
COMBINED FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY

For

REED HOUSE, JACKSONS LANE, REED, HERTFORDSHIRE (SG8 8AB)

Job Number: 10-5217
Date: May 2024

NOTICE

This document and its contents have been prepared and are intended solely for David Tait's information and use.

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Document history

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Client signoff

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Document title	Combined Flood Risk Assessment & Drainage Strategy
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1 INTRODUCTION

Peterdann have been commissioned by David Tait to prepare a Combined Flood Risk Assessment and Drainage Strategy (FRA & DS) to support a planning application at Reed House, Jacksons Lane, Reed, Hertfordshire (SG8 8AB) for 14no. residential units with associated infrastructure and hard and soft landscaping.

The total site red line boundary is 2.07ha and the existing site is occupied by Reed House and associated soft landscaping areas. In total, 0.13ha of the site red line boundary is impermeable area within the existing scenario.

Development proposals along with retained existing impermeable area, generate a total impermeable area of 0.73ha. Thus, there is an increase of 0.60ha in impermeable area when compared to the existing site.

The purpose of this Combined FRA & DS is to demonstrate how development proposals will not lead to an increase in flood risk on or offsite. The strategy has been developed in full accordance with Local and National standards as well as best practice design guidance.

Specifically, this Combined FRA & DS demonstrates proposals will not lead to an increase in;

- Peak runoff rate of storm water runoff leaving the site
- Volume of runoff leaving the site
- Pollution to receiving waters from storm water runoff
- Flood risk to nearby or neighbouring sites

2 EXISTING SITE

2.1 Site Location

The site is located at Reed House, Jacksons Lane, Reed, Hertfordshire (SG8 8AB).

The site is located at grid reference (536391,236490).

Access to the site can be taken from Jackson Lane to the south and The Joint to the north.

The existing site comprises Reed House to the south and open green fields to the north. In total 0.13 ha of the existing site is impermeable.

Reed House is located to the south of the site and is accessed via a ~50m long private drive connecting with Jackson Lane.

A site location plan is shown in **Appendix A**

2.2 Site Topography

A Topographical Survey of the site was prepared by Ratcliff Land & Engineering Surveys (ref; *Topographical & Level Survey*, dwg no. 4703-1), undertaken during February 2014.

The Topographical Survey shows site levels typically falling southwest at a gradient of around 1 in 60.

The highest point of the site at the northeast corner is ~157.20 Above Ordnance Datum (AOD) and the lowest point of the site, directly to the south adjacent to Jackson Lane is ~153.00 AOD.

A topographical survey of the site is provided in **Appendix B**

2.3 Ground Conditions

An intrusive ground investigation at the site was carried out by Ground Engineering Limited during February 2014. As part of this investigation, 7no trial pits between 0.73 – 2.10m deep were undertaken.

Infiltration tests to BRE 365 were performed in all 7 trial pits. Infiltration rates within all trial pits were measured at 1×10^{-9} m/s except for TPC which recorded a first test result of 5.18×10^{-7} m/s.

General ground make-up comprised of topsoil between 0.30 – 0.35m deep on top of firm, stiff, grey, brown and orange mottled slightly gravelly CLAY present to the bottom of all boreholes.

No groundwater seepages were recorded within any of the boreholes.

Ground Investigation information of the site is provided in **Appendix C**

2.4 Existing Drainage Regime

Surface Water

Review of the topographical survey shows a very shallow depression / ditch along the western boundary of the site. This ditch runs north to south at a gradient of around 1 in 60 and outfalls into a small dense area of vegetation located at the southwest corner of the site. Due to the natural fall of the site topography from east to west, it is believed this existing ditch drains around two thirds of the site area.

2no. private ponds are located to the south of the site, adjacent to Jackson Lane. These are linked together via a 400mm culvert underneath the private drive leading to Reed House.

The pond furthest east outfalls via a 225mm pipe located underneath Jackson Lane to a ditch along the western side of High St. This ditch runs around 130m south before out falling to an ordinary water course maintained by Hertfordshire Council.

Due to the ditch along High Street not appearing on Ordinary watercourse or main River mapping, it is believed it is private or operated by Highways.

The only existing impermeable area on the site is that from Reed House and associated hardstanding to the south and a small portion of hardstanding from a vehicular access with The Joint to the north. It is believed the hardstanding from the access infiltrates. It is believed the hardstanding area associated with Reed House and associated hardstanding drains to the existing ponds to the south.

The greenfield runoff rates of the existing site based on the site area of 2.07ha and using the IHS 124 method is identified in **Table 1**.

Greenfield runoff rate	Existing greenfield runoff rate using SPR of 0.1	Existing greenfield runoff rate using SPR of 0.4 (as observed onsite)
1 in 1 year	0.27 l/s	7.53 l/s
QBAR	0.31 l/s	8.65 l/s
1 in 30 year	0.75 l/s	21.20 l/s
1 in 100 year	1.08 l/s	30.80 l/s

Table 1 - Existing greenfield runoff rates for the 1,30 and 100 year storm event

It should be noted whilst the default Standard Percentage Runoff (SPR) value associated with the Greenfield run off rate calculation is 0.1 (consistent with sandy soils), this has been edited to an SPR of 0.4 (consistent with heavy clay) which based on the intrusive ground investigation results, is a more accurate baseline as to what ground conditions on site are.

Please refer to **Appendix D** for existing drainage information.

Foul Water

Thames Water asset information shows a 150mm diameter foul water sewer within Jackson Lane conveying flows west to east before conveying flows south down High Street

Thames Water manhole 4302 located where Jackson Lane and High Street connect, records a cover level and invert level of 152.50 and 149.38 AOD respectively.

Please refer to **Appendix D** for existing drainage information.

3 DEVELOPMENT PROPOSALS

Development proposals are for 14no. residential units with associated infrastructure and hard and soft landscaping.

The total site red line boundary is 2.07ha and the existing site is occupied by Reed House and associated soft landscaping areas. In total, 0.13ha of the site red line boundary is impermeable area within the existing scenario.

Development proposals along with retained existing impermeable area, generate a total impermeable area of 0.73ha. Thus, there is an increase of 0.60ha in impermeable area when compared to the existing site.

It is proposed existing Reed House and associated hardstanding is maintained as of existing as part of development proposals.

A masterplan of development proposals is shown in **Appendix E**

4 FLOOD RISK

4.1 Policy & Best Practice

This proposed Flood Risk Assessment has been primarily prepared in accordance with the following best practice drainage documentation;

- North Hertfordshire District Council Strategic Flood Risk Assessment (SFRA, July 2008).
- Department for Communities and Local Government National Planning Policy Framework, 2024.
- Environment Agency (EA) publications and modelling outputs.
- CIRIA 753, 2015: The SuDS Manual; This document provides current best practice and National guidance on the planning, design, construction, operation and maintenance of SuDS to facilitate their effective implementation within developments.

4.2 Fluvial Flooding

Review of EA fluvial flood mapping identifies the development to be within the *very low flooding extents* (Flood Zone 1).

Fluvial flood mapping extract is shown in **Appendix F**.

It is believed therefore the site is at *very low risk* of Fluvial flooding.

4.3 Surface Water Flooding

Review of EA surface water flood mapping identifies the site to be located within the very low flood risk extents.

Surface water mapping extract is shown in **Appendix G**.

It is proposed implementation of the SuDS Strategy identified in **Section 5** will sufficiently mitigate surface water flooding.

It is believed therefore the site is at *very low risk* of surface water flooding.

4.4 Groundwater Flooding

An intrusive ground investigation at the site was carried out by Ground Engineering Limited during February 2014. As part of this investigation, 7no trial pits between 0.73 – 2.10m deep were undertaken.

Infiltration tests to BRE 365 were performed in all 7 trial pits. Infiltration rates within all trial pits were measured at 1×10^{-9} m/s except for TPC which recorded a first test result of 5.18×10^{-7} m/s.

General ground make-up comprised of topsoil between 0.30 – 0.35m deep on top of firm, stiff, grey, brown and orange mottled slightly gravelly CLAY present to the bottom of all boreholes.

No groundwater seepages were recorded within any of the boreholes.

Ground Investigation information of the site is provided in **Appendix C**

Given that the site is underlain by clay, typically impermeable to rising groundwater, and no groundwater has been identified during the infiltration testing, the site is not considered to be at risk of groundwater flooding.

It is believed therefore the existing site is at *very low* risk of groundwater flooding.

4.5 Reservoir Flooding

EA Reservoir Flood mapping identifies that flooding from reservoirs is unlikely in this site.

A reservoir flood risk mapping is shown in **Appendix H**.

It is believed therefore the site is at *very low* risk of reservoir flooding.

4.6 Artificial Flooding

Thames Water asset information shows a 150mm diameter foul water sewer within Jackson Lane conveying flows west to east before conveying flows south down High Street.

Thames Water manhole 4302 located where Jackson Lane and High Street connect, records a cover level and invert level of 152.50 and 149.38 AOD respectively.

Please refer to **Appendix D** for existing drainage information.

Given that Thames Water manhole cover levels within Jackson Lane are at least 2.5m lower than the site, it is believed if any surcharging of gravity sewerage was to materialise, flood water would be contained within Jackson Lane.

It is believed therefore the site is at *very low risk* of artificial flooding.

4.7 Flood Vulnerability

Technical guidance to the National Planning Policy Framework (NPPF) 2023, divides land use into five classifications as follows;

- Essential infrastructure e.g essential transport infrastructure and utility infrastructure, wind turbines
- Highly vulnerable e.g caravans, mobile homes and park home intended for permanent residential use.
- More vulnerable e.g hospitals, residential institutions, dwelling houses.
- Less vulnerable e.g shops, land and buildings used for agriculture, non-residential institutions, assembly and leisure.
- Water compatible e.g docks, marinas and wharves, amenity open space, sports grounds (and essential facilities such as changing rooms).

The flood risk vulnerability categorisation for the site is “more vulnerable” development (dwelling houses). “More vulnerable” development is fully permissible within flood Zone 1.

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	X	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	X	X	X	✓ *

Key:

✓ Exception test is not required

X Development should not be permitted

Figure 1 – NPPF Flood Risk Vulnerability & Flood Zone Compatibility

4.8 Flood Risk Summary

A summary of the flood risk posed from each flood source before and after development (with the proposed drainage / flood mitigation measures in place) are provided in **Table 2**;

Type of Flooding	Existing Risk Category	Proposed Risk Category
Fluvial flooding	Very Low Risk	Very Low Risk
Surface Water flooding	Very Low Risk	Very Low Risk
Groundwater flooding	Very Low Risk	Very Low Risk
Reservoir flooding	Very Low Risk	Very Low Risk
Artificial Flooding	Very Low Risk	Very Low Risk

Table 2 – Flood Risk Summary from all sources before and after development

5 PROPOSED DRAINAGE STRATEGY

5.1 Surface Water Discharge Strategy

Part H of the Building Regulations (2010) recommends surface water run-off shall discharge to one of the following, listed in order of priority:

- An adequate soakaway or some other adequate infiltration system, or where that is not reasonably practicable,
- A watercourse, or, where that is not reasonably practicable,
- A sewer.

Infiltration

An intrusive ground investigation was carried out by Ground Engineering Limited during February 2014. As part of this investigation, 7no trial pits were undertaken between 0.73 – 2.10m deep and infiltration testing in accordance with BRE 365 performed in all trial pits.

All trial pits failed to drain after their first test and testing was therefore abandoned. The best recorded rate was at TPC which recorded a first test result of 5.18×10^{-7} m/s. This rate would be insufficient in ensuring half drain down times within 24 hours could occur (a requirement within the SuDS Manual). Similarly given infiltration rates at all other trial pits was measured at 1×10^{-9} m/s, attempting to use infiltration drainage would be impractical on this site.

Watercourse

In line with the next preferred disposal mechanism, it is proposed a connection to an existing watercourse to the south of the site is progressed.

5.2 Runoff Rate & Volume

The proposed site generates a total impermeable area of 0.73 ha.

Reed House and associated hardstanding generating an impermeable area of 0.13ha is to drain as of existing.

Based on the existing greenfield runoff rates (refer to **Table 1**), **Table 3** identifies the applicable greenfield runoff rate for the 1, 30 and 100 year storm events based on the proposed site impermeable area of 0.60 ha.

Greenfield runoff rate	Existing greenfield runoff rate (Per hectare)	Existing greenfield runoff rate (Per 0.60 ha, as of development proposals)	Proposed development Discharge rate
1 in 1 year	3.64 l/s	2.18 l/s	2.00 l/s
QBAR	4.18 l/s	2.51 l/s	2.00 l/s
1 in 30 year	10.24 l/s	6.14 l/s	2.00 l/s
1 in 100 year	17.60 l/s	10.56 l/s	2.00 l/s

Table 3 – Comparison of existing and proposed site runoff rates for the 1,30 and 100 year storm events

5.3 SuDS Strategy

A variety of SuDS have been used as part of the proposed drainage system as identified below;

- Permeable paving will be used for all private hardstanding drives and pathway surfaces to all plots. Due to the potential requirement for adoption of the main access road, this will utilise a kerb and gully system.
- A detention basin with geo-cellular under storage will be used as the primary attenuation facility for the site. It is believed this is preferable to providing an open attenuation basin since it prevents boggy / muddy conditions accumulating over time and reduces the open depth of the earthworks structure. The open water basin has been designed to come into effect for more severe storm events.
- The detention basin In turn will drain to a dry swale system. Further to taking controlled runoff from the northern detention basin, the swale will also convey flows directly from the proposed pathway and adjacent roadways.
- The swale system will discharge to an open attenuation basin located within the south east corner of the site.

The proposed drainage general arrangement plans and supporting hydraulic calculations are shown in **Appendix F**

5.4 Surface Water Policy & Best Practice

This proposed Surface and Foul Water Drainage Strategy has been primarily designed in accordance with the following best practice drainage documentation;

- Hertfordshire LLFA, Summary Guidance for Developers
- Department for Communities and Local Government National Planning Policy Framework, 2019.
- CIRIA 753, 2015: The SuDS Manual; This document provides current best practice National guidance on the planning, design, construction, operation, and maintenance of SuDS to facilitate their effective implementation within developments.
- Environment Agency publications
- Building Regulations Part H (2010); Drainage and Water Disposal.

5.5 Rainfall Simulation & Climate Change

This drainage strategy uses Flood Studies Report (FSR) rainfall data.

An allowance of +40% for climate change corresponding to the 'upper end' of current legislation on climate change published by the EA has been used.

Additionally, a 10% allowance for urban creep has been factored into the residential roof impervious areas of the proposed development.

All attenuation structures have been sized based on the 1 in 100 year critical storm event plus an additional 40% allowance for climate change.

5.6 Surface Water Treatment

The SuDS Manual, 2015 identifies pollution hazard levels of new development based off their proposed land use. In line with the SuDS Manual pollution hazard categorisations, a *medium* pollution risk for all development site hardstanding area has been adopted. A *low* pollution risk for the roof area has been adopted.

Table 4 shows the total suspended solids, metals and hydrocarbons associated with low and medium pollution categorizations (as provided within the SuDS Manual)

	Total Suspended Solids (TSS)	Metals	Hydro-carbons
Low pollution hazard index	0.3	0.2	0.05
Medium pollution hazard index	0.7	0.6	0.7

Table 4 – Total suspended solids, metals and hydrocarbons associated with low and medium pollution categorizations (as provided within the SuDS Manual)

As of the SuDS Manual guidance, conveying run off through different forms of SuDS provides varied mitigation values. On the basis the mitigation index value is higher than the initial values associated with either a low or medium pollution risk, the drainage system is deemed to have sufficiently mitigated the pollution hazard posed.

Table 5 shows the combined mitigation index provided by the various SuDS runoff will pass through prior to being discharged into the ground.

	Total Suspended Solids (TSS)	Metals	Hydro-carbons
Mitigation index provided to runoff falling on to private drive areas	1.30	1.35	1.40
Mitigation index provided to runoff falling on to southern access road	0.75	0.95	0.90

Table 5 – SuDS Pollution Mitigation provided across proposed development site

It can be confirmed all run off is treated over and above the guidance provided within the SuDS Manual (C753).

5.7 Exceedence Events

Whilst it is a requirement to fully attenuate the 1 in 100 year critical storm event plus an allowance of 40% for climate change onsite, it is also necessary to ensure storms which exceed this severity do not cause unreasonable or unsafe flooding or exacerbate flooding elsewhere.

All proposed finished surface levels will be chosen to ensure exceedance runoff is directed away from building areas and towards areas less vulnerable to flooding such as hard and soft landscaped areas.

Exceedence flow arrows are shown on the drainage strategy layout plan shown in **Appendix E**.

5.8 Surface Water Management & Maintenance

For any surface water drainage system to operate as originally designed, it is necessary to ensure that it is adequately maintained to ensure its continued performance throughout its lifetime.

It is proposed SuDS features used within this development will be maintained and managed by a private management company.

Table 6, 7, 8, 9 and 10 identify the proposed operation, maintenance requirements and frequencies of the SuDS features used for this development which will be maintained by the private management company to ensure a satisfactory maintenance regime is carried out.

Table 6: Operation and Maintenance Requirements for Pervious Pavements

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 glyphosphate 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 50mm 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 hours after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Table 7: Operation and Maintenance Requirements for Geo-cellular Tank

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect and identify 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 risk to performance)	Monthly
	For system where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary	Annually
	Remove sediment from pre-treatment structures and / or internal forebays	Annually, or as required
Remedial Actions	Repair / rehabilitate inlets, outlets, 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 8: Operation and Maintenance Requirements for Detention Basin

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter and debris	Monthly
	Cut the grass	Monthly (during growing season)
	Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years)	Monthly (at start then as required)
	Inspect inlets, outlets, bankside, structures pipework etc for evidence of blockage and damage	Monthly
	Inspect water body for signs of poor water quality	Monthly
	Inspect silt accumulation rates in main body of pond. Undertake contamination testing once some build up has occurred to inform disposal options	Half yearly
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1m above pond base, include max 25% of pond surface)	Annually
	Remove 25% of bank vegetation from water edge to min of 1m above water level	Annually
	Tidy all dead growth before start of growing season	Annually
Occasional Maintenance	Remove sediment from the main body when pool volume is reduced by 20%	Typically required every 20 -50 years
Remedial Actions	Repair erosion or other damage	As required
	Replant where necessary	As required
	Aerate pond when signs of eutrophication are detected	As required
	Realign rip-rap or repair other damage	As required
	Repair / rehabilitate inlets, outlets and overflows	As required

Table 9: Operation and Maintenance requirement for Swales

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter and debris	Monthly
	Cut the grass to retain grass height to 0.1m	Monthly (during growing season)
	Manage other vegetation and remove nuisance planting	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages and clear if required	Monthly
	Inspect infiltration surface for ponding, compaction, silt accumulation, record areas where water is ponding for more than 48 hours	Monthly or when required
	Inspect vegetation cover	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional Maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial Actions	Repair erosion or other damage by re-turfing or reseed	As required
	Re-level uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil later to improve infiltration performance, break up silt deposits and prevent compactions of the soil surface	As required
	Remove build up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrols residues using safe standard practices	As required

Table 10: Operation and Maintenance requirement for Vortex Flow Control Device

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Visual inspection and removal of debris / silt. If any siltation or debris is observed, it will be removed by hosing down, manual cleaning (subject to sufficient risk assessment taking place)	Visual inspection to be carried out once every month or after a substantial storm event.
Occasional Maintenance	Remove debris and hose down as a matter of course including clearing of sump chamber	Every 6 months
Remedial Work	Operation of flow control including testing as required. If operation is compromised in any way, flow control to be replaced.	As required

6 PROPOSED FOUL WATER DRAINAGE

It is proposed all foul water flows from development proposals will gravitate to the existing Thames Water foul water drainage system.

As of OFWOT guidance (April 2018), a right to connect to the public foul sewer exists.

A predevelopment enquiry confirming Thames Water acceptance of the foul water connection however is shown in **Appendix G**

It is proposed as part of development proposals a “Y” connection to the existing 150mm foul water sewer between TW FW MH 3301 and TW FW MH 4301 is made.

The total foul water flow rate from development proposals can be calculated based on guidance given within Sewers for Adoption Design criteria.

Sewers for Adoption assumes a flow rate of 4000 litres per dwelling per day (l/d/d). Based on this criteria, a peak flow rate of **0.65 l/s** can be calculated

- Peak Flow rate = $(4000 \text{ l/d/d} \times 14) / 86,400 = 0.65 \text{ l/s}$

It is recommended detailed design drawings are provided to TW in due course as part of a S106 application to formally agree the foul water sewerage connection.

7 CONCLUSION

Peterdann have been commissioned by David Tait to prepare a Combined Flood Risk Assessment and Drainage Strategy (FRA & DS) to support a planning application at Reed House, Jacksons Lane, Reed, Hertfordshire (SG8 8AB) for 14no. residential units with associated infrastructure and hard and soft landscaping.

The total site red line boundary is 2.07ha and the existing site is occupied by Reed House and associated soft landscaping areas. In total, 0.13ha of the site red line boundary is impermeable area within the existing scenario.

Development proposals along with retained existing impermeable area, generate a total impermeable area of 0.73ha. Thus, there is an increase of 0.60ha in impermeable area when compared to the existing site.

A summary of the flood risk posed from each flood source before and after development (including with the implemented proposed mitigation measures) are provided below;

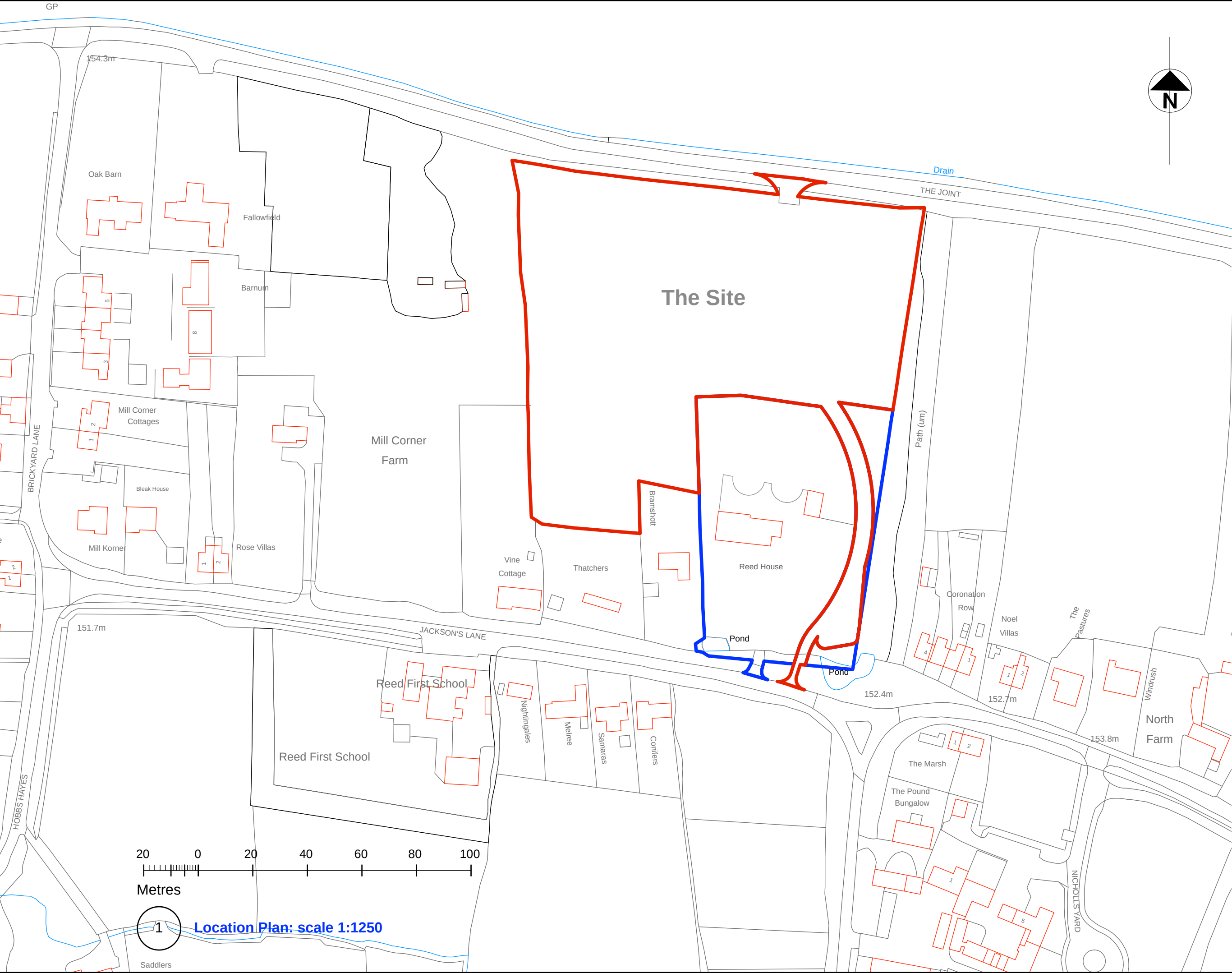
Type of Flooding	Existing Risk Category	Proposed Risk Category
Fluvial flooding	Very Low Risk	Very Low Risk
Surface Water flooding	Very Low Risk	Very Low Risk
Groundwater flooding	Very Low Risk	Very Low Risk
Reservoir flooding	Very Low Risk	Very Low Risk
Artificial Flooding	Very Low Risk	Very Low Risk

Since BRE 365 infiltration testing has ruled out infiltration discharge of surface water, it is proposed the full impermeable area generated from development proposals will utilise a controlled discharge of 2l/s for all storm events up to and including the 100 year plus 40% climate change event. This measure ensures the proposed site drains at a rate lower than the existing greenfield runoff rate.

The Drainage strategy proposes permeable paving, detention basins and swales. These measures ensure run off is treated in accordance with latest guidance and legislation prior to discharge.

Furthermore, this report demonstrates if storm events greater than the 1 in 100 year were to materialise, how exceedance flows could be directed safely away from building areas to less vulnerable soft and hard landscaped areas.

APPENDIX A – SITE LOCATION PLAN



general notes

This drawing must not be scaled except for Planning purposes.
All setting out must be checked out on site.
All levels must be checked on site and refer to Ordinance Datum Newlyn unless alternative given
Any discrepancy between the drawing and site conditions are to be notified to Sapele Design in writing without delay
This drawing must be read in conjunction with the relevant specification clauses
All fixings and weatherings must be checked on site
This drawing must not be used for land transfer purposes.
This drawing must not be used on site unless issued for construction - see status on this drawing.

notes

P1 PLANNING ISSUE28.04.24

client

Mr & Mrs D Tait

project

Reed House
Jackson Lane, REED
Hertfordshire SG8 8AB

title

Master Site Location Plan
Location Plan

scaledate

1:1250April 2018

drawing no.drawn

S1017 - PL01.P1

status

PLANNING ISSUE

drawing status

PL = Planning: P = Preliminary: T = Tender:
C = Construction

Sapele Design Limited

Courtyard Cottage
Manor Farm Barns
Church End
Barley Nr Royston
Hertfordshire SG8 8JW
T : 01763 849154
E: timothy@sapeledesign.co.uk

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APPENDIX B – TOPOGRAPHICAL SURVEY

APPENDIX C – GROUND INVESTIGATION INFORMATION

GROUND ENGINEERING LIMITED Tel: 01733-566566 www.groundengineering.co.uk			Site: LAND OFF THE JOINT, REED, NEAR ROYSTON		TRIAL PIT TP1	
			Date: 24/02/14	Pit Size: 1.40m L x 0.60m W x 2.00m D.	Ground Level:	
Samples and in-situ Tests			(Date) Water	Description of Strata	Legend	O.D. Level m
Depth m	Type	Result				Depth m
0.20	D1			TOPSOIL - Soft, friable, dark brown, slightly sandy, slightly gravelly, silty CLAY. Gravel consists of sub-angular to sub-rounded chalk and flint.		0.30
0.50	D2			Firm, becoming stiff below 1.50m depth, grey, brown and orange brown mottled, slightly sandy, slightly gravelly CLAY. Gravel consists of sub-angular to sub-rounded chalk and flint. Occasional red brown fine sand pockets from 1.50m depth.		
0.80	D3					
1.00	V1	(67)				
1.20	D4					
1.50	V2	(94)				2.00
1.60	D5					
2.00	D6					
2.00	V3	(140+)		Pit completed at 2.00m depth		

KEY	REMARKS
D - Disturbed Sample	1. Live roots observed to at least 2.00m depth 2. Pit sides stable 3. Pit dry
B - Bulk Sample	
U - Undisturbed Sample	
R - Root Sample	
W - Water Sample	
J - Jar Sample	
☒ - Water Strike	
☒ - Water Rise	
☒c - Level on completion	
MP - Mackintosh Probe	
P() - Hand Penetrometer	
Cohesion () kPa	
V - Vane Shear Test	
Cohesion () kPa	

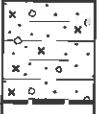
Project No 13206	
Scale 1:25	Page 1/1

GROUND ENGINEERING L I M I T E D Tel: 01733-566566 www.groundengineering.co.uk			Site: LAND OFF THE JOINT, REED, NEAR ROYSTON		TRIAL PIT TP2	
Date: 24/02/14			Pit Size: 1.35m L x 0.60m W x 2.05m D.		Ground Level:	
Samples and in-situ Tests			(Date) Water	Description of Strata	Legend	Depth m
Depth m	Type	Result				O.D. Level m
0.20	D1			TOPSOIL - Soft, friable, dark brown, slightly sandy, slightly gravelly, silty CLAY. Gravel consists of sub-angular to sub-rounded chalk and flint.		0.35
0.50	D2			Firm, becoming stiff below 1.00m depth, brown, orange brown mottled, slightly sandy, slightly gravelly CLAY. Gravel consists of sub-angular to rounded chalk and flint. Occasional red brown fine sand partings from 1.40m depth.		
0.80	D3					
0.80	V1	(61)				
1.20	D4					
1.20	V2	(90)				
1.60	D5					
1.60	V3	(119)				
2.00	D6					
2.00	V4	(140+)				
				Pit completed at 2.05m depth		2.05
KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed Sample R - Root Sample W - Water Sample J - Jar Sample Water Strike Water Rise Level on completion MP - Mackintosh Probe P () - Hand Penetrometer Cohesion () kPa V - Vane Shear Test Cohesion () kPa			REMARKS 1. Live roots observed to 0.30m depth 2. Slight water seepage at 1.90m depth 3. Pit sides stable			
				Project No 13206		
				Scale 1:25		
				Page 1/1		

[illegible]

GROUND ENGINEERING LIMITED Tel: 01733-566566 www.groundengineering.co.uk			Site: LAND OFF THE JOINT, REED, NEAR ROYSTON		TRIAL PIT TP4	
Date: 24/02/14			Pit Size: 1.35m L x 0.60m W x 2.00m D.		Ground Level:	
Samples and in-situ Tests			(Date) Water	Description of Strata	Legend	Depth m
Depth m	Type	Result				O.D. Level m
0.20	D1	(67)		TOPSOIL - Soft, friable, dark brown, slightly sandy, slightly gravelly, silty CLAY. Gravel consists of sub-angular to sub-rounded chalk and flint.		0.35
0.60	D2			Firm, brown, orange brown, grey mottled, slightly sandy, slightly gravelly CLAY. Gravel consists of sub-angular to sub-rounded chalk and flint.		0.70
0.90 1.00	D3 V1			Firm becoming stiff below 1.20m depth, grey, orange brown, brown mottled, slightly sandy, slightly gravelly CLAY. Gravel consists of sub-angular to rounded flint and chalk. Occasional red brown sand and silt partings between 0.90m-1.50m depth.		
1.20	D4	(94)				
1.50	V2					
1.60	D5					
2.00 2.00	D6 V3	(140+)				2.00
			Pit completed at 2.00m depth			
KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed Sample R - Root Sample W - Water Sample J - Jar Sample Water Strike Water Rise Level on completion MP - Mackintosh Probe P() - Hand Penetrometer Cohesion () kPa V - Vane Shear Test Cohesion () kPa			REMARKS 1. Live roots observed to 1.20m depth 2. Pit sides stable 3. Pit dry			
			Project No 13206			
			Scale Page 1:25 1/1			

GROUND ENGINEERING L I M I T E D Tel: 01733-568566 www.groundengineering.co.uk			Site: LAND OFF THE JOINT, REED, NEAR ROYSTON		TRIAL PIT TPA	
Date: 24/02/14			Pit Size: 1.20m L x 0.60m W x 0.60m D.		Ground Level:	
Samples and in-situ Tests			(Date) Water	Description of Strata	Legend	Depth m
Depth m	Type	Result				O.D. Level m
0.20	D1	(56)		TOPSOIL - Soft, friable, dark brown, slightly sandy, slightly gravelly, silty CLAY. Gravel consists of sub-angular to sub-rounded chalk and flint.		0.30
0.60	D2			Firm, grey, brown, orange brown mottled, slightly sandy, slightly gravelly CLAY. Gravel consists of sub-angular to sub-rounded chalk and flint.		0.60
0.60	V1			Pit completed at 0.60m depth		
KEY			REMARKS			
D - Disturbed Sample B - Bulk Sample U - Undisturbed Sample R - Root Sample W - Water Sample J - Jar Sample  Water Strike  Water Rise  Level on completion MP - Mackintosh Probe P() - Hand Penetrometer Cohesion () kPa V - Vane Shear Test Cohesion () kPa			1. Live roots observed to 0.40m depth 2. Pit sides stable 3. Pit dry			
			Project No 13206		Scale 1:25	
			Page 1/1			

GROUND ENGINEERING LIMITED Tel: 01733-566566 www.groundengineering.co.uk			Site: LAND OFF THE JOINT, REED, NEAR ROYSTON		TRIAL PIT TPB	
Date: 24/02/14			Pit Size: 1.30m L x 0.60m W x 0.65m D.		Ground Level:	
Samples and in-situ Tests			(Date) Water	Description of Strata	Legend	Depth m
Depth m	Type	Result				O.D. Level m
0.20	D1			TOPSOIL - Soft, friable, dark brown, slightly sandy, slightly gravelly, silty CLAY. Gravel consists of sub-angular to sub-rounded chalk and flint.		0.30
0.60 0.60	D2 V1	(61)		Firm, brown, orange brown, grey mottled, slightly sandy, slightly gravelly CLAY. Gravel consists of sub-angular to sub-rounded chalk and flint.		0.65
				Pit completed at 0.65m depth		
KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed Sample R - Root Sample W - Water Sample J - Jar Sample  Water Strike  Water Rise  Level on completion MP - Mackintosh Probe P() - Hand Penetrometer Cohesion () kPa V - Vane Shear Test Cohesion () kPa			REMARKS 1. Live roots observed to 0.30m depth 2. Pit sides stable 3. Pit dry			
Project No 13206						
Scale 1:25		Page 1/1				

GROUND ENGINEERING LIMITED Tel: 01733-566566 www.groundengineering.co.uk			Site: LAND OFF THE JOINT, REED, NEAR ROYSTON		TRIAL PIT TPC					
Date: 24/02/14			Pit Size: 1.55m L x 0.60m W x 0.60m D.		Ground Level:					
Samples and in-situ Tests			(Date) Water	Description of Strata	Legend	Depth m				
Depth m	Type	Result								
0.20	D1	(83)		TOPSOIL - Soft, friable, dark brown, slightly gravelly, slightly sandy, silty CLAY. Gravel consists of sub-angular to sub-rounded chalk and flint.		0.30				
0.60	D2			Firm becoming stiff, grey, brown, orange brown mottled, slightly sandy, slightly gravelly CLAY. Gravel consists of sub-angular to sub-rounded chalk and flint.		0.60				
0.60	V1			Pit completed at 0.60m depth						
KEY D = Disturbed Sample B = Bulk Sample U = Undisturbed Sample R = Root Sample W = Water Sample J = Jar Sample  Water Strike  Water Rise  Level on completion MP = Mackintosh Probe P() = Hand Penetrometer Cohesion () kPa V = Vane Shear Test Cohesion () kPa			REMARKS 1. Live roots observed to 0.30m depth 2. Pit sides stable 3. Pit dry							
			<table border="1"> <tr> <td colspan="2">Project No 13206</td> </tr> <tr> <td>Scale 1:25</td> <td>Page 1/1</td> </tr> </table>				Project No 13206		Scale 1:25	Page 1/1
Project No 13206										
Scale 1:25	Page 1/1									

SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: Land off The Joint, Reed, near Royston
Client: Mr D. Tait

Project No: C13206
Sheet No: 1/1

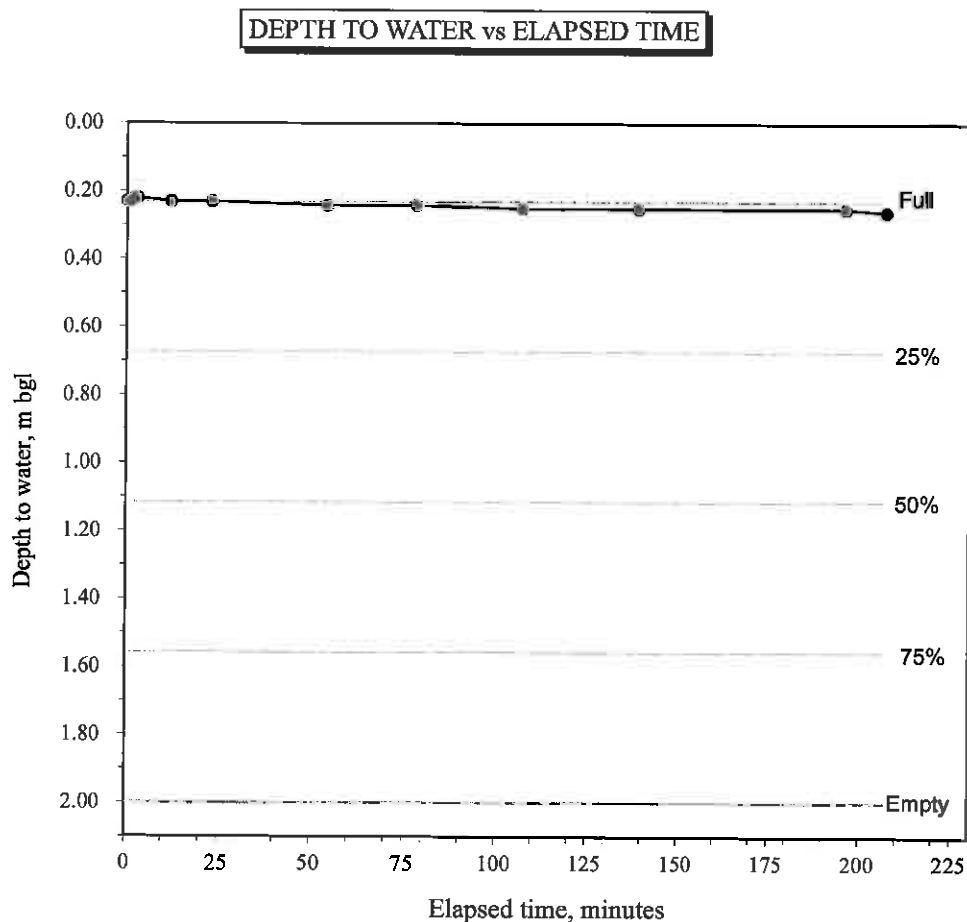
Trial Pit: TP1 FIRST FILLING
Depth: 2.00
Length: 1.40
Width: 0.60

Description of Stratum under test: Stiff, slightly sandy, slightly gravelly CLAY

Depth to water prior to test: Dry
(below ground level)

Elapsed Time mins	Depth to Water m
0	0.23
1	0.23
2	0.22
3	0.22
12	0.23
23	0.23
54	0.24
78	0.24
107	0.25
139	0.25
196	0.25
207	0.26

All dimensions given in metres



$$f = (V75 - V25) / A50(T75 - T25)$$

$$V75 - V25 = 0.743$$

$$A50 = 4.380$$

$$T75 - T25 = 6141 \quad (\text{extrapolated})$$

Extrapolated Soil Infiltration Rate $f = \underline{4.61E-07} \text{ m/s}$

SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: Land off The Joint, Reed, near Royston
Client: Mr D. Tait

Project No: C13206
Sheet No: 1/1

Trial Pit: TP2
Depth: 2.05
Length: 1.35
Width: 0.60

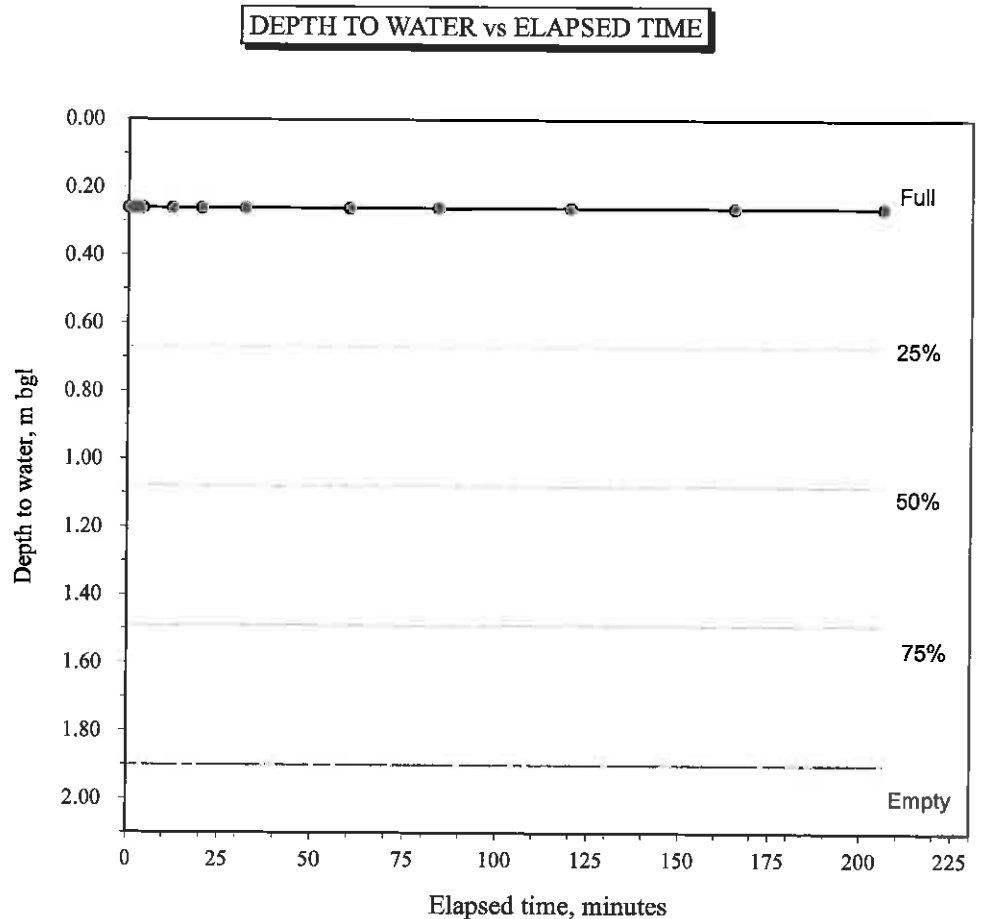
FIRST FILLING

Description of Stratum under test: Stiff, slightly sandy, slightly gravelly CLAY

Depth to water prior to test: 1.90
(below ground level)

Elapsed Time mins	Depth to Water m
0	0.26
1	0.26
2	0.26
3	0.26
4	0.26
12	0.26
20	0.26
32	0.26
60	0.26
84	0.26
120	0.26
165	0.26
206	0.26

All dimensions given in metres



$$f = (V75 - V25) / A50(T75 - T25)$$

V75-V25 = 0.664
A50 = 4.008
T75-T25 = >10000 (extrapolated)

Estimated Soil Infiltration Rate $f = <1.00E-09$ m/s

SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: Land off The Joint, Reed, near Royston
Client: Mr D. Tait

Project No: C13206
Sheet No: 1/1

Trial Pit: TP3
Depth: 2.10
Length: 1.20
Width: 0.60

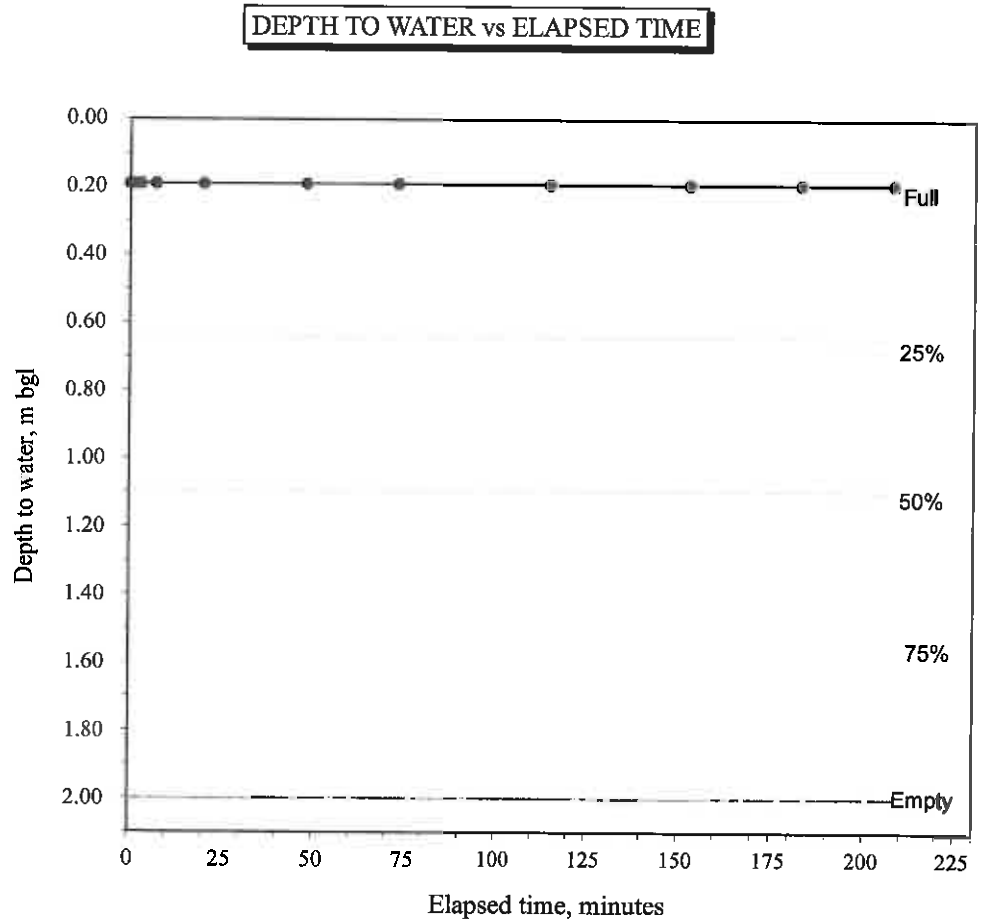
FIRST FILLING

Description of Stratum under test: Stiff, slightly sandy, slightly gravelly CLAY

Depth to water prior to test: Dry
(below ground level)

Elapsed Time mins	Depth to Water m
0	0.19
1	0.19
2	0.19
3	0.19
7	0.19
20	0.19
48	0.19
73	0.19
115	0.19
153	0.19
183	0.19
208	0.19

All dimensions given in metres



$$f = (V75 - V25) / A50(T75 - T25)$$

V75-V25 = 0.652
A50 = 3.978
T75-T25 = >10000 (extrapolated)

Estimated Soil Infiltration Rate $f = <1.00E-09$ m/s

SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: Land off The Joint, Reed, near Royston
Client: Mr D. Tait

Project No: C13206
Sheet No: 1/1

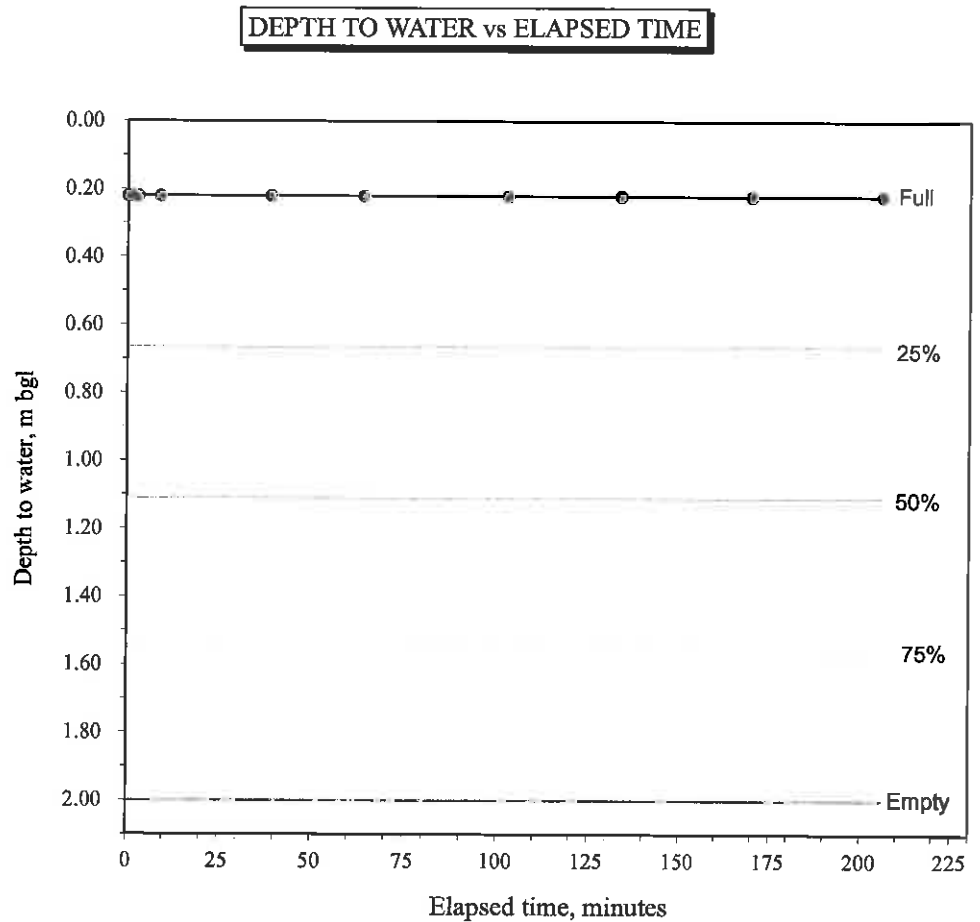
Trial Pit: TP4 FIRST FILLING
Depth: 2.00
Length: 1.35
Width: 0.60

Description of Stratum under test: Stiff, slightly sandy, slightly gravelly CLAY

Depth to water prior to test: Dry
(below ground level)

Elapsed Time mins	Depth to Water m
0	0.22
1	0.22
2	0.22
3	0.22
9	0.22
39	0.22
64	0.22
103	0.22
134	0.22
170	0.22
206	0.22

All dimensions given in metres



$$f = (V_{75} - V_{25}) / A_{50}(T_{75} - T_{25})$$

$V_{75} - V_{25} = 0.721$
 $A_{50} = 4.281$
 $T_{75} - T_{25} = >10000$ (extrapolated)

Estimated Soil Infiltration Rate $f = <1.00E-09$ m/s

SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: Land off The Joint, Reed, near Royston
Client: Mr D. Tait

Project No: C13206
Sheet No: 1/1

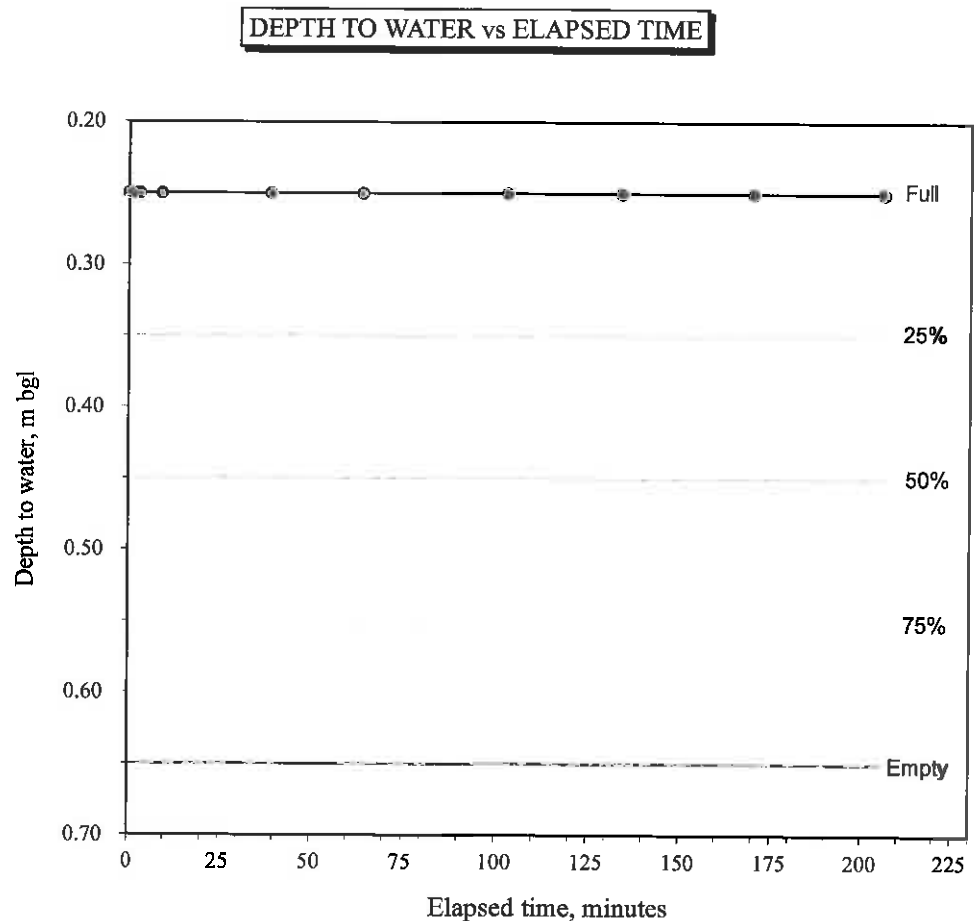
Trial Pit: TPB FIRST FILLING
Depth: 0.65
Length: 1.30
Width: 0.60

Description of Stratum under test: Firm, slightly sandy, slightly gravelly CLAY

Depth to water prior to test: Dry
(below ground level)

Elapsed Time mins	Depth to Water m
0	0.25
1	0.25
2	0.25
3	0.25
9	0.25
39	0.25
64	0.25
103	0.25
134	0.25
170	0.25
206	0.25

All dimensions given in metres



$$f = (V75 - V25) / A50(T75 - T25)$$

$$V75 - V25 = 0.156$$

$$A50 = 1.540$$

$$T75 - T25 = >10000 \quad (\text{extrapolated})$$

Estimated Soil Infiltration Rate $f = \underline{<1.00E-09} \quad \text{m/s}$

SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: Land off The Joint, Reed, near Royston
Client: Mr D. Tait

Project No: C13206
Sheet No: 1/1

Trial Pit: TPA
Depth: 0.60
Length: 1.20
Width: 0.60

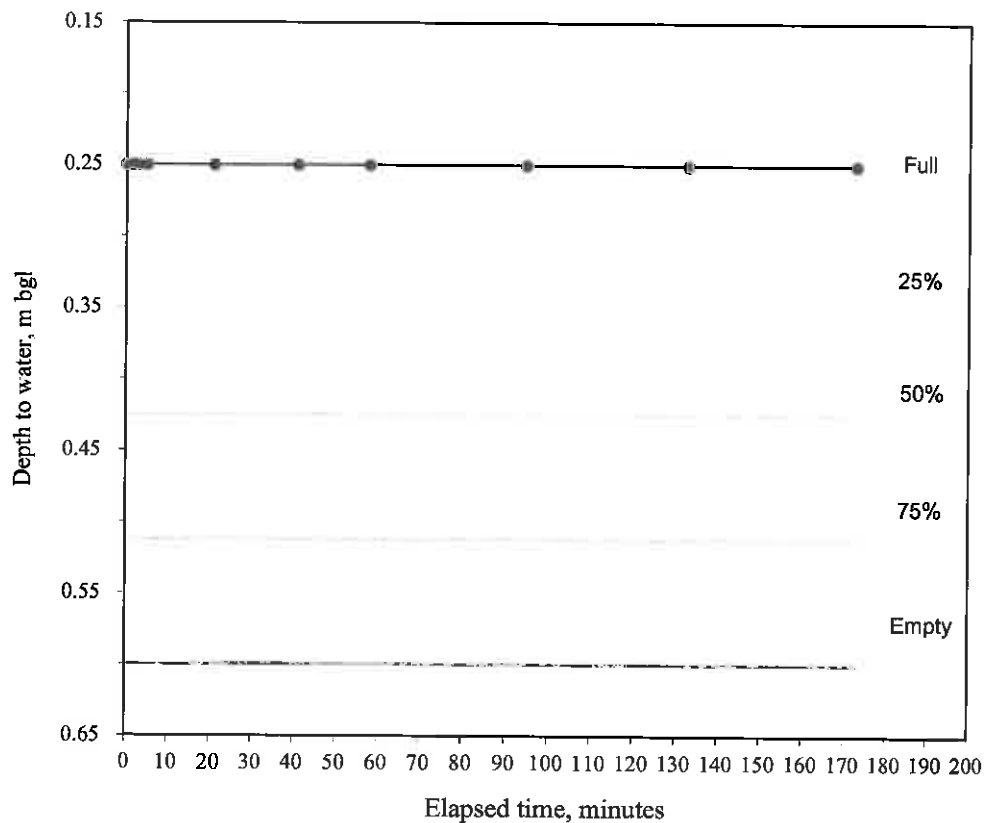
FIRST FILLING

Description of Stratum under test: Firm, slightly sandy, slightly gravelly CLAY

Depth to water prior to test: Dry
(below ground level)

Elapsed Time mins	Depth to Water m
0	0.25
1	0.25
2	0.25
3	0.25
5	0.25
21	0.25
41	0.25
58	0.25
95	0.25
133	0.25
173	0.25

DEPTH TO WATER vs ELAPSED TIME



All dimensions given in metres

$$f = (V75 - V25) / A50(T75 - T25)$$

$$V75 - V25 = 0.126$$

$$A50 = 1.350$$

$$T75 - T25 = >10000 \quad (\text{extrapolated})$$

Estimated Soil Infiltration Rate $f = <1.00E-09 \quad \text{m/s}$

SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: Land off The Joint, Reed, near Royston
Client: Mr D. Tait

Project No: C13206
Sheet No: 1/1

Trial Pit: TPC
Depth: 0.60
Length: 1.55
Width: 0.60

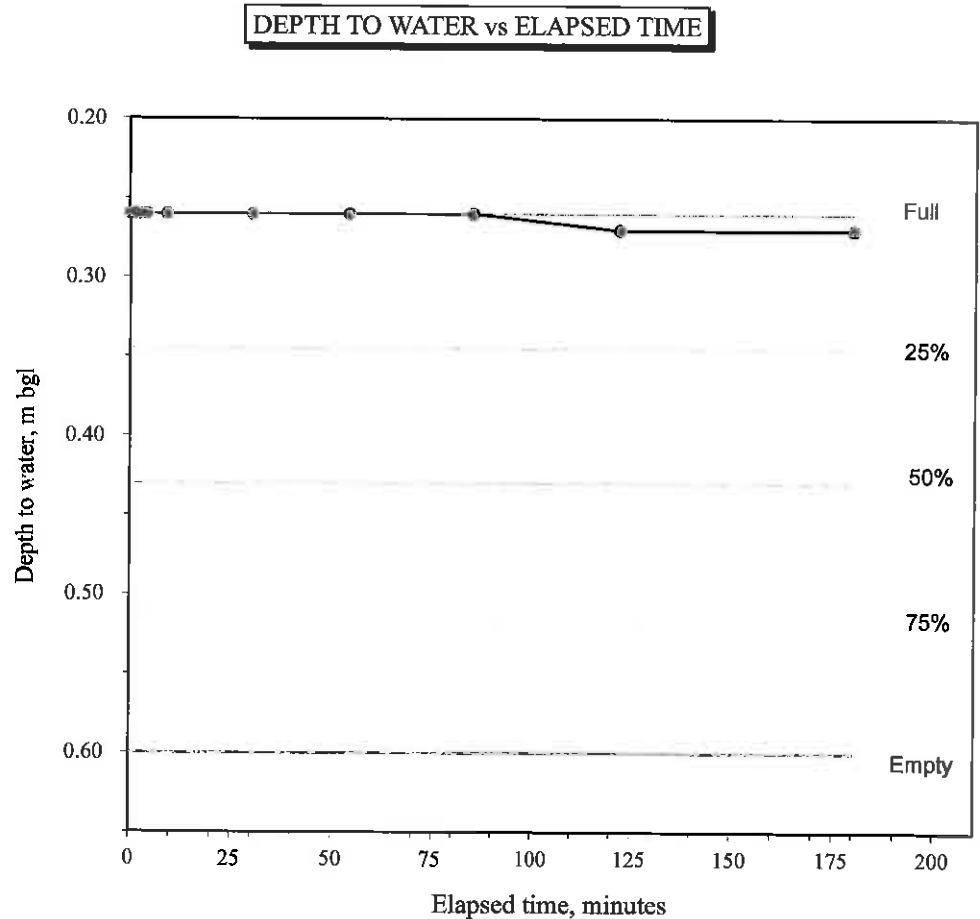
FIRST FILLING

Description of Stratum under test: Firm, becoming stiff, slightly sandy, slightly gravelly CLAY

Depth to water prior to test: Dry
(below ground level)

Elapsed Time mins	Depth to Water m
0	0.26
1	0.26
2	0.26
4	0.26
9	0.26
30	0.26
54	0.26
85	0.26
122	0.27
180	0.27

All dimensions given in metres

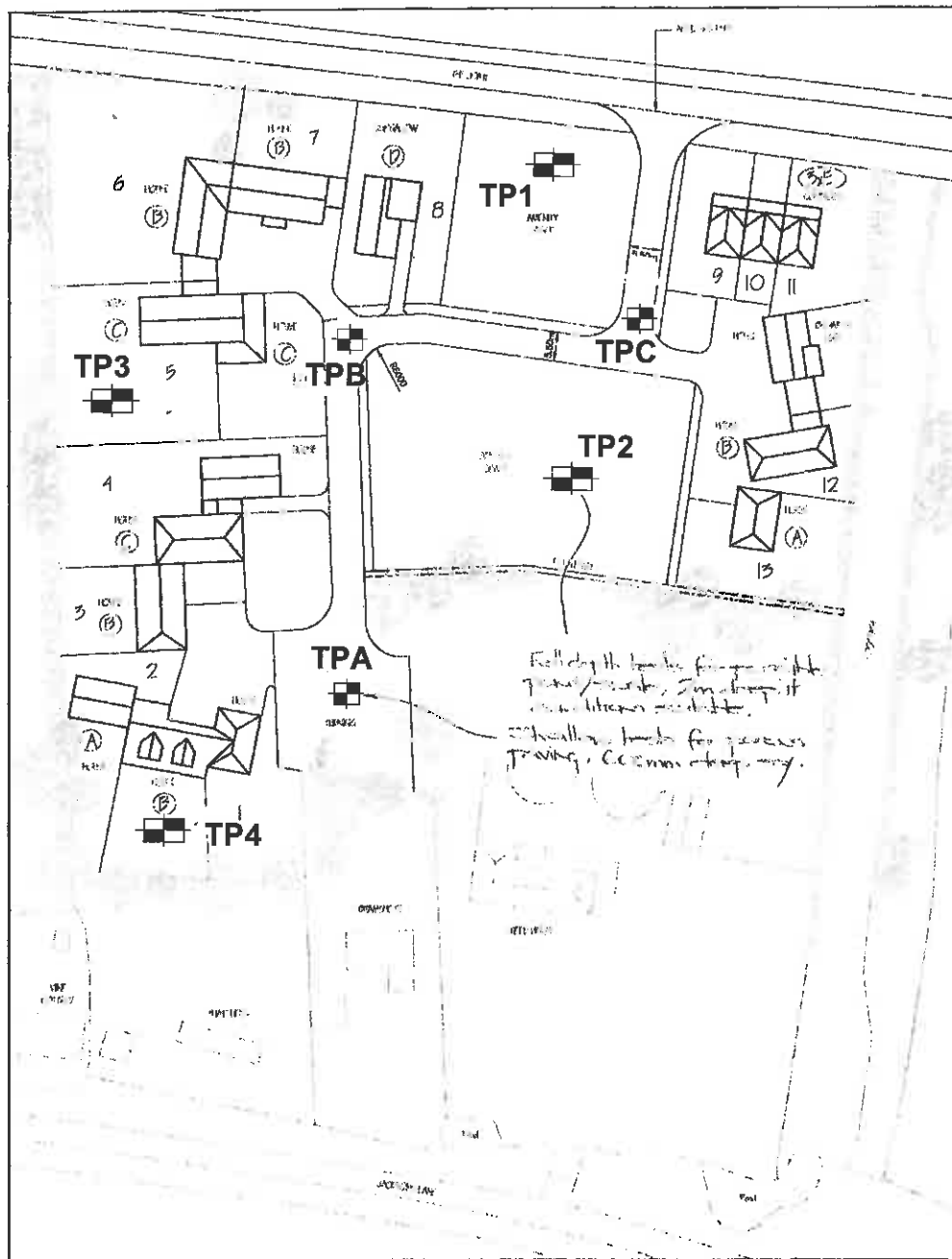


$$f = (V75-V25)/A50(T75-T25)$$
$$V75-V25 = 0.158$$
$$A50 = 1.661$$
$$T75-T25 = 3060 \quad (\text{extrapolated})$$

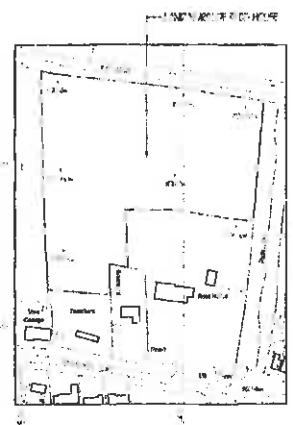
Extrapolated Soil Infiltration Rate $f = \underline{5.18E-07} \text{ m/s}$

Trial Pit Location Plan

Based on the Ordnance Survey sheet with the permission of the Controller of Her Majesty's Stationery Office,
© Crown Copyright. All rights reserved. Licence number AL 100005523.



SITE LOCATION PLAN
(1:500)



LOCATION PLAN
(1:500)

Not To Scale

Project : Land off The Joint, Reed, near Royston

Client : Mr D. Tait

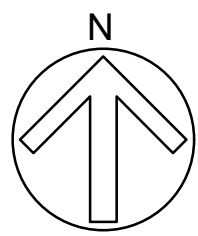
**GROUND
ENGINEERING
LIMITED**

Peterborough

Tel : 01733 566566

Project No.
C13206

APPENDIX D – EXISTING DRAINAGE INFORMATION



EXISTING DRAINAGE LEGEND

- Site Boundary (2.07ha)
- CWMH
Existing Thames Water Combined Water Drainage (locations / levels as taken from Thames Water asset plan information).
- SWMH
Existing Surface Water drainage
- Surface Fall Direction

EXISTING CATCHMENT LEGEND:

Existing Impermeable Area 0.130 ha

NOTES:

- This drawing is to be read in conjunction with all Peter Dann Consulting Engineers, Architects, MEP Engineers and Specialists drawings along with all relevant specifications.
- All gridlines, building lines, etc. are to be set out in accordance with the relevant Architects drawings. Any discrepancies between the information given by the Engineer and that provided by others must be referred to the Architect before work proceeds.
- Dimensions are NOT to be scaled from this drawing. If in doubt ask. Dimensions marked * are subject to confirmation by site measurement before construction commences.
- All proprietary fixings shall be installed in accordance with the manufacturer's recommendations.
- The Contractor shall comply with the health and safety requirements as set out by the CDM Regulations, THE HEALTH AND SAFETY EXECUTIVE.
- All works are to be undertaken in accordance with the Building Regulations and latest relevant British Standards.
- All construction products are to be CE marked in accordance with the Construction Products Regulation (EU) No. 305/2011.



CDM 2015

CONSTRUCTION - It is considered that the proposed works are within the scope of a competent contractor and as such no unusual hazards have been identified, with the exception of the following:-

- ** (Assessed & completed by PDL Project Manager)

LIFETIME/USAGE - The building has no exceptional structural features that present a hazard to potential users, with the exception of the following:-

- ** (Assessed & completed by PDL Project Manager)

DECOMMISSIONING/DEMOLITION - There are no unusual structural aspects to this building that require highlighting in the event that the building is demolished, with the exception of the following:-

- ** (Assessed & completed by PDL Project Manager)

RECORD INFORMATION - The record drawings / operating manual for the building should be thoroughly studied and its implications assessed by the demolition contractor.

PI	11.08.23	DT	DM	PLANNING ISSUE
REV	DATE	DWN	CHK	DESCRIPTION

AMENDMENTS

peter dann
consulting engineers

peter dann limited
newton house
cambridge road | barton | cambridge
CB23 7WJ t: 01223 264688
info@peterdann.com www.peterdann.com

JOB TITLE

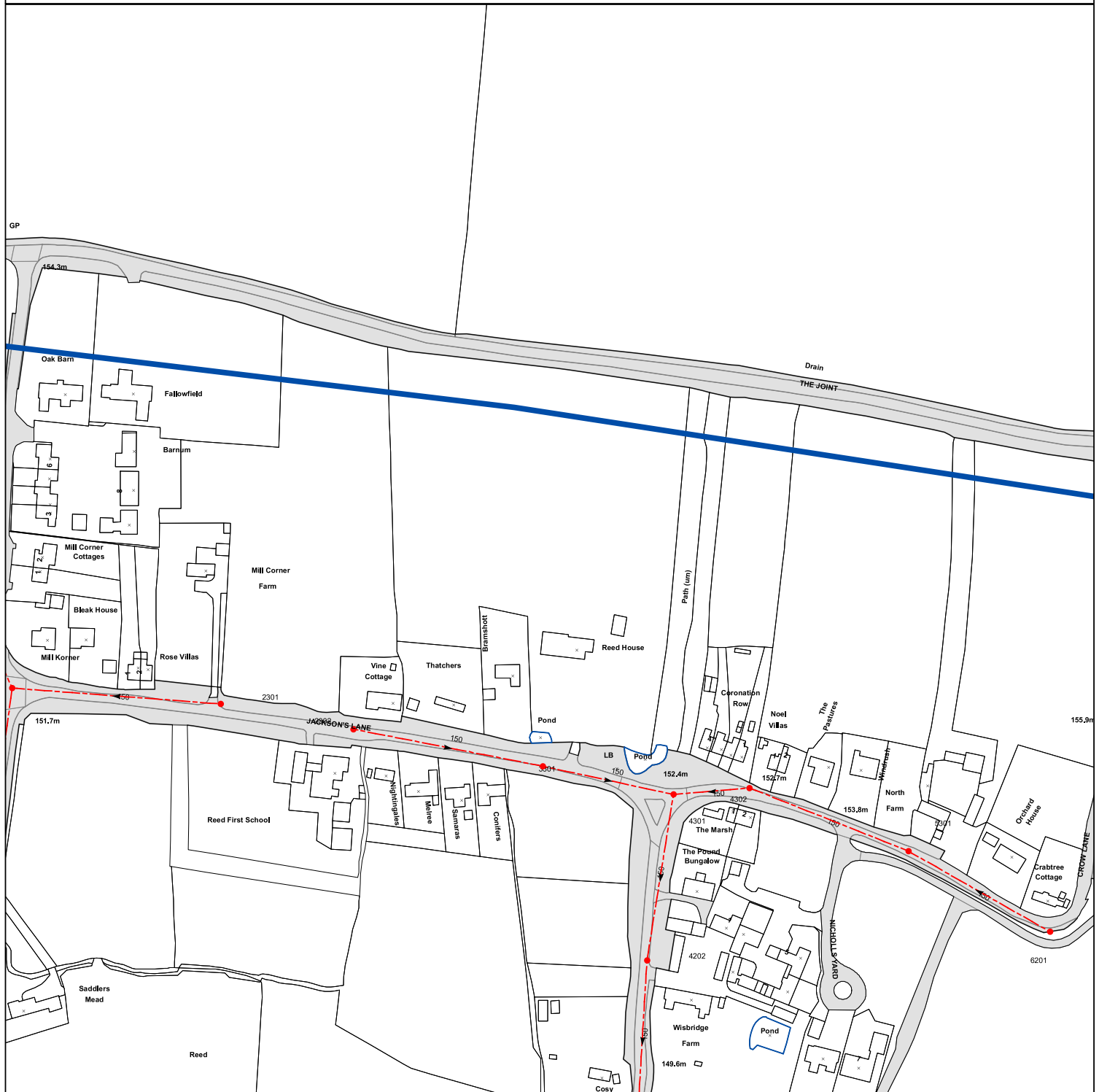
Reed House, Jacksons Lane
Reed, Hertfordshire (SG8 8AB)

DRAWING TITLE

Existing Drainage Plan

DATE	DRAWN	CHECKED	SCALE	@A1
Aug 2020	DM	DM	N.T.S	
DRAWING STATUS	STATUS CODE			
PLANNING	FOR PLANNING			
JOB/DWG No.	REV.			
10-5217_C-001	P1			

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0 10 20 40 60 80
Meters

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 before any works are undertaken. Crown copyright Reserved

Scale: 1:1791
Width: 500m
Printed By: annagraj
Print Date: 14/02/2014
Map Centre: 536386,236465
Grid Reference: TL3636SW

Comments:

ALS/ALS Standard/2014_2686751

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
5301		
1401	151.68	150.45
2302		
4202	150.76	148.65
4302	152.68	151.35

REFERENCE	COVER LEVEL	INVERT LEVEL
6201	154.42	153.05
2301	152.08	151.07
3301		
4301	152.5	149.38



estimation for sites

www.uksubs.com | Greenfield runoff tool

Calculated by:	Dan Martin
Site name:	Reed House
Site location:	SG8 8AB

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	52.00993° N
Longitude:	0.01424° W
Reference:	1868025507
Date:	Aug 20 2020 09:13

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	1
-----------------------	---

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	1	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.1	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	619	619
Hydrological region:	5	5
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	2.45	2.45
Growth curve factor 100 years:	3.56	3.56
Growth curve factor 200 years:	4.21	4.21

Notes

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

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

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

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is $SPR/SPRHOST \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	0.15	4.18
1 in 1 year (l/s):	0.13	3.64
1 in 30 years (l/s):	0.36	10.24
1 in 100 year (l/s):	0.52	14.88
1 in 200 years (l/s):	0.61	17.6

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

Hertfordshire County Council

[Maps and geographic info](#)[Public Sector Mapping Agreement](#)[OS Copyright](#)[Disclaimer](#)[Metadata](#)

Flood Risk Management Map



Flood Incident

☐ HCC Flood Incident Record

Watercourses

☒ Ordinary Watercourses☐ Main Rivers

EA Floodmaps

☐ Flood Zone 3☐ Flood Zone 2

Risk of Flooding from Surface Water

Max Extent

Ordinary Watercourses

— Ordinary Watercourse

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Find something:

Click on a Result (text or row) in table below to zoom the map

☐ Settlement	☒ Postcode	☐ County Councillor	☐ Division	Highway ID	Road Name
...	SG8 8AB	...	...	...	...

Using the map

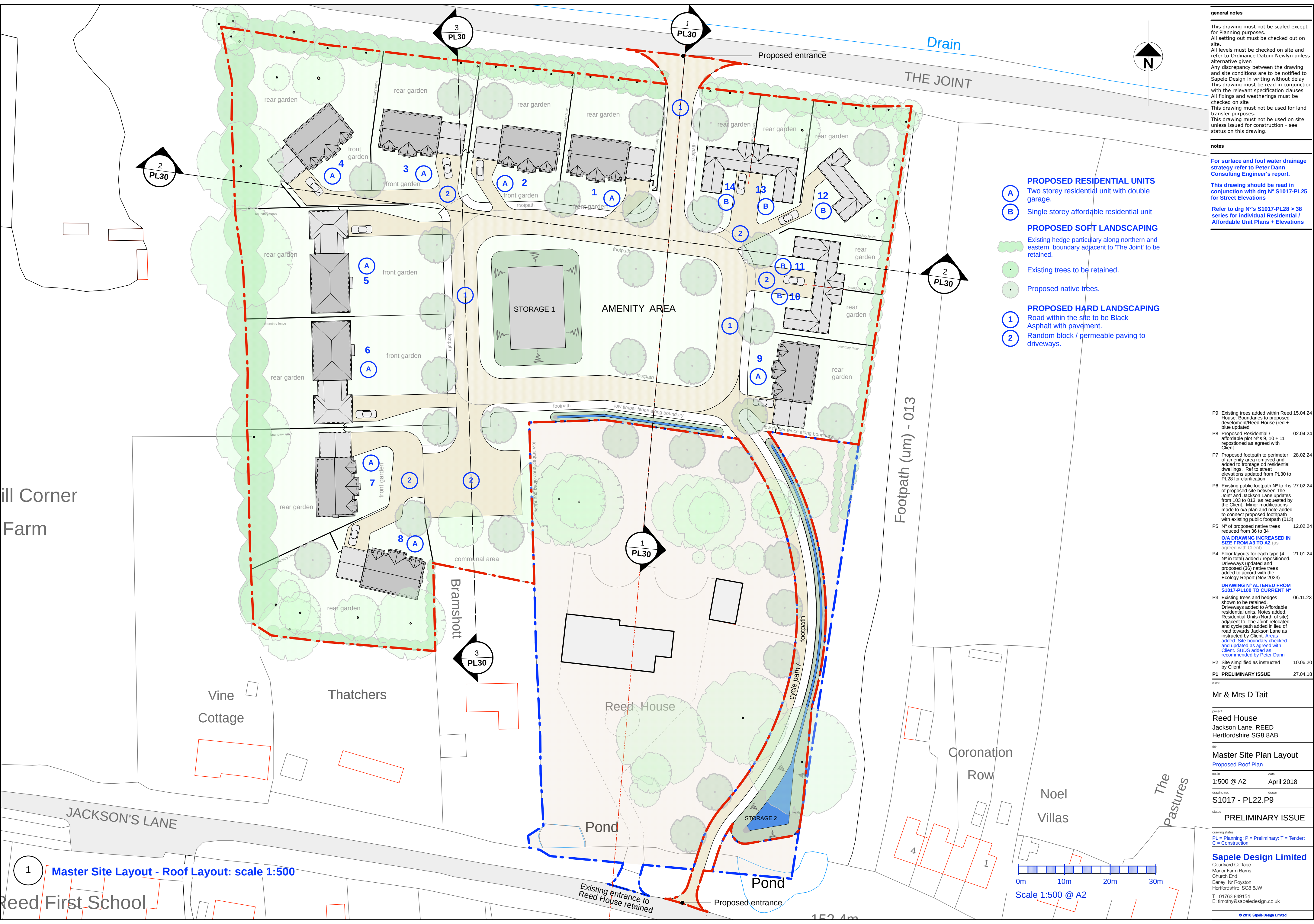
To zoom in and out use your mouse wheel or the zoom controls on the map. You can drag the map to move to a different location.

Webmaps is delivered by the Mapping and GIS (Geographic Information Systems) Service: gis@hertfordshire.gov.uk

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APPENDIX E – DEVELOPMENT MASTERPLAN



general notes

This drawing must not be scaled except for Planning purposes.
All setting out must be checked out on site.
All levels must be checked on site and refer to Ordinance Datum Newlyn unless alternative given.
Any discrepancy between the drawing and site conditions are to be notified to Sapele Design in writing without delay.
This drawing must be read in conjunction with the relevant specification clauses.
All fixings and weatherings must be checked on site.
This drawing must not be used for land transfer purposes.
This drawing must not be used on site unless issued for construction - see status on this drawing.

notes

For surface and foul water drainage strategy refer to Peter Dann Consulting Engineer's report.

This drawing should be read in conjunction with drg N° S1017-PL25 for Street Elevations

Refer to drg N°s S1017-PL28 > 38 series for individual Residential / Affordable Unit Plans + Elevations

PROPOSED RESIDENTIAL UNITS

- A Two storey residential unit with double garage.
- B Single storey affordable residential unit

PROPOSED SOFT LANDSCAPING

- Existing hedge particularly along northern and eastern boundary adjacent to 'The Joint' to be retained.
- Existing trees to be retained.
- Proposed native trees.

PROPOSED HARD LANDSCAPING

- 1 Road within the site to be Black Asphalt with pavement.
- 2 Random block / permeable paving to driveways.

P9	Existing trees added within Reed House. Boundaries to proposed development/Reed House (red + blue updated)	15.04.24
P8	Proposed Residential / affordable plot N°s 9, 10 + 11 repositioned as agreed with Client.	02.04.24
P7	Proposed footpath to perimeter of amenity area removed and added to frontage of residential dwellings. Ref to street elevations updated from PL30 to PL28 for clarification	28.02.24
P6	Existing public footpath N° to rhs of proposed site between The Joint and Jackson Lane updates from 103 to 013, as requested by the Client. Minor modifications made to o/a plan and note added to connect proposed footpath with existing public footpath (013)	27.02.24
P5	N° of proposed native trees reduced from 36 to 34	12.02.24
O/A DRAWING INCREASED IN SIZE FROM A3 TO A2 (as agreed with Client)		
P4	Floor layouts for each type (4 N° in total) added / repositioned. Driveways updated and proposed (35) native trees added to accord with the Ecology Report (Nov 2023)	21.01.24
DRAWING N° ALTERED FROM S1017-PL100 TO CURRENT N°		
P3	Existing trees and hedges shown to be retained. Driveways added to Affordable residential units. Notes added. Residential Units (North of site) adjacent to 'The Joint' relocated and cycle path added in lieu of road towards Jackson Lane as instructed by Client. Areas added. Site boundary checked and updated as agreed with Client. SUDS added as recommended by Peter Dann	06.11.23
P2	Site simplified as instructed by Client	10.06.20
P1	PRELIMINARY ISSUE	27.04.18

Mr & Mrs D Tait

Reed House
Jackson Lane, REED
Hertfordshire SG8 8AB

Master Site Plan Layout
Proposed Roof Plan

scale 1:500 @ A2 date April 2018

drawing no. S1017 - PL22.P9

status PRELIMINARY ISSUE

drawing status
PL = Planning; P = Preliminary; T = Tender;
C = Construction

Sapele Design Limited

Courtyard Cottage
Manor Farm Barns
Church End
Barley Nr Royston
Hertfordshire SG8 8JW
T: 01763 849154
E: timothy@sapeledesign.co.uk

APPENDIX F – FLUVIAL FLOODING INFORMATION

← Exit map

Rivers and sea map

Yearly chance of flooding

● Flood area (extent)

■ High chance

■ Medium chance

■ Low chance

■ Very low chance

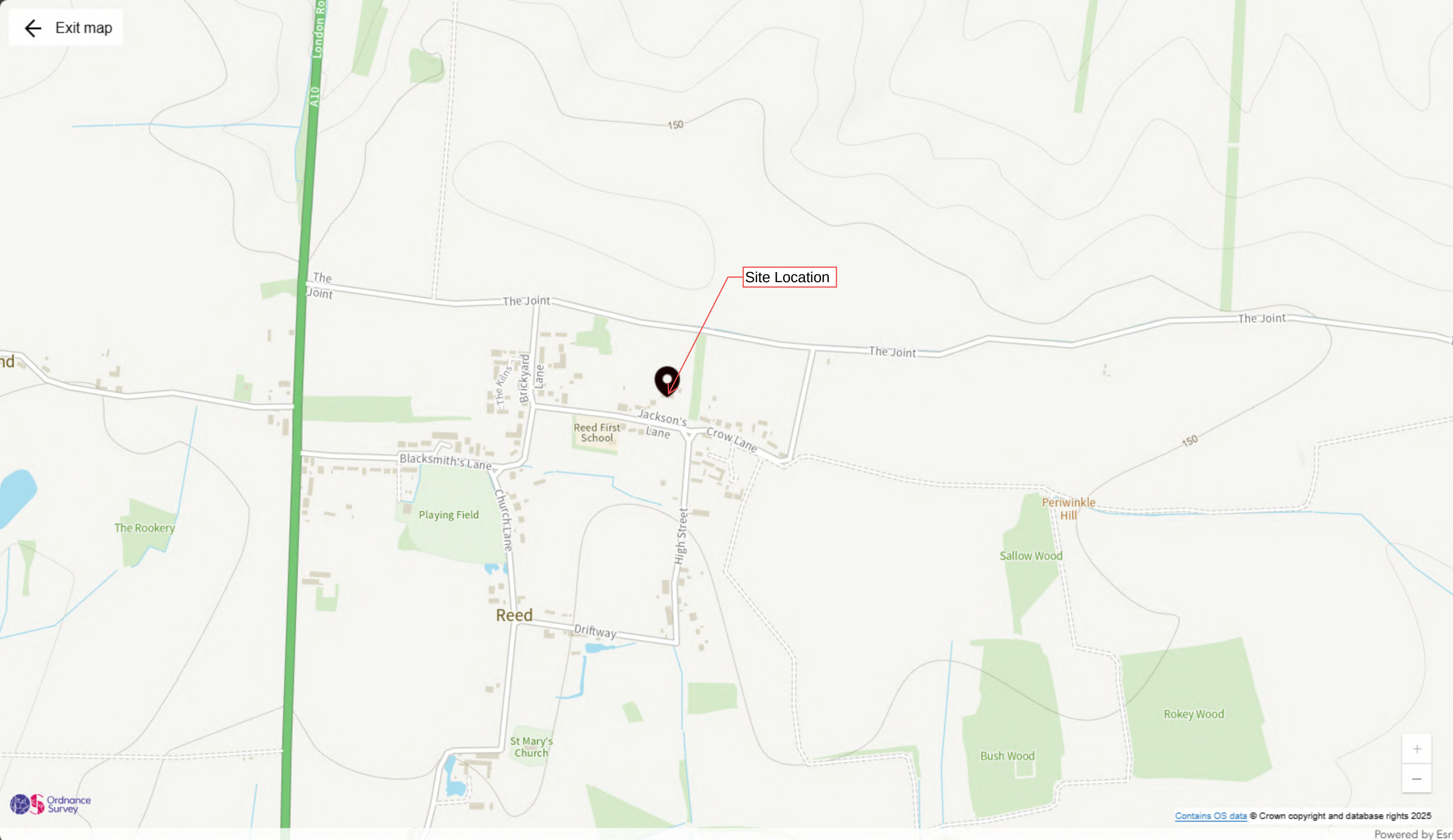
Yearly chance of flooding between 2036 and 2069

○ Flood area (extent)

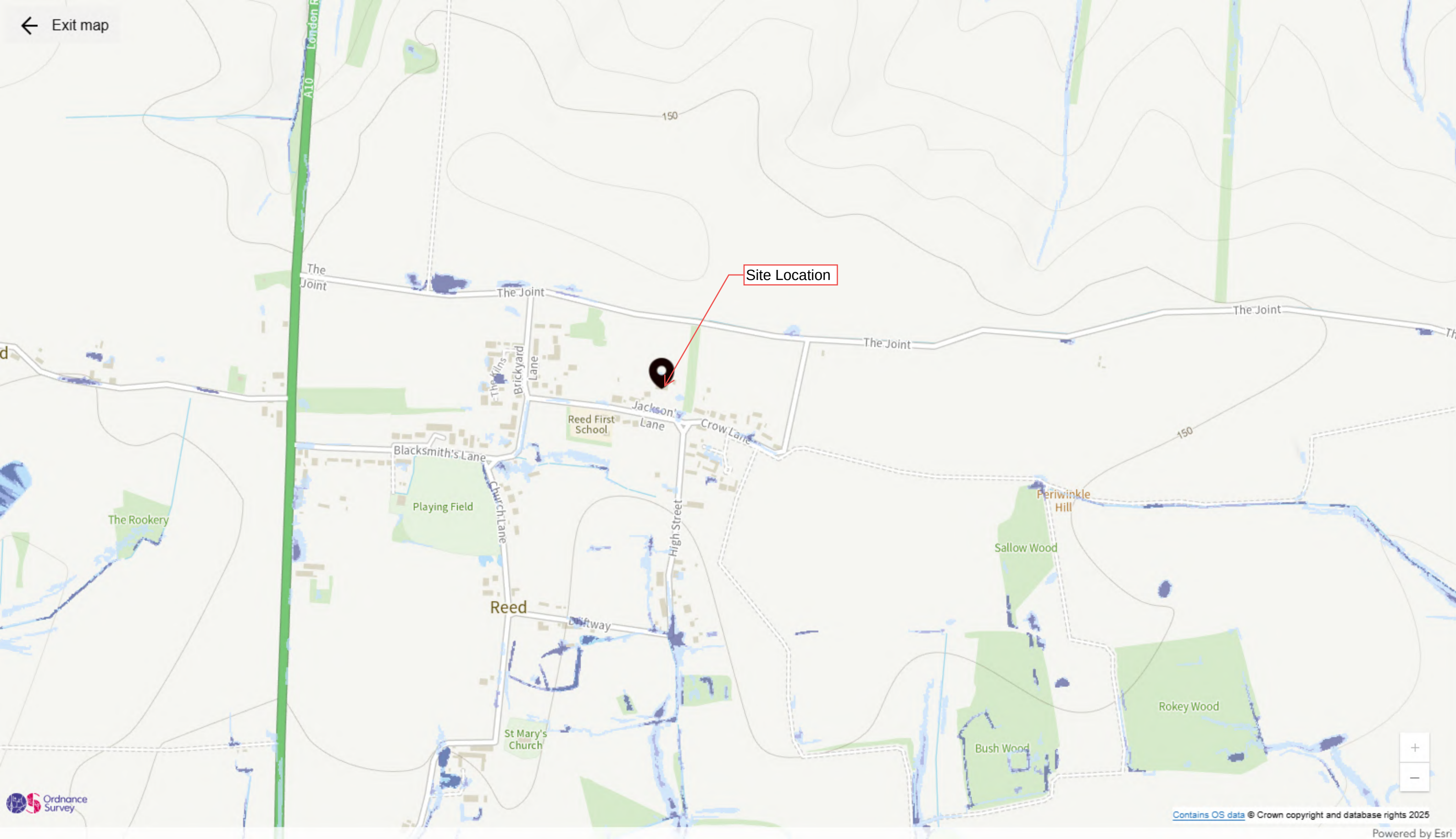
Map details

☒ Show flooding

☒  Selected address



APPENDIX G – SURFACE WATER FLOODING INFORMATION



Surface water map

Yearly chance of flooding

- ☒ Flood area (extent)
 - High chance
 - Medium chance
 - Low chance

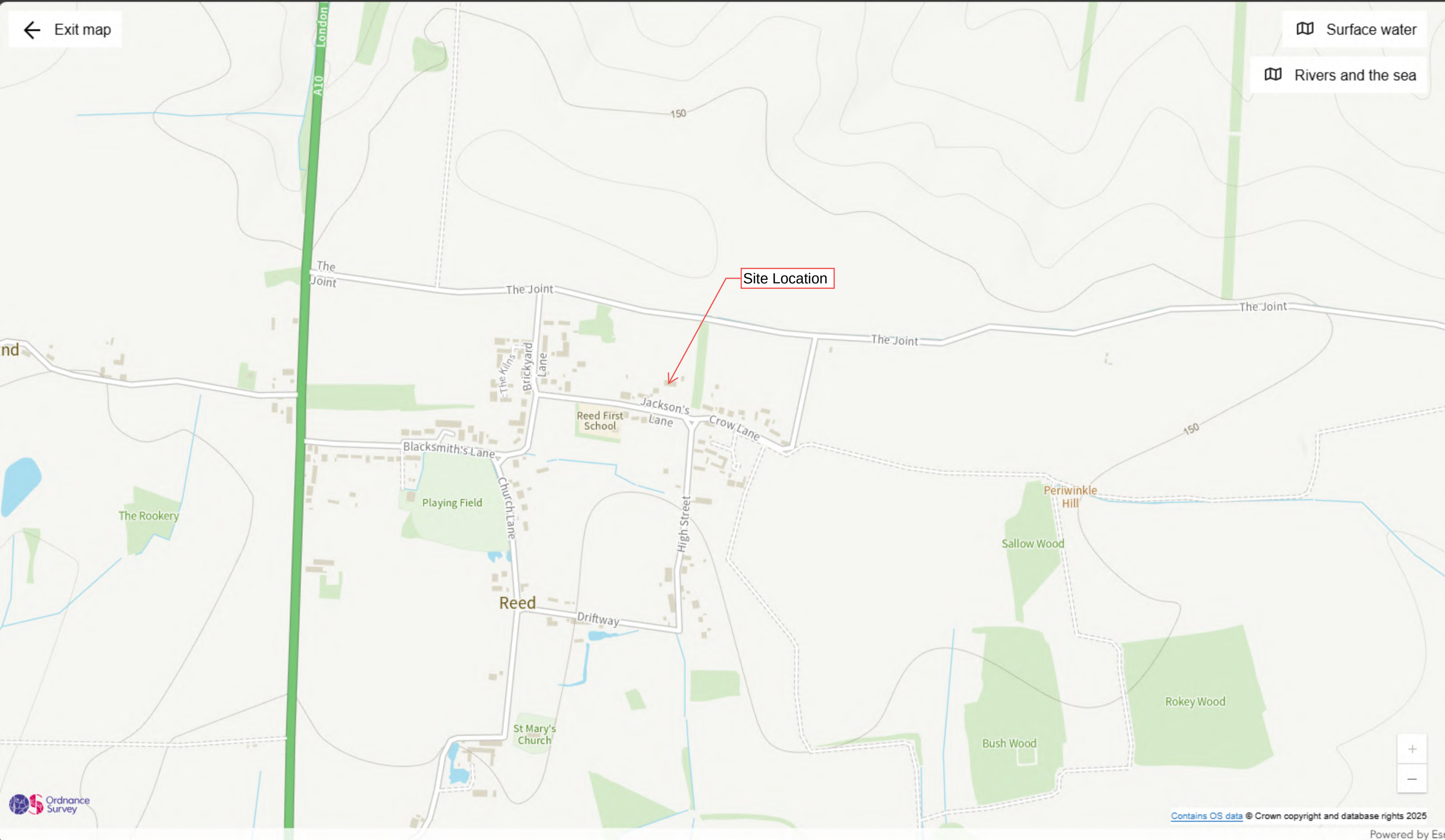
Yearly chance of flooding between 2040 and 2060

- ☐ Flood area (extent)

Map details

- ☒ Show flooding
- ☒ Selected address

APPENDIX H – RESERVOIR FLOODING INFORMATION



Reservoirs map

- ☒ Extent
- ☒ When river levels are normal
 - ☐ When there is also flooding from rivers

Map details

- ☒ Show flooding

**APPENDIX I – PROPOSED DRAINAGE STRATEGY & ASSOCIATED HYDRAULIC NETWORK
CALCULATIONS**



EXISTING DRAINAGE LEGEND

- CWMH
Existing Thames Water Combined Water Drainage
(locations / levels as taken from Thames Water asset plan information).
- SWMH
Existing Surface Water drainage

DRAINAGE LEGEND

- Site Boundary (2.07ha)
- SWMH
Proposed Surface Water Drainage (For pipe diameter, refer to Causeway FLOW calculations).
- FWMH
Proposed Foul Water Drainage (Pipe diameter to be 150ø)
- Proposed pre-cast concrete headwall
- Proposed Permeable paving construction
- Proposed 2.50m wide dry swale.
- Exceedence Flow Arrow (Storm Events greater than the 100yr + 40% climate change event)
- Indicates cover level is indicative and subject to detailed hard-standing design
- Proposed 600x600 Road Gully (Exact road gully position subject to hard-standing detailed design)
Each Road gully to take no greater than 125m² of impermeable area.
- Proposed Underground Geo-Cellular Storage Tank

- NOTES:
- This drawing is to be read in conjunction with all Peter Dann Consulting Engineers, Architects, MEP Engineers and Specialists drawings along with all relevant specifications.
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 - All works are to be undertaken in accordance with the Building Regulations and latest relevant British Standards.
 - All construction products are to be CE marked in accordance with the Construction Products Regulation (EU) No. 305/2011.



CDM 2015

- CONSTRUCTION** - It is considered that the proposed works are within the scope of a competent contractor and as such no unusual hazards have been identified, with the exception of the following:-
- ** (Assessed & completed by PDL Project Manager)
- LIFETIME/USAGE** - The building has no exceptional structural features that present a hazard to potential users, with the exception of the following:-
- ** (Assessed & completed by PDL Project Manager)
- DECOMMISSIONING/DEMOLITION** - There are no unusual structural aspects to this building that require highlighting in the event that the building is demolished, with the exception of the following:-
- ** (Assessed & completed by PDL Project Manager)
- RECORD INFORMATION** - The record drawings / operating manual for the building should be thoroughly studied and its implications assessed by the demolition contractor.

REV	DATE	OWN	CHK	DESCRIPTION
P1	14/08/22	DM	DM	PLANNING ISSUE
P2	10/08/22	DM	DM	MASTERPLAN & DRAINAGE LAYOUT REVISED

AMENDMENTS



peter dann limited
newton house
cambridge road | barton | cambridge
CB23 7WJ t: 01223 264688
info@peterdann.com www.peterdann.com

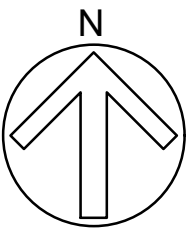
JOB TITLE

Reed House, Jacksons Lane
Reed, Hertfordshire (SG8 8AB)

DRAWING TITLE

Proposed Drainage Strategy
(Sheet 1 of 3)

DATE	DRAWN	CHECKED	SCALE	
Aug 2020	DM	DM	1:250	@A1
DRAWING STATUS				STATUS CODE
PLANNING				FOR PLANNING
JOB/DWG No.				REV.
10-5217_C-002				P2



NOTES:

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DECOMMISSIONING/DEMOLITION - There are no unusual structural aspects to this building that require highlighting in the event that the building is demolished, with the exception of the following:-

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REV	DATE	DWN	CHK	DESCRIPTION
P1	15/09/22	DT	DM	MASTERPLAN & DRAINAGE LAYOUT REVISED
P2	15/09/22	DT	DM	PLANNING ISSUE

AMENDMENTS



peter dann limited
newton house
cambridge road | barton | cambridge
CB23 7WJ t: 01223 264688
info@peterdann.com www.peterdann.com

JOB TITLE

Reed House, Jacksons Lane
Reed, Hertfordshire (SG8 8AB)

DRAWING TITLE

Proposed Drainage Strategy
(Sheet 2 of 3)

DATE: Aug 2020
DRAWN: DM
CHECKED: DM
SCALE: 1:250

DRAWING STATUS

PLANNING

JOI/DORG No.

10-5217_C-003

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STATUS CODE

FOR PLANNING

REV.

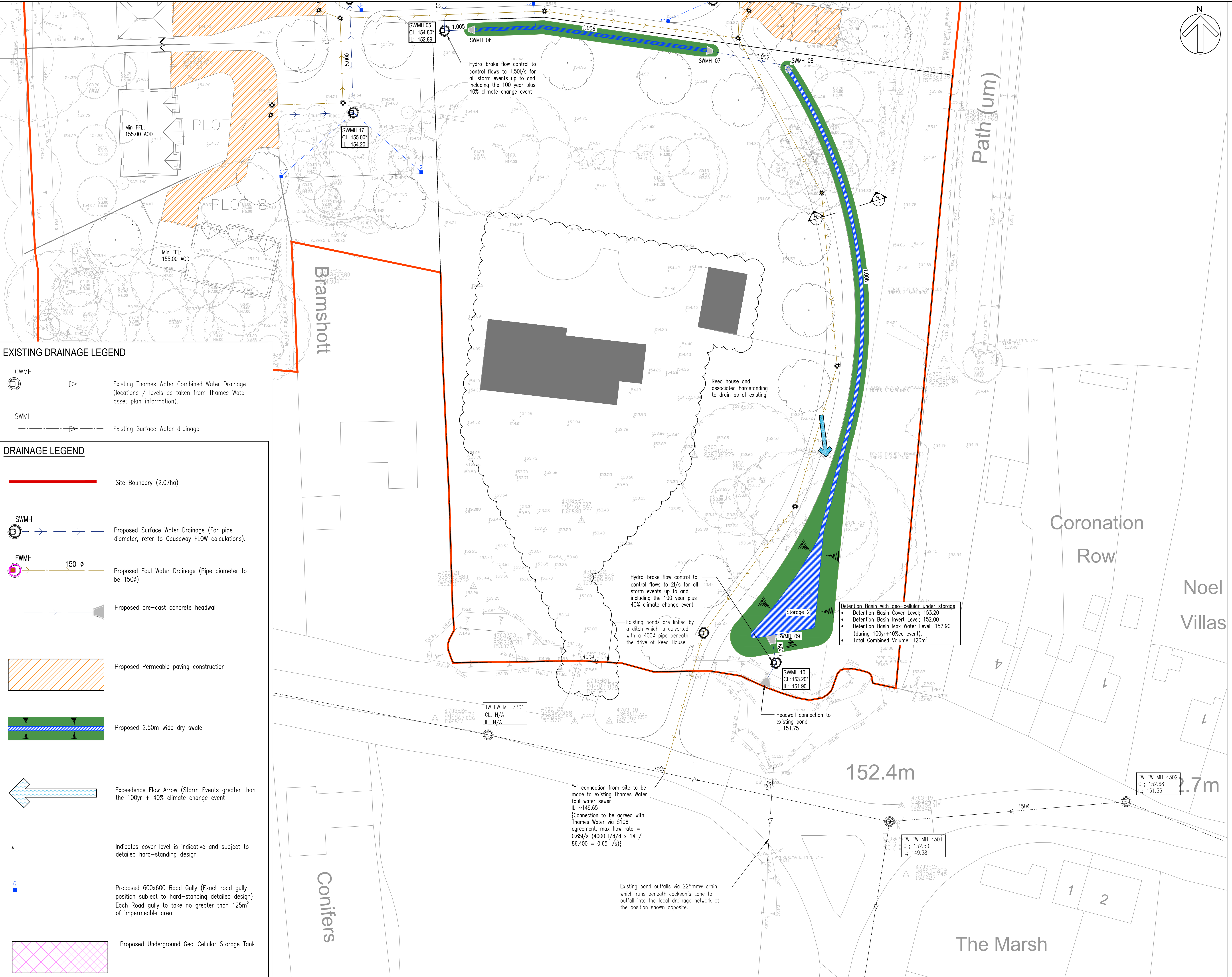
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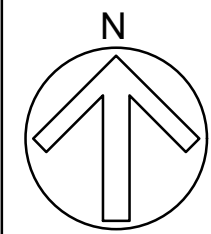
EXISTING DRAINAGE LEGEND

- CWMH
 Existing Thames Water Combined Water Drainage (locations / levels as taken from Thames Water asset plan information).
- SWMH
 Existing Surface Water drainage

DRAINAGE LEGEND

- Site Boundary (2.07ha)
- SWMH
 Proposed Surface Water Drainage (For pipe diameter, refer to Causeway FLOW calculations).
- FWMH
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- *
Indicates cover level is indicative and subject to detailed hard-standing design
- G
 Proposed 600x600 Road Gully (Exact road gully position subject to hard-standing detailed design) Each Road gully to take no greater than 125m² of impermeable area.
- Proposed Underground Geo-Cellular Storage Tank





CATCHMENT PLAN LEGEND

Site red line boundary (2.074 ha)

Proposed Impermeable Area = 0.600 ha

Existing Impermeable Area = 0.130 ha

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02	10/09/20	DR	DM	MASTERPLAN & DRAINAGE LAYOUT REVISED
01	13/09/20	DT	DM	PLANNING ISSUE
REV	DATE	DWN	CHK	DESCRIPTION

AMENDMENTS

peter dann
consulting engineers

peter dann limited
newton house
cambridge road | barton | cambridge
CB23 7WJ t: 01223 264688
info@peterdann.com www.peterdann.com

JOB TITLE
**Reed House, Jacksons Lane
Reed, Hertfordshire (SG8 8AB)**

DRAWING TITLE
Proposed Drainage Catchment Plan

DATE	DRAWN	CHECKED	SCALE	@A1
Aug 2020	DM	DM	N.T.S	
DRAWING STATUS				STATUS CODE
PLANNING				FOR PLANNING
JOB/DRG No.				REV.
10-5217_C-005				P2

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- ** (Assessed & completed by PDL Project Manager)

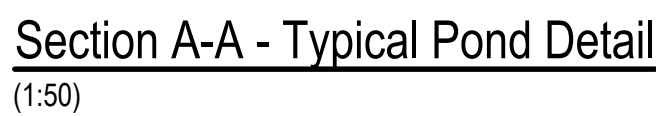
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- ** (Assessed & completed by PDL Project Manager)



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AMENDMENTS



DRAWING TITLE
Proposed Drainage Strategy
(Sheet 3 of 3)

DRAWING STATUS	STATUS CODE
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PLANNING FOR PLANNING

JOB/DRG No.	REV
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10-5017-0-001

10-5217_C-004 P1



Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	100.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.000
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	1.000	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
SWMH 01	0.051	4.00	156.100	1200	536345.903	236545.387	0.900
SWMH 02	0.027	4.00	157.000	1200	536408.082	236536.922	2.505
SWMH 03	0.020	4.00	156.100	1200	536404.091	236507.932	1.975
SWMH 04	0.000		156.000	1200	536381.570	236510.998	2.110
STORAGE 1	0.048	4.00	155.200	1200	536376.329	236485.327	2.200
SWMH 05	0.039	4.00	154.800	1200	536376.595	236469.538	1.910
SWMH 06	0.000	4.00	154.800	1200	536380.149	236469.662	1.940
SWMH 07	0.000		155.000	1200	536416.593	236466.444	2.340
SWMH 08	0.052	4.00	155.000	1200	536427.493	236464.309	2.575
STORAGE 2	0.020	4.00	153.200	1200	536425.306	236379.441	1.200
SWMH 10	0.000		153.200	1200	536425.976	236375.332	1.300
SWMH 11	0.026	4.00	157.000	1200	536447.281	236531.586	2.000
SWMH 13	0.034	4.00	155.400	1200	536416.608	236474.134	0.720
SWMH 14	0.049	4.00	156.000	1200	536419.179	236499.750	1.650
SWMH 15	0.026	4.00	156.200	1200	536416.663	236506.221	1.900
SWMH 16	0.096	4.00	155.800	1200	536363.059	236510.408	1.600
SWMH 17	0.135	4.00	155.000	1200	536363.003	236457.341	0.800
SWMH 18	0.010	4.00	155.200	1200	536362.114	236484.999	1.450

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	SWMH 01	SWMH 02	62.753	0.600	155.200	154.570	0.630	99.6	225	4.80	92.7
1.001	SWMH 02	SWMH 03	29.263	0.600	154.495	154.200	0.295	99.2	225	5.17	89.0
1.002	SWMH 03	SWMH 04	22.729	0.600	154.125	153.890	0.235	96.7	300	5.41	86.8
1.003	SWMH 04	STORAGE 1	26.201	0.600	153.890	153.000	0.890	29.4	300	5.56	84.6
1.004	STORAGE 1	SWMH 05	15.791	0.600	153.000	152.890	0.110	143.6	150	5.87	83.5
1.005	SWMH 05	SWMH 06	3.556	0.600	152.890	152.860	0.030	118.5	150	5.94	83.2
1.006	SWMH 06	SWMH 07	39.741	0.600	152.860	152.660	0.200	198.7	150	6.87	80.2

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	1.310	52.1	17.1	0.675	2.205	0.051	0.0
1.001	1.312	52.2	33.5	2.280	1.675	0.104	0.0
1.002	1.599	113.0	73.1	1.675	1.810	0.233	0.0
1.003	2.908	205.6	100.6	1.810	1.900	0.329	0.0
1.004	0.836	14.8	157.5	2.050	1.760	0.522	0.0
1.005	0.922	16.3	168.7	1.760	1.790	0.561	0.0
1.006	0.709	12.5	162.6	1.790	2.190	0.561	0.0

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.007	SWMH 07	SWMH 08	16.144	0.600	152.660	152.500	0.160	100.9	150	7.14	79.1
1.008	SWMH 08	STORAGE 2	85.835	0.600	152.425	152.000	0.425	202.0	225	8.70	73.6
1.009	STORAGE 2	SWMH 10	3.893	0.600	152.000	151.900	0.100	38.9	150	8.74	73.3
2.000	SWMH 11	SWMH 02	39.561	0.600	155.000	154.570	0.430	92.0	150	4.63	93.8
3.000	SWMH 13	SWMH 14	24.901	0.600	154.680	154.425	0.255	97.7	150	4.41	95.8
3.001	SWMH 14	SWMH 15	8.244	0.600	154.350	154.300	0.050	164.9	225	4.54	94.3
3.002	SWMH 15	SWMH 03	16.944	0.600	154.300	154.200	0.100	169.4	225	4.83	92.0
4.000	SWMH 16	SWMH 04	18.520	0.600	154.200	153.965	0.235	78.8	225	4.21	96.7
5.000	SWMH 17	SWMH 18	27.672	0.600	154.200	153.750	0.450	61.5	225	4.28	95.4
5.001	SWMH 18	STORAGE 1	14.219	0.600	153.750	153.000	0.750	19.0	225	4.35	94.8

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.007	1.000	17.7	160.4	2.190	2.350	0.561	0.0
1.008	0.916	36.4	163.1	2.350	0.975	0.613	0.0
1.009	1.618	28.6	167.7	1.050	1.150	0.633	0.0
2.000	1.048	18.5	8.8	1.850	2.280	0.026	0.0
3.000	1.017	18.0	11.8	0.570	1.425	0.034	0.0
3.001	1.015	40.4	28.3	1.425	1.675	0.083	0.0
3.002	1.001	39.8	36.2	1.675	1.675	0.109	0.0
4.000	1.474	58.6	33.5	1.375	1.810	0.096	0.0
5.000	1.670	66.4	46.5	0.575	1.225	0.135	0.0
5.001	3.019	120.0	49.7	1.225	1.975	0.145	0.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	62.753	99.6	225	Circular	156.100	155.200	0.675	157.000	154.570	2.205
1.001	29.263	99.2	225	Circular	157.000	154.495	2.280	156.100	154.200	1.675
1.002	22.729	96.7	300	Circular	156.100	154.125	1.675	156.000	153.890	1.810
1.003	26.201	29.4	300	Circular	156.000	153.890	1.810	155.200	153.000	1.900
1.004	15.791	143.6	150	Circular	155.200	153.000	2.050	154.800	152.890	1.760
1.005	3.556	118.5	150	Circular	154.800	152.890	1.760	154.800	152.860	1.790

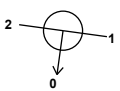
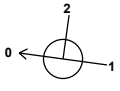
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	SWMH 01	1200	Manhole	Adoptable	SWMH 02	1200	Manhole	Adoptable
1.001	SWMH 02	1200	Manhole	Adoptable	SWMH 03	1200	Manhole	Adoptable
1.002	SWMH 03	1200	Manhole	Adoptable	SWMH 04	1200	Manhole	Adoptable
1.003	SWMH 04	1200	Manhole	Adoptable	STORAGE 1	1200	Manhole	Adoptable
1.004	STORAGE 1	1200	Manhole	Adoptable	SWMH 05	1200	Manhole	Adoptable
1.005	SWMH 05	1200	Manhole	Adoptable	SWMH 06	1200	Manhole	Adoptable

Pipeline Schedule

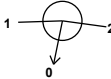
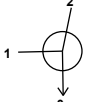
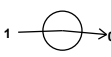
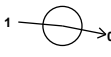
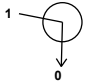
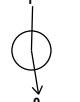
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.006	39.741	198.7	150	Circular	154.800	152.860	1.790	155.000	152.660	2.190
1.007	16.144	100.9	150	Circular	155.000	152.660	2.190	155.000	152.500	2.350
1.008	85.835	202.0	225	Circular	155.000	152.425	2.350	153.200	152.000	0.975
1.009	3.893	38.9	150	Circular	153.200	152.000	1.050	153.200	151.900	1.150
2.000	39.561	92.0	150	Circular	157.000	155.000	1.850	157.000	154.570	2.280
3.000	24.901	97.7	150	Circular	155.400	154.680	0.570	156.000	154.425	1.425
3.001	8.244	164.9	225	Circular	156.000	154.350	1.425	156.200	154.300	1.675
3.002	16.944	169.4	225	Circular	156.200	154.300	1.675	156.100	154.200	1.675
4.000	18.520	78.8	225	Circular	155.800	154.200	1.375	156.000	153.965	1.810
5.000	27.672	61.5	225	Circular	155.000	154.200	0.575	155.200	153.750	1.225
5.001	14.219	19.0	225	Circular	155.200	153.750	1.225	155.200	153.000	1.975

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.006	SWMH 06	1200	Manhole	Adoptable	SWMH 07	1200	Manhole	Adoptable
1.007	SWMH 07	1200	Manhole	Adoptable	SWMH 08	1200	Manhole	Adoptable
1.008	SWMH 08	1200	Manhole	Adoptable	STORAGE 2	1200	Manhole	Adoptable
1.009	STORAGE 2	1200	Manhole	Adoptable	SWMH 10	1200	Manhole	Adoptable
2.000	SWMH 11	1200	Manhole	Adoptable	SWMH 02	1200	Manhole	Adoptable
3.000	SWMH 13	1200	Manhole	Adoptable	SWMH 14	1200	Manhole	Adoptable
3.001	SWMH 14	1200	Manhole	Adoptable	SWMH 15	1200	Manhole	Adoptable
3.002	SWMH 15	1200	Manhole	Adoptable	SWMH 03	1200	Manhole	Adoptable
4.000	SWMH 16	1200	Manhole	Adoptable	SWMH 04	1200	Manhole	Adoptable
5.000	SWMH 17	1200	Manhole	Adoptable	SWMH 18	1200	Manhole	Adoptable
5.001	SWMH 18	1200	Manhole	Adoptable	STORAGE 1	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SWMH 01	536345.903	236545.387	156.100	0.900	1200				
						0	1.000	155.200	225
SWMH 02	536408.082	236536.922	157.000	2.505	1200				
						1	2.000	154.570	150
						2	1.000	154.570	225
						0	1.001	154.495	225
SWMH 03	536404.091	236507.932	156.100	1.975	1200				
						2	3.002	154.200	225
						1	1.001	154.200	225
						0	1.002	154.125	300

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
SWMH 04	536381.570	236510.998	156.000	2.110	1200		1	4.000	153.965	225
							2	1.002	153.890	300
							0	1.003	153.890	300
STORAGE 1	536376.329	236485.327	155.200	2.200	1200		1	5.001	153.000	225
							2	1.003	153.000	300
							0	1.004	153.000	150
SWMH 05	536376.595	236469.538	154.800	1.910	1200		1	1.004	152.890	150
							0	1.005	152.890	150
SWMH 06	536380.149	236469.662	154.800	1.940	1200		1	1.005	152.860	150
							0	1.006	152.860	150
SWMH 07	536416.593	236466.444	155.000	2.340	1200		1	1.006	152.660	150
							0	1.007	152.660	150
SWMH 08	536427.493	236464.309	155.000	2.575	1200		1	1.007	152.500	150
							0	1.008	152.425	225
STORAGE 2	536425.306	236379.441	153.200	1.200	1200		1	1.008	152.000	225
							0	1.009	152.000	150
SWMH 10	536425.976	236375.332	153.200	1.300	1200		1	1.009	151.900	150
SWMH 11	536447.281	236531.586	157.000	2.000	1200					
							0	2.000	155.000	150
SWMH 13	536416.608	236474.134	155.400	0.720	1200					
							0	3.000	154.680	150
SWMH 14	536419.179	236499.750	156.000	1.650	1200		1	3.000	154.425	150
							0	3.001	154.350	225
SWMH 15	536416.663	236506.221	156.200	1.900	1200		1	3.001	154.300	225
							0	3.002	154.300	225
SWMH 16	536363.059	236510.408	155.800	1.600	1200					
							0	4.000	154.200	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
SWMH 17	536363.003	236457.341	155.000	0.800	1200					
						0	5.000	154.200	225	
SWMH 18	536362.114	236484.999	155.200	1.450	1200		1	5.000	153.750	225
						0	5.001	153.750	225	

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440 | 2160

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	40	0	0

Node STORAGE 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	153.000	Product Number	CTL-SHE-0052-1500-1500-1500
Design Depth (m)	1.500	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.5	Min Node Diameter (mm)	1200

Node STORAGE 2 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	152.000	Product Number	CTL-SHE-0069-2000-0900-2000
Design Depth (m)	0.900	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node STORAGE 1 Lined Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	153.000	Pit Length (m)	18.000
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.800
Safety Factor	2.0	Ring Diameter (m)	1.200	Inf Depth (m)	
Porosity	0.95	Pit Width (m)	12.000	Number Required	1

Node STORAGE 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	153.800
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	



Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	240.0	0.0	0.900	442.0	0.0

Node STORAGE 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	152.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	65.0	0.0	1.200	200.0	0.0

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.03%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SWMH 01	10	155.331	0.131	33.9	0.2967	0.0000	OK
15 minute winter	SWMH 02	11	155.023	0.528	67.6	0.7115	0.0000	SURCHARGED
15 minute winter	SWMH 03	11	154.626	0.501	129.1	0.6679	0.0000	SURCHARGED
1440 minute winter	SWMH 04	1410	154.511	0.621	9.3	0.7027	0.0000	SURCHARGED
1440 minute winter	STORAGE 1	1410	154.511	1.511	14.5	394.2972	0.0000	SURCHARGED
15 minute winter	SWMH 05	11	153.587	0.697	25.9	1.0725	0.0000	SURCHARGED
15 minute winter	SWMH 06	12	153.516	0.656	21.0	0.7422	0.0000	SURCHARGED
15 minute winter	SWMH 07	11	153.040	0.380	18.3	0.4295	0.0000	SURCHARGED
15 minute winter	SWMH 08	11	152.848	0.423	49.7	0.6492	0.0000	SURCHARGED
960 minute winter	STORAGE 2	960	152.677	0.677	5.6	70.7870	0.0000	SURCHARGED
15 minute summer	SWMH 10	1	151.900	0.000	2.0	0.0000	0.0000	OK
15 minute winter	SWMH 11	11	155.278	0.277	17.3	0.3860	0.0000	SURCHARGED
15 minute winter	SWMH 13	11	155.300	0.620	22.6	1.2860	0.0000	FLOOD RISK
15 minute winter	SWMH 14	11	154.999	0.649	49.2	1.1193	0.0000	SURCHARGED
15 minute winter	SWMH 15	11	154.905	0.604	63.1	0.8493	0.0000	SURCHARGED
1440 minute winter	SWMH 16	1410	154.511	0.311	2.7	0.7258	0.0000	SURCHARGED
15 minute winter	SWMH 17	11	154.775	0.575	89.7	2.5923	0.0000	FLOOD RISK
1440 minute winter	SWMH 18	1410	154.511	0.761	4.1	0.9661	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SWMH 01	1.000	SWMH 02	33.9	1.218	0.651	2.0006	
15 minute winter	SWMH 02	1.001	SWMH 03	55.4	1.439	1.061	1.1638	
15 minute winter	SWMH 03	1.002	SWMH 04	127.0	1.813	1.124	1.6006	
1440 minute winter	SWMH 04	1.003	STORAGE 1	9.3	1.105	0.045	1.8451	
1440 minute winter	STORAGE 1	Hydro-Brake®	SWMH 05	1.5				
15 minute winter	SWMH 05	1.005	SWMH 06	21.0	1.192	1.289	0.0626	
15 minute winter	SWMH 06	1.006	SWMH 07	18.3	1.041	1.463	0.6996	
15 minute winter	SWMH 07	1.007	SWMH 08	19.9	1.131	1.127	0.2842	
15 minute winter	SWMH 08	1.008	STORAGE 2	46.9	1.382	1.288	3.4137	
960 minute winter	STORAGE 2	Hydro-Brake®	SWMH 10	2.0				113.9
15 minute winter	SWMH 11	2.000	SWMH 02	16.7	1.048	0.899	0.6965	
15 minute winter	SWMH 13	3.000	SWMH 14	18.3	1.134	1.018	0.4384	
15 minute winter	SWMH 14	3.001	SWMH 15	45.9	1.153	1.136	0.3279	
15 minute winter	SWMH 15	3.002	SWMH 03	60.7	1.526	1.524	0.6739	
1440 minute winter	SWMH 16	4.000	SWMH 04	2.7	0.749	0.046	0.7366	
15 minute winter	SWMH 17	5.000	SWMH 18	81.7	2.114	1.230	1.0091	
1440 minute winter	SWMH 18	5.001	STORAGE 1	4.0	0.904	0.033	0.5655	