.
4. This drawing is to be read in conjunction with and checked against all other drawings, Engineering Details, Specification and any structural, geotechnical or other specialist document provided.
5. Any anomaly or contradiction between any of the above is to be reported to GreenSquare Accord.
6. This drawing is schematic for clarity only, positions of pipes and manholes may vary due to site conditions.

ROAD AND SEWER ADOPTION NOTES

1. All works for adoption under a Section 38 agreement shall be carried out to the approval of Oxfordshire County Council.
2. All works for adoption under a Section 104 agreement shall be carried out to the National Water Council guide 'Sewers for Adoption' 8th edition and Thames Water requirements.
3. Streetlighting positions to be pegged on site and agreed by the Local Authority PRIOR to erection commencing.

LEGEND

Surface Water Exceedance Flow Route

Rev:	Date	Details	By.	Chk.
-	23.05.22	First Issue.	KF	SJD

Amendments

Client:

Green Square Accord

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Project:

GreenSquare Accord
Oxford Road
Bodicote

Drawing Title:

Flood Exceedance Plan

Drawn:	Chk:	Status:	Scale:
KF	SJD	Planning	1:500 @ A1

Date:	Job No:	Dwg. No:	Rev.
May-22	2192	106	

APPENDIX H – MAINTENANCE SCHEDULES

SuDS Maintenance Plan

List of Maintenance Tables

Managing the SuDS Features

The SuDS features will be adopted. Maintenance to be carried out by the adopting body. The systems have been designed so defects to be view from the surface and for easy maintenance comprise:

Regular care	Litter collection, grass cutting and checking the inlets and outlets where water enters or leaves a SuDS feature. Regular maintenance activities should be recorded and logged to optimise future maintenance.
Occasional tasks	Managing vegetation and removing any silt that builds up in the SuDS features.
Remedial work	Repairing damage where necessary.

Litter, debris and sediment entering the drainage network is normally greater during the construction period, therefore once construction is complete all SuDS features should be cleared of all litter, debris and sediment. Vegetated features should then be complete, the following is based removal of litter, debris and sediment after construction.

Table 1. Permeable paving maintenance

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's

		recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Table 2. Cellular storage maintenance

Maintenance schedule	**Required action**	**Typical frequency**
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter;	Annually

	remove and replace surface infiltration medium as necessary.	
	Remove sediment from pre-treatment structures and/or internal forebays	Annually, or as required
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

Table 3. Channel drain maintenance

Maintenance schedule	**Required action**	**Typical frequency**
Regular maintenance	Remove organic deposits (fats, proteins, saccharides and polysaccharides)	Monthly (or as required)
	Removal of inorganic deposits that could promote very resistant biofilms	Monthly (or as required)
Occasional maintenance	Lift grating and inspect sediment build-up in areas prone to blockages	Annually
	Inspect inlets and outlets for blockages	Quarterly
Structural Repair	Remove and replace any damaged sections of the channel.	As required

Table 4. Gullies and Pipe maintenance plan

Maintenance schedule	**Required action**	**Typical frequency**
Regular inspections	Inspect the sediment build-up in at the bottom of the gully pot. Undertake inspection after leaf fall in Autumn	Annually
	Inspect inlets and outlets for blockages	Quarterly or as required (before and after major rainfall events)
Regular maintenance	High-pressure water jetting. Areas identified as problematic or prone to blockages to have more regular maintenance.	Annually or as required
	CCTV survey and jetting	Five yearly, or as required

Structural Repair	Remove and replace any connecting pipes, or gullies, and replace if damaged.	As required

References

Woods Ballard, B., Wilson, S., Udale-Clarke, H., Illman, S., Scott, T., Ashley, R., & Kellagher, R. (2015). *The SuDS Manual (C753).* CIRIA.

APPENDIX I – WATER QUALITY

SIMPLE INDEX APPROACH: TOOL

1. The steps set out in the tool should be applied for each inflow or 'runoff area' (ie each impermeable surface area separately discharging to a SuDS component).

2. The supporting 'Design Conditions' stated by the tool must be fully considered and implemented in all cases.

3. Relevant design examples are included in the SuDS Manual Appendix C.

4. Each of the steps below are part of the process set out in the flowchart on Sheet 3.

5. Sheet 4 summarises the selections made below and indicates the acceptability of the proposed SuDS components.

DROP DOWN LIST — RELEVANT INPUTS NEED TO BE SELECTED FROM THESE LISTS, FOR EACH STEP

USER ENTRY — USER ENTRY CELLS ARE ONLY REQUIRED WHERE INDICATED BY THE TOOL

STEP 1: Determine the Pollution Hazard Index for the runoff area discharging to the proposed SuDS scheme

This step requires the user to select the appropriate land use type for the area from which the runoff is occurring

If the land use varies across the 'runoff area', either:

- use the land use type with the highest Pollution Hazard Index
- apply the approach for each of the land use types to determine whether the proposed SuDS design is sufficient for all. If it is not, consider collecting more hazardous runoff separately and providing additional treatment.

If the generic land use types suggested are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in the row below the drop down lists.

	Runoff Area Land Use Description	*Hazard Level*	*Pollution Hazard Indices* Total Suspended Solids	Metals	Hydrocarbons
Select land use type from the drop down list (or 'Other' if none applicable):	Residential roofing	Very low	0.2	0.2	0.05
If the generic land use types in the drop down list above are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in this row:					
	Landuse Pollution Hazard Index	**Very low**	**0.2**	**0.2**	**0.05**

DESIGN CONDITIONS	1	2

STEP 2A: Determine the Pollution Mitigation Index for the proposed SuDS components

This step requires the user to select the proposed SuDS components that will be used to treat runoff - before it is discharged to a receiving surface waterbody or downstream infiltration component
If the runoff is discharged directly to an infiltration component, without upstream treatment, select 'None' for each of the 3 SuDS components and move to Step 2B

This step should be applied to evaluate the water quality protection provided by proposed SuDS components for discharges to receiving surface waters or downstream infiltration components (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

If you have fewer than 3 components, select 'None' for the components that are not required

If the proposed component is bespoke and/or a proprietary treatment product and not generically described by the suggested components, then 'Proprietary treatment system' or 'User defined indices' should be selected and a description of the component and agreed user defined indices should be entered in the rows below the drop down lists

	SuDS Component Description	*Pollution Mitigation Indices* Total Suspended Solids	Metals	Hydrocarbons
Select SuDS Component 1 (i.e. the upstream SuDS component) from the drop down list:	None			
Select SuDS Component 2 (i.e. the second SuDS component in a series) from the drop down list:	None			
Select SuDS Component 3 (i.e. the third SuDS component in a series) from the drop down list:	None			
If the proposed SuDS components are bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary treatment system' or 'User defined indices' and enter component descriptions and agreed user defined indices in these rows:				
	Aggregated Surface Water Pollution Mitigation Index	**0**	**0**	**0**

DESIGN CONDITIONS	1	2	3

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

Is the runoff now discharged to an infiltration component?

Yes ? Go to Step 2B
No ? Go to Step 2C

STEP 2B: Determine the Pollution Mitigation Index for the proposed Groundwater Protection

This step requires the user to select the type of groundwater protection that is either part of the SuDS component or that lies between the component and the groundwater

This step should be applied where a SuDS component is specifically designed to infiltrate runoff (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

'Groundwater protection' describes the proposed depth of soil or other material through which runoff will flow between the runoff surface and the underlying groundwater.

Where the discharge is to surface waters and risks to groundwater need not be considered, select 'None'

If the proposed groundwater protection is bespoke and/or a proprietary product and not generically described by the suggested measures, then a description of the protection and agreed user defined indices should be entered in the row below the drop down list

	Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Select type of groundwater protection from the drop down list: 300 mm minimum depth of soils with good contamination attenuation potential	0.4	0.3	0.3
If the proposed groundwater protection is bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary product' or 'User defined indices' and enter a description of the protection and agreed user defined indices in this row:			
Groundwater Protection Pollution Mitigation Index	**0.4**	**0.3**	**0.3**

DESIGN CONDITIONS	1	2	3	4
	All designs must include a minimum of 1 m unsaturated depth of subsoil or aquifer material between the infiltration surface and the maximum likely groundwater level. Infiltration components should always be preceded by upstream component(s) that trap(s) silt, or designed specifically to retain sediment in a separate lined zone, easily accessible for maintenance, such that the sediment will not be re-suspended in subsequent events	The underlying soils must provide good contaminant attenuation potential (eg as recommended in Sniffer 2008 (a) and (b) / Scott Wilson (2010) or other appropriate guidance). Alternative depth and soil combinations must provide equivalent protection to the underlying groundwater	

STEP 2C: Determine the Combined Pollution Mitigation Indices for the Runoff Area

This is an automatic step which combines the proposed SuDS Pollution Mitigation Indices with any Groundwater Protection Pollution Mitigation Indices

	Combined Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Combined Pollution Mitigation Indices for the Runoff Area	**0.4**	**0.3**	**0.3**

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

STEP 2D: Determine Sufficiency of Pollution Mitigation Indices for Selected SuDS Components

This is an automatic step which compares the Combined Pollution Mitigation Indices with the Land Use Hazard Indices, to determine whether the proposed components are sufficient to manage each pollutant category type

When the combined mitigation index exceeds the land use pollution hazard index, then the proposed components are considered sufficient in providing pollution risk mitigation.

In England and Wales, where the discharge is to protected surface waters or groundwater, an additional treatment component (ie over and above that required for standard discharges), or other equivalent protection, is required that provides environmental protection in the event of an unexpected pollution event or poor system performance. Protected surface waters are those designated for drinking water abstraction. In England and Wales, protected groundwater resources are defined as Source Protection Zone 1. In Northern Ireland, a more precautionary approach may be required and this should be checked with the environmental regulator on a site by site basis.

	Sufficiency of Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
	Sufficient	**Sufficient**	**Sufficient**

DESIGN CONDITIONS	1
	Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see *Chapter 7 The SuDS design process*). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England

SIMPLE INDEX APPROACH: TOOL

1. The steps set out in the tool should be applied for each inflow or 'runoff area' (ie each impermeable surface area separately discharging to a SuDS component).

2. The supporting 'Design Conditions' stated by the tool must be fully considered and implemented in all cases.

3. Relevant design examples are included in the SuDS Manual Appendix C.

4. Each of the steps below are part of the process set out in the flowchart on Sheet 3.

5. Sheet 4 summarises the selections made below and indicates the acceptability of the proposed SuDS components.

DROP DOWN LIST — RELEVANT INPUTS NEED TO BE SELECTED FROM THESE LISTS, FOR EACH STEP

USER ENTRY — USER ENTRY CELLS ARE ONLY REQUIRED WHERE INDICATED BY THE TOOL

STEP 1: Determine the Pollution Hazard Index for the runoff area discharging to the proposed SuDS scheme

This step requires the user to select the appropriate land use type for the area from which the runoff is occurring

If the land use varies across the 'runoff area', either:

- use the land use type with the highest Pollution Hazard Index

- apply the approach for each of the land use types to determine whether the proposed SuDS design is sufficient for all. If it is not, consider collecting more hazardous runoff separately and providing additional treatment.

If the generic land use types suggested are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in the row below the drop down lists.

	Runoff Area Land Use Description	Hazard Level	Pollution Hazard Indices: Total Suspended Solids	Metals	Hydrocarbons
Select land use type from the drop down list (or 'Other' if none applicable):	Low traffic roads (e.g. residential roads and general access roads, < 300 traffic movements/day)	Low	0.5	0.4	0.4
If the generic land use types in the drop down list above are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in this row:					
Landuse Pollution Hazard Index		**Low**	**0.5**	**0.4**	**0.4**

DESIGN CONDITIONS: 1, 2

STEP 2A: Determine the Pollution Mitigation Index for the proposed SuDS components

This step requires the user to select the proposed SuDS components that will be used to treat runoff - before it is discharged to a receiving surface waterbody or downstream infiltration component
If the runoff is discharged directly to an infiltration component, without upstream treatment, select 'None' for each of the 3 SuDS components and move to Step 2B

This step should be applied to evaluate the water quality protection provided by proposed SuDS components for discharges to receiving surface waters or downstream infiltration components (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

If you have fewer than 3 components, select 'None' for the components that are not required

If the proposed component is bespoke and/or a proprietary treatment product and not generically described by the suggested components, then 'Proprietary treatment system' or 'User defined indices' should be selected and a description of the component and agreed user defined indices should be entered in the rows below the drop down lists

	SuDS Component Description	Pollution Mitigation Indices: Total Suspended Solids	Metals	Hydrocarbons
Select SuDS Component 1 (i.e. the upstream SuDS component) from the drop down list:	None			
Select SuDS Component 2 (i.e. the second SuDS component in a series) from the drop down list:	None			
Select SuDS Component 3 (i.e. the third SuDS component in a series) from the drop down list:	None			
If the proposed SuDS components are bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary treatment system' or 'User defined indices' and enter component descriptions and agreed user defined indices in these rows:				
Aggregated Surface Water Pollution Mitigation Index		**0**	**0**	**0**

DESIGN CONDITIONS: 1, 2, 3

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

Is the runoff now discharged to an infiltration component?

Yes ? Go to Step 2B
No ? Go to Step 2C

STEP 2B: Determine the Pollution Mitigation Index for the proposed Groundwater Protection

This step requires the user to select the type of groundwater protection that is either part of the SuDS component or that lies between the component and the groundwater

This step should be applied where a SuDS component is specifically designed to infiltrate runoff (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

'Groundwater protection' describes the proposed depth of soil or other material through which runoff will flow between the runoff surface and the underlying groundwater.

Where the discharge is to surface waters and risks to groundwater need not be considered, select 'None'

If the proposed groundwater protection is bespoke and/or a proprietary product and not generically described by the suggested measures, then a description of the protection and agreed user defined indices should be entered in the row below the drop down list

		Pollution Mitigation Indices: Total Suspended Solids	Metals	Hydrocarbons
Select type of groundwater protection from the drop down list:	Pervious pavement underlain by 300 mm minimum depth of soils with good contamination attenuation potential	0.7	0.6	0.7
If the proposed groundwater protection is bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary product' or 'User defined indices' and enter a description of the protection and agreed user defined indices in this row:				
Groundwater Protection Pollution Mitigation Index		**0.7**	**0.6**	**0.7**

DESIGN CONDITIONS: 1, 2, 3, 4

1	2	3	4
All designs must include a minimum of 1 m unsaturated depth of subsoil or aquifer material between the infiltration surface and the maximum likely groundwater level. Infiltration components should always be preceded by upstream component(s) that trap(s) silt, or designed specifically to retain sediment in a separate lined zone, easily accessible for maintenance, such that the sediment will not be re-suspended in subsequent events	The permeable pavement must include a suitable filtration layer provides treatment and must include a geotextile at the base separating the foundation from the sub-grade. The underlying soils must provide good contaminant attenuation potential (eg as recommended in Sniffer 2008 (a) and (b) / Scott Wilson (2010) or other appropriate guidance). Alternative depth and soil combinations must provide equivalent protection to the underlying groundwater		

STEP 2C: Determine the Combined Pollution Mitigation Indices for the Runoff Area

This is an automatic step which combines the proposed SuDS Pollution Mitigation Indices with any Groundwater Protection Pollution Mitigation Indices

	Combined Pollution Mitigation Indices: Total Suspended Solids	Metals	Hydrocarbons
Combined Pollution Mitigation Indices for the Runoff Area	**0.7**	**0.6**	**0.7**

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

STEP 2D: Determine Sufficiency of Pollution Mitigation Indices for Selected SuDS Components

This is an automatic step which compares the Combined Pollution Mitigation Indices with the Land Use Hazard Indices, to determine whether the proposed components are sufficient to manage each pollutant category type

When the combined mitigation index exceeds the land use pollution hazard index, then the proposed components are considered sufficient in providing pollution risk mitigation.

In England and Wales, where the discharge is to protected surface waters or groundwater, an additional treatment component (ie over and above that required for standard discharges), or other equivalent protection, is required that provides environmental protection in the event of an unexpected pollution event or poor system performance. Protected surface waters are those designated for drinking water abstraction. In England and Wales, protected groundwater resources are defined as Source Protection Zone 1. In Northern Ireland, a more precautionary approach may be required and this should be checked with the environmental regulator on a site by site basis.

Sufficiency of Pollution Mitigation Indices: Total Suspended Solids	Metals	Hydrocarbons
Sufficient	**Sufficient**	**Sufficient**

DESIGN CONDITIONS: 1

1
Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see *Chapter 7 The SuDS design process*). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England