

EXPANSION OF RUISLIP SCHOOL LONDON BOROUGH OF HILLINGDON

Drainage Strategy

5001-UA009222-02
AUGUST 2017

Expansion of Ruislip School, London Borough of Hillingdon

Drainage Strategy

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Report No 5001-UA009222-02

Date AUGUST 2017

VERSION CONTROL

Version	Date	Author	Changes
01	01.08.2017	S. Hicks	First Issue
02	30.08.2017	S. Hicks	Issue for planning

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1 Introduction

1.1 Introduction

The purpose of this document is to outline the strategy for the proposed foul and surface water drainage that is to be provided as part of the development at Ruislip High School.

The purpose of this report is to describe the proposed drainage strategy for the new development, as well as the information, calculations and assumptions on which it is based. This report should be read alongside the Flood Risk Assessment Report, Ground Investigation Interpretive Report and all other relevant documents issued as part of the Planning Application.

The strategy will form part of the submission to the Local Authority at Planning and Building Control stages.

1.2 Description of Development

The proposed development is an extension to Ruislip High School for expansion from a 6FE to an 7FE school. The site is located within the grounds of Ruislip School in Middlesex at ordnance survey reference 510184,186097. Access to Ruislip school is from the north off Sidmouth Drive. An indicative plan is presented in Figure 1.

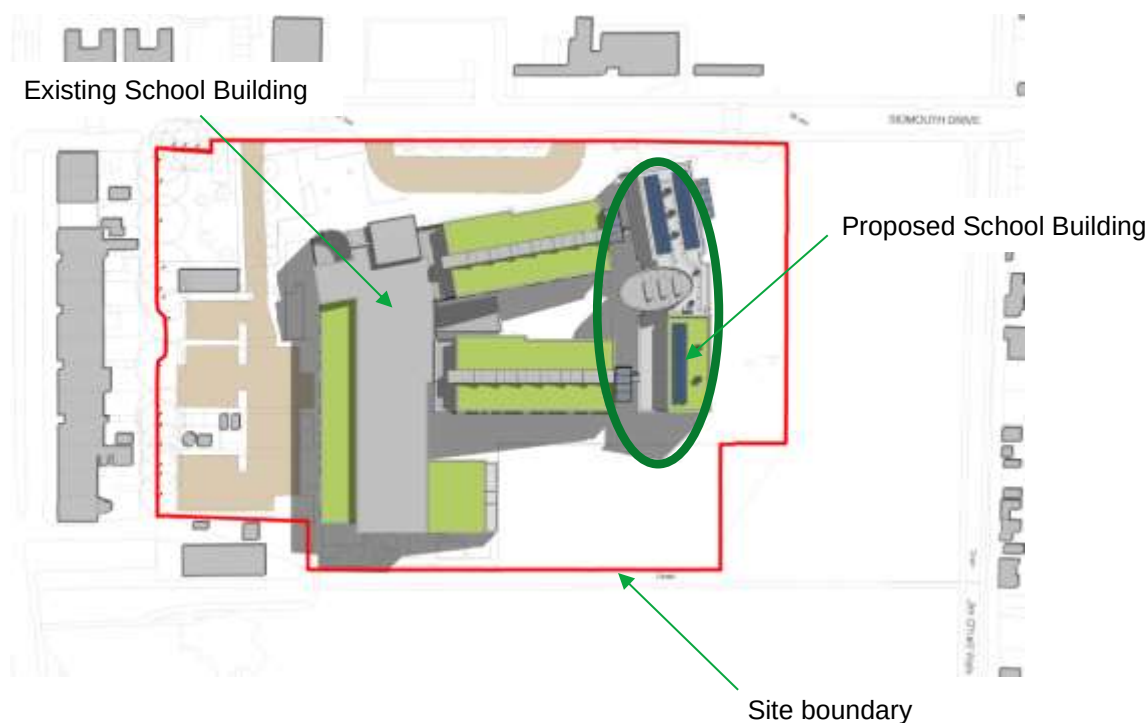


Figure 1 – Ruislip High School

2 Site Description

2.1 Topography

The development area is relatively flat topographical survey and gently slopes from north to south direction. The existing school is at 37.6m AOD. The proposed location of the new school extension is at a level of approximately 37.7m AOD.

2.2 Current Use

The site is an existing school and the development includes an extension to provide additional facilities. The area of the proposed development currently comprises of informal soft play space.

The total area of the main site is approximately 19,255m² (approximately 1.9 ha), based on the current plans. The additional hardstanding is approximately 3900m².

2.3 Existing Ground Conditions

A review of the published British Geological Survey (BSG) map indicated the site bedrock as Lambeth Group comprising clay, silt and sand. No superficial deposits have been recorded on site or in the surrounding area. More detailed information on ground conditions of the site is included within the Ground Investigation Report.

2.4 Existing Runoff Rates

The greenfield runoff rates for this location are detailed below:

Return Period	Greenfield Rate (l/sec/ha)
1 in 1 Year	9.1
1 in 30 Year	22.8
1 in 100 Year	30.4
1 in 100 +40% CC	42.6

Table 1 - Greenfield Runoff Rates

2.5 Ground Infiltration Rates

The existing school drainage strategy does not utilise infiltration therefore it is presumed that infiltration is not suitable in this area.

2.6 Flood Risk

As stated in the Ambient Flood Risk Assessment (FRA), document reference; 53066 the site is situated in Flood Zones 1,2 and 3 and is therefore considered to be 'More Vulnerable'. The proposed development is considered to be suitable as the site is within an existing developed area, it lies on land higher than the 1:100 (+35% for climate change) and records show there has been no flooding at the site historically, however an area in close proximity was affected by flooding in 1959. The site is at low risk of flooding from surface water flooding.

3 Surface Water Drainage

3.1 Planning Policy Requirements

London Plan Policy is aimed at ensuring that sustainable drainage techniques are utilised wherever practical for new developments.

The policy requires developers to aim for Greenfield run-off rates. However, it also recognises that in such a densely built-up city as London this may not always be possible, particularly given that the vast majority of development is targeted on brownfield sites.

The policy contains a hierarchy of drainage methods, with a preference going to methods that make active use of any rainfall captured, for example for irrigation or other non-potable uses such as vehicle cleaning. The policy also places a preference for sustainable drainage measures that retain water in surface features over methods than store water below the surface.

3.1.1 London Plan Policy Hierarchy:

Policy 5.13 – Sustainable Drainage of the London Borough of Hillingdon Local Flood Risk Management (February 2016) states that development should utilise urban drainage systems (SUDS), unless there are practical reasons for not doing so, and should aim to achieve Greenfield runoff rates and ensure that surface water runoff is managed as close to its source as possible, in line with the following drainage hierarchy:

1. Store rainwater for later use
2. Use infiltration techniques, such as porous surfaces in non-clay areas
3. Attenuate rainwater in ponds or open water features for gradual release
4. Attenuate rainwater by storing in tanks or sealed water features for gradual release
5. Discharge rainwater direct to a watercourse
6. Discharge rainwater to a surface water sewer/drain
7. Discharge rainwater to the combined sewer.

The drainage proposals within this strategy are designed to be implemented to deliver the policy objectives of this Plan.

3.1.2 Design Standards

The following design guidance will be adhered to for the proposed foul and surface water drainage system serving the proposed site.

- Building Regulations Part H
- National Planning Policy Framework (NPPF)
- Sewers for Adoption 7th Edition (for adopted connections)
- BS EN 752:2008, Drainage & Sewer Systems Outside Buildings
- BS EN 12056:200, Gravity Drainage Inside Buildings
- EA Pollution Prevention Guidelines
- BRE Digest 365 Soakaway Design

3.2 Drainage Principles

As per the guidance, the main options which are considered for drainage of surface water from proposed development sites are:

- Store rainwater for later use;
- Ground infiltration within the site;

- Attenuation and discharge at a restricted rate to a watercourse; and
- Attenuation and connection at a restricted rate to an existing piped network.

It is proposed to provide the following drainage infrastructure as part of the new development:

- Separate foul and surface water systems within the site boundary;
- Foul water to be discharged into the adopted Thames Water sewer local to the site boundary.
- Surface water to incorporate SUDS measures which will connect into the Thames Water surface water culvert.

3.3 Existing Drainage Infrastructure

Information with regard to existing surface, foul and combined drainage systems is included on the site layout plan in Appendix A.

From the existing site data and plans it can be seen that there are 150mm diameter foul and surface water drainage systems located along Sidmouth Drive to the north of the development.

There is a 1800mm surface water main that crosses the site along the western side of the existing school.

The existing pedestrian hardstanding areas around the existing school are constructed using permeable paving, while the tarmac car parking areas are constructed using a permeable macadam. As built drawing of the existing school has been reviewed and concluded that these permeable areas are contained within their sub bases and discharge via controlled outfalls to the 1800m diameter Thames Water culvert.

The existing school has a separate foul water network which connects to the Thames Water sewer located to the south of the development.

The proposed school extension is to be constructed on area of green field. Upon inspection of the existing schools planning drawings it is believed that this area of green field currently drains via to land drainage and discharges to a pond to the south of the development. There are currently no as built drawings available to confirm this situation.

A survey of the existing sewers to determine pipe size and location has been undertaken by Amethyst Surveys Limited and should be read in conjunction with this report. The report has identified a number of defects within the existing drainage which will need to be addressed at detailed design.

3.4 Proposed Strategy

Sustainable drainage systems are water sensitive drainage systems which mimic natural catchment processes to manage urban runoff. A “treatment train” of various Sustainable drainage systems is required to capture, detain, convey and discharge water from an urban environment. The treatment train concept is fundamental to designing a successful Sustainable Drainage Systems (SuDS) strategy.

The treatment train philosophy uses drainage techniques to systematically control the three elements of runoff: pollution, flow rates and volumes. This is achieved in three main steps: Source Control, Conveyance Control and Discharge Control. Source control is preferred to those steps further down the train as it leads to the control of water before it enters the proposed or existing drainage network/ watercourse. All of the methods suggested are recommended controls considered for Sustainable drainage systems and have been considered where practical.



The most practical solution for the management of surface water runoff from the proposed development is to locally attenuate and discharge at a set rate into existing infrastructure.

Green roofs and rainwater harvesting were considered but determined to be unsuitable for this development as PV panels are proposed for the new roof and there is a legionella risk with rainwater harvesting as outlined below.

3.4.1 Green Roof

A green roof is proposed above the art studio area which will typically intercept the first 5mm of rainfall. The amount depends on the depth and type of substrate on the green roof system. For the purpose of surface water storage proposed in this drainage strategy, it has been assumed that the green roof would be fully saturated during the 1 in 100 year plus 40% event

3.4.2 Rainwater Harvesting

Rainwater harvesting or grey water recycling is not considered viable for the proposed development in terms of the drainage strategy as the school will be empty for several weeks at a time increasing the risk of water contamination by pathogens such as legionella.

Additionally, rainwater harvesting does not assist with flood attenuation for peak storms as the rainwater harvesting tank can be full and offer no storage.

3.4.3 Infiltration and Attenuation

Ground infiltration is normally the most suitable method of discharging surface water runoff from a proposed development and should be used wherever feasible to mimic the existing diffuse discharge to ground.

However, infiltration has not been considered as a viable means of surface water disposal for this development as it is known that the existing school has used a contained permeable system with a controlled outfall into the Thames Water surface water culvert.

Attenuation will be provided by using cellular storage to ensure flood risk offsite is not increased for the 1 in 100 +40% Climate Change event.

3.5 Overland Flow Paths

Individual drainage features would be designed to accommodate a variety of specific maximum rainfall events depending on the requirements of legislation, the adopting party and constraints local to the feature, typically the 10 year, 30 year or 100 year rainfall events together with an allowance for climate change. Therefore, where not feasible, practical or permitted to deliberately accommodate 100-year events, surface water in excess of the design event could result in overland flows.

It is anticipated that there would be no additional surface water runoff caused by a change in land characteristics (the drainage design will attenuate all surface water run off at source before discharging).

The overland flow paths will follow the existing topography and drain in the direction of the general fall of the site which is towards the South.

3.6 Runoff Rates

The post development runoff rate is to be the Greenfield run off rate as required by the London Plan. For this site, this has been calculated (using a 0.5km² catchment) as 4.1 l/sec.

The required run off rate would be achieved through the use of a cellular storage to provide attenuation before discharging at a set maximum rate, therefore ensuring there is no increased risk of flooding downstream of the site.

Return Period	Design Flows (l/sec)
1 in 2 Year (Qbar)	4.1
1 in 30 Year	8.89
1 in 100 Year	11.86
1 in 100 +40% CC	16.6

Table 2 - Design Flows

3.7 Storage Requirements

By using Windes software, an industry standard drainage design package developed by Micro Drainage, the required storage volume has been estimated based on the rainfall event, size of development and allowable outflow.

The total storage volume has been calculated for the 1 in 100-year + 40% Climate Change event. These calculations show that the proposed development must provide a minimum of 266m³ storage to achieve the required discharge rate. Although this could be refined following detailed design. The calculations are provided within Appendix C.

3.8 Adoption & Maintenance

- It is anticipated that the drainage system inside the development boundary will be private and not adopted.
- Storm Drainage: to be maintained by the current school maintenance contract.
- Foul Drainage: to be maintained by current school maintenance contract.
- The Tank manufacturers will provide the jetting specification for the attenuation tanks.
- It is recommended that a visual inspection of all the manholes and chambers be carried out once a year; preferably in the autumn season.
- It is recommended that all rain water gutters and gullies be cleaned once a year; preferably in the autumn season,

It is to be noted that the facility management contract will need to maintain the private drainage system as far as the connection with any adopted system located at the south of the proposed site.

The final Operation and Maintenance plan will be completed in readiness for building handover and prior to occupation. It is proposed that the plan includes the following:

Type	Indicative Frequency	Possible Tasks
Routine Maintenance	Monthly (for normal care of SUDS)	Litter Picking Inspection of inlets, outlets and control structures
Occasional Maintenance	Annually	Silt Control & removal Vegetation Management
Remedial Maintenance	As required	Inlet/outlet repair Erosion repairs Reinstatement of edgings Reinstatement following pollution

4 Proposed Drainage Strategy

Specific design criteria for the system includes:

- Piped system design is to prevent flooding in any part of the site for the critical duration, 1:100-year return storm event. Including an allowance of 40% for climatic change (sewers can surcharge during this return period).
- Surface water drainage will convey the runoff that cannot be soaked away from roofs, roads and other hard-standing areas to the public surface water sewer at a controlled rate.
- Check design for the 1:100 +40% year to ensure properties on and off site are not subject to flooding.
- Design event rainfall based on the use of the most recent version of the 'Flood Estimation Handbook' with an enhancement of 40% to account for climate change.
- Foul drainage will be conveyed by pipe to the public sewer

4.1 Surface Water

The proposed surface water system for the site is depicted on the Drainage Strategy Plans contained within Appendix B of this report.

Surface water runoff from the school will be collected by trapped gullies this will discharge into cellular storage which will provide attenuation for the surface water. It will be pumped to discharge into the Thames Water surface water culvert, via a new connection with a route laid through the school site boundary. The plan for the proposed route is included in Appendix B. Thames water have been contacted regarding connection into their existing surface water culvert, the correspondence is included in Appendix D.

The silt traps will ensure the quality of the surface water runoff is improved. This strategy will allow the surface water to be managed without causing any flooding issues on the paved areas, play areas or surrounding areas

Calculations have been provided in Appendix C to ensure the storage provided in the scheme is sufficient for the 1 in 100 year + 40% Climate Change event for the development area.

The surface water drainage system, including any storage features will remain private and will be maintained by the site owner / operator as part of their existing O&M procedures.

4.2 Foul Water

The proposed foul water system for the development is depicted on the Drainage Strategy Plans contained within Appendix B of this report. The external foul water drainage system for the site will be designed to outfall into the existing foul water network.

Information on the location of the any existing foul sewers within the site and surrounding area is contained within Appendix A of this report.

The additional anticipated foul water peak discharge has been calculated as 1.525 litres a second (6 x DWF) calculated based on 90l/s per person/activity/day for an additional population of 244 in accordance with the British Water Code of practice.

This estimation has been calculated using flow calculations for similar developments and will be confirmed when the full design requirements of the facility are known and agreed. This flow will discharge to the existing sewer network by means of a new connection from the site.

The appointed contractor will submit their proposals for the control of any temporary foul or surface water to the Thames Water Sewer and must seek and obtain their approval prior to commencement of any site work or temporary connection into their existing system.

5 Conclusions

This document has set out a viable drainage strategy for the proposed development scheme. This report has demonstrated that the proposed development can be adequately provided with all necessary surface and foul water infrastructure.

The discharge point for the surface water is to be confirmed by on-going discussions with Thames Water.

Through the use of trapped gullies and cellular storage, the proposed development will attenuate surface water flows, provide water quality treatment and prevent downstream flooding. These achievements align with the aims and objectives of the London Plan and other legislative guidelines.

APPENDIX A
Proposed Site Plan

Notes.

Drawing to be read in conjunction with designer risk register



Plant schedule Species	Size & Spec.	Spacing	No.
NATIVE TREES			
Acer campestre 'Streetwise'	10-12 Select standard 3.0-3.5m height CG	as shown	8
Pyrus calleryana 'Chanticleer'	12-14 Heavy standard 3.5-4.0m height CG / BR, 2m clear stem	as shown	6
Orchard Trees (to be confined with school prior to tender)			
Apple: Bramleys Seedling	C10 Standard, 2m height		1
Apple: Worcester Pearmain	C10 Standard, 2m height		1
Pear: Williams Bon Chretien	C10 Standard, 2m height		1
Plum: Marjorie Seedling	C10 Standard, 2m height		1
NATIVE HEDGE			
Carpinus betulus	900-1200 BR	5 / lin m	185
LOW ORNAMENTAL SHRUB PLANTING			
Hebe 'Mrs Winder'	200-300 C2	7/m2	70
PLANTER SENSORY PLANTING			
Alysis citrodora	C2 bushy	7/m2	14
Artemisia vulgaris	C2 bushy	7/m2	14
Stachys byzantina	C2 bushy	7/m2	14
Lavandula angustifolia 'Hidcote'	C1 bushy	5/m2	10
Origanum vulgare 'Compactum'	C1 bushy	15/m2	30
Pennisetum alopecuroides Hameln	C1 bushy	30-40cm	10
Rosmarinus officinalis	C1 bushy	5/m2	10
Rudbeckia fulgida sultii 'Goldsturm'	C1	10/m2	20
Salvia officinalis 'Purpurascens'	C2 bushy	7/m2	14
Sipa tenuissima	C3 30-40cm	5/m2	10
Thymus citriodorus aurea	C1 20-30cm	15/m2	30
Salvia pratensis	C2 bushy	7/m2	7
Eryngium planum	C1	10/m2	10

NOTES:

Landscape Implementation Guidelines.
The approved hard and soft landscaping scheme for the whole site shall be carried out prior to occupation of the building or during the first planting season following the full completion of building works, whichever is sooner.

All planting and landscape operations should comply with the requirements specified in BS 3936 (1992) Nursery Stock Part One, BS 4428 (1989) Code of Practice for General Landscape Operations (excluding hard surfaces) and BS8545 Trees from nursery to independence in the landscape.

Any plant species shown on the approved landscape scheme which within a period of 5 years from the completion of the development dies, is removed or in the opinion of the LPA becomes seriously damaged or diseased shall be replaced in the same place in the next planting season with identical species unless the LPA gives written consent to any variation.

Proposed Tree Planting
Stock size proposed is as shown.
Tree support for semi mature specimens shall be an underground strapped anchor system with ground anchors including an integrated irrigation and aeration system.
Other tree support to be two softwood stakes @ 7.5cm diameter @ 230cm length and should be driven into the ground to knee-height with ties and horizontal cross support.
Tree pit size to conform to BS8545 Trees from nursery to independence in the landscape.

Proposed Shrub and Hedge Row Planting
Hedge row planting to be planted as shown in the plant schedule, to be planted in the first available planting season following the occupation of the building or the completion of the development (whichever is sooner), in a minimum 450mm depth of clean topsoil, with a minimum of 50mm approved bark mulch applied.

Proposed Seeding / Turfing
Seeding / turfing to be carried out in the first available seeding / turfing season following the occupation of the building or the completion of the development (whichever is sooner), in a minimum 150mm depth of clean topsoil.

Additional Notes.

- Existing trees and vegetation to be retained are to be protected during construction to BS:5837:2012
- Any necessary tree works to be carried out by an approved tree surgeon to BS 3998.
- Trees, hedges and shrubs shown to be retained on the approved plan shall not be damaged, uprooted, felled, lopped or topped without the prior written consent of the local planning authority.
- If any retained tree, hedge or shrub is removed or severely damaged during construction work, or is found to be seriously diseased or dying, another tree, hedge or shrub shall be planted at the same place and shall be of a size and species to be agreed in writing by the Local Planning Authority and shall be planted in the first planting season following the completion of the development or the occupation of the buildings, whichever is the earlier.

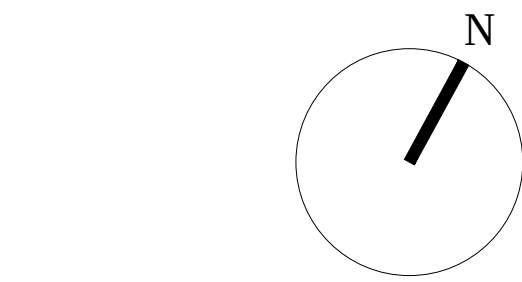
Hard Landscape Legend

	Paving - Concrete slab paving 400 x 400mm, Natural grey colour. Tobermure textured slabs or similar approved
	Surfacing - Block paving to match existing
	Surfacing - Resin bound gravel
	Surfacing - Artificial grass sports pitch
	Edging - Concrete pin kerb 914 x 150 x 50mm

Soft Landscape Legend

	Furniture - Gero table and benches by Bailey Street Scene or similar approved
	Furniture - Gero bench by Bailey Street Scene or similar approved
	Furniture - Treeline bench components by Artform Urban, or similar approved
	Furniture - Perla Q tree grille by Artform Urban, galv & powder coated or similar approved
	Fencing - 1.45m high metal fence to match existing
	Proposed tree - refer to planting schedule
	Planting - Hedge - Refer to plant schedule
	Planting - Shrubs - Refer to plant schedule
	Grass - Lawn

- Notes:**
- 1 Drainage: Refer to Engineers drawings and specification
 - 2 Highway / Civils works: Refer to Engineers drawings and specification
 - 3 Sub bases and foundations: Refer to Engineers drawings and specification
 - 4 Lighting / Mugs Lighting: Refer to M&E Engineers / Lighting Specialist drawings and specification
 - 5 Refer to Project Health and Safety File for locations and details of existing services
 - 6 Road marking white lining: Refer to Engineers drawings and specification



Revisions:
P1 ISSUED FOR PLANNING Aug 17

Landscape Architect

ijla

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Contractors are not to scale from this drawing. All dimensions are to be checked on site. Any discrepancies, omissions and/or omissions between this drawing and information given elsewhere are to be reported to this office for clarification before proceeding.

STATUS:
PLANNING

Project Title:
Ruislip High School

Drawing Title:

Landscape Plan
Sheet 1 of 2

Scale: 1:200@A0 Drawn: team

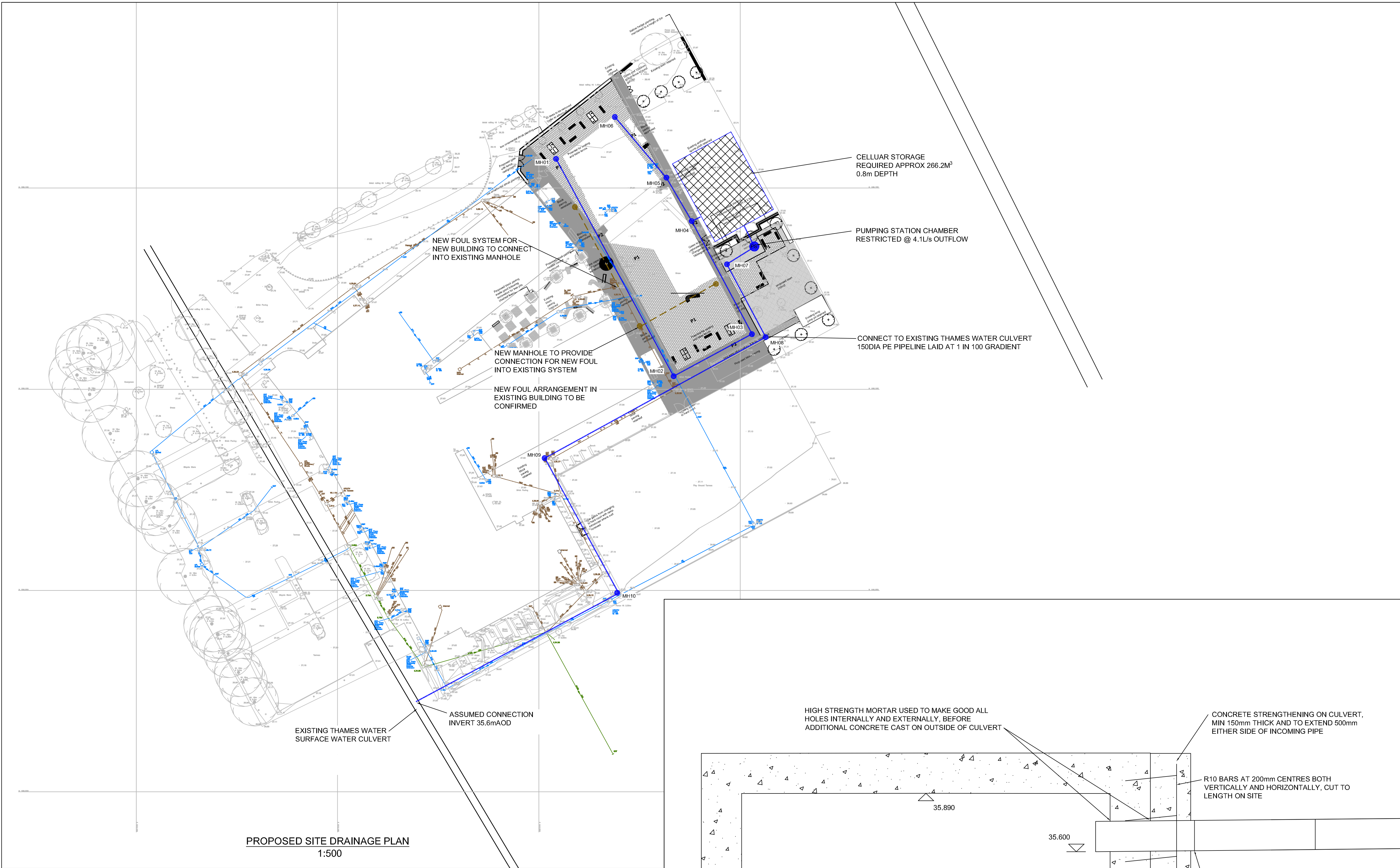
Date: May 17

Drawing Number: M297-100 Revision: P1

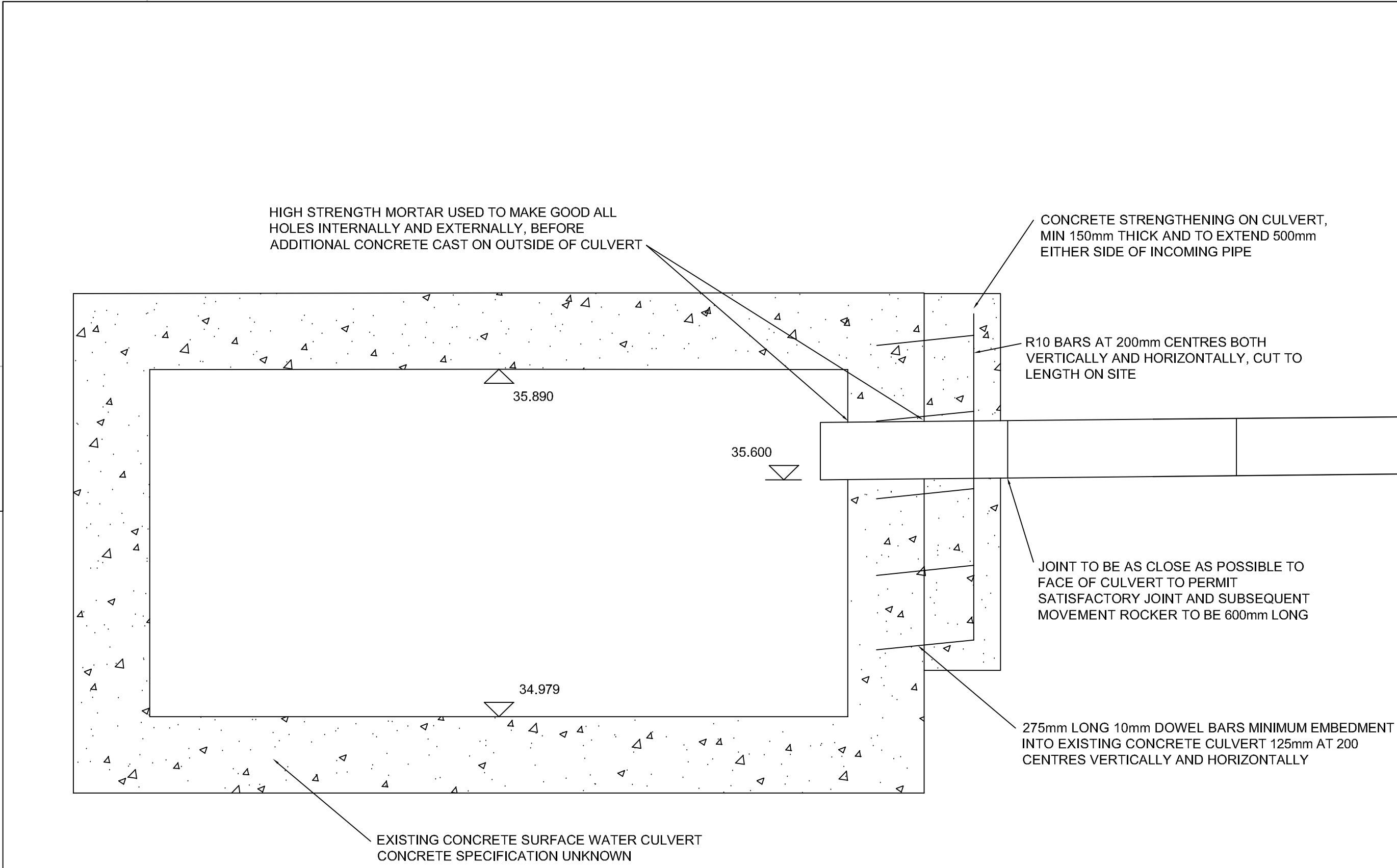
Project reference: 1 - CRN/rev0170801/050-160089 - Ruislip High School - Option 7

Proposed v6 CDP.dwg 3

APPENDIX B
Proposed Drainage Strategy Plan



PROPOSED SITE DRAINAGE PLAN
1:500



CONNECTION DETAIL INTO EXISTING CULVERT
1:10

- NOTES:
1. TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
 2. POSITION, SIZE AND INVERT OF EXISTING DRAINS TAKEN FROM EXISTING SURVEY AND CCTV INFORMATION (IF APPLICABLE).
 3. ALL ABANDONED DRAINAGE TO BE GRUBBED UP OR GROUTED UNLESS OTHERWISE SHOWN. ABANDONED CONNECTIONS INTO EXISTING CHAMBERS TO BE FILLED WITH 200MM GEN3 CONCRETE PLUG AND BENCHINGS OF CHAMBER TO BE ALTERED TO SUIT NEW INTERNAL ARRANGEMENT. EXTENT OF ABANDONMENT TO BE AGREED.
 4. ALL EXISTING DRAINAGE TO BE MAINTAINED IN WORKING ORDER UNLESS OTHERWISE SHOWN.
 5. RAINWATER PIPES AND CONNECTIONS HAVE NOT BEEN SHOWN FOR CLARITY. ALL RAINWATER FROM ROOFS WILL CONNECT INTO THE INDICATIVE SURFACE WATER SYSTEM. THIS WILL BE SUBJECT TO DETAILED DESIGN PROPOSALS.
 6. SOIL STACK POSITIONS AND CONNECTIONS (INCLUDING INTERNAL GULLIES) HAVE NOT BEEN SHOWN FOR CLARITY. THESE WILL BE SUBJECT TO DETAILED DESIGN PROPOSALS.
 7. THRESHOLD DRAINS TO PROPOSED DOORWAYS ARE SUBJECT TO DETAILED DESIGN LEVELS AND PROPOSALS.
 8. ALL RAINWATER GULLIES TO BE TRAPPED GULLIES UNLESS OTHERWISE SHOWN.
 9. ROCKER PIPES TO BE FITTED TO ALL NEW CHAMBERS AND NEW CHAMBERS FITTED ON EXISTING RUNS.

KEY

	Proposed Surface Water
	Proposed Foul Water
	Proposed Surface Water Chamber
	Proposed Foul Water Chamber
	Pumping Station Chamber
	Proposed Attenuation
	Existing Surface Water
	Existing Foul Water

P01	04-08-17	FIRST ISSUE	SH	JE	SAD
Rev	Date	Description	Drawn	Check	Approv

Client
London Borough of Hillingdon Council

PROJECT:
Ruislip High School
Sidmouth Drive
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TITLE:
RUSLIP HIGH SCHOOL
DRAINAGE STRATEGY

Designed	S. HICKS	Signed	Date	AUG 2017
Drawn	S. HICKS	Signed	Date	AUG 2017
Checked	J. EVANS	Signed	Date	AUG 2017
Approved	S.A. DAVIES	Signed	Date	
Scale:	1:500	Datum:	AOD	
Original Size:	A1	Grid:	OS	
Suitability Code:	D2	Project Number:	UA005241	

Suitability Description:
PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION
Drawing Number:
BIC-ARC-XX-000-DRG-CE-0005
Revision:
P01

APPENDIX C

Calculations

Arcadis Consulting (UK) Ltd							Page 2
HCL House Fortran Road St Mellons Business Park Cardiff CF3 0EY							
Date 01/08/2017 11:27 File Drainage 1 in 100				Designed by sha77856 Checked by			
XP Solutions				Source Control 2016.1			
Summary of Results for 100 year Return Period (+40%)							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	36.893	0.593	0.0	4.1	4.1	205.6	O K
60 min Winter	36.959	0.659	0.0	4.1	4.1	228.8	O K
120 min Winter	37.021	0.721	0.0	4.1	4.1	250.2	O K
180 min Winter	37.049	0.749	0.0	4.1	4.1	259.9	O K
240 min Winter	37.063	0.763	0.0	4.1	4.1	264.6	O K
360 min Winter	37.067	0.767	0.0	4.1	4.1	266.2	O K
480 min Winter	37.056	0.756	0.0	4.1	4.1	262.5	O K
600 min Winter	37.038	0.738	0.0	4.1	4.1	256.2	O K
720 min Winter	37.017	0.717	0.0	4.1	4.1	248.8	O K
960 min Winter	36.989	0.689	0.0	4.1	4.1	239.1	O K
1440 min Winter	36.924	0.624	0.0	4.1	4.1	216.4	O K
2160 min Winter	36.809	0.509	0.0	4.1	4.1	176.6	O K
2880 min Winter	36.693	0.393	0.0	4.1	4.1	136.4	O K
4320 min Winter	36.505	0.205	0.0	4.1	4.1	71.0	O K
5760 min Winter	36.421	0.121	0.0	3.8	3.8	42.0	O K
7200 min Winter	36.399	0.099	0.0	3.2	3.2	34.3	O K
8640 min Winter	36.386	0.086	0.0	2.8	2.8	29.8	O K
10080 min Winter	36.378	0.078	0.0	2.4	2.4	26.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
30 min Winter	129.467	0.0	206.9	40			
60 min Winter	73.356	0.0	238.5	68			
120 min Winter	41.563	0.0	270.4	126			
180 min Winter	29.811	0.0	291.0	182			
240 min Winter	23.550	0.0	306.5	240			
360 min Winter	16.891	0.0	329.7	354			
480 min Winter	13.343	0.0	347.2	464			
600 min Winter	11.113	0.0	361.4	566			
720 min Winter	9.570	0.0	373.5	608			
960 min Winter	7.628	0.0	396.6	746			
1440 min Winter	5.540	0.0	431.3	1058			
2160 min Winter	4.024	0.0	473.6	1504			
2880 min Winter	3.207	0.0	503.2	1876			
4320 min Winter	2.241	0.0	526.5	2516			
5760 min Winter	1.737	0.0	545.8	3064			
7200 min Winter	1.426	0.0	559.9	3752			
8640 min Winter	1.214	0.0	571.5	4416			
10080 min Winter	1.059	0.0	581.0	5144			
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
Site Location	GB 509900 186150 TQ 09900 86150
C (1km)	-0.026
D1 (1km)	0.300
D2 (1km)	0.331
D3 (1km)	0.235
E (1km)	0.308
F (1km)	2.542
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) 0.390

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To:	From:	To:	From:	To:
0	4	4	8	8	12
0.130	0.130	0.130	0.130	0.130	0.130

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Model Details

Storage is Online Cover Level (m) 37.700

Cellular Storage Structure

Invert Level (m) 36.300 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	365.2	0.0	0.801	0.0	0.0
0.800	365.2	0.0			

Hydro-Brake Optimum® Outflow Control

Unit Reference MD-SHE-0099-4100-0800-4100
Design Head (m) 0.800
Design Flow (l/s) 4.1
Flush-Flo™ Calculated
Objective Minimise upstream storage
Application Surface
Sump Available Yes
Diameter (mm) 99
Invert Level (m) 36.300
Minimum Outlet Pipe Diameter (mm) 150
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	4.1	Kick-Flo®	0.525	3.4
Flush-Flo™	0.238	4.1	Mean Flow over Head Range	-	3.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.2	1.200	4.9	3.000	7.6	7.000	11.4
0.200	4.1	1.400	5.3	3.500	8.2	7.500	11.7
0.300	4.0	1.600	5.7	4.000	8.7	8.000	12.1
0.400	3.9	1.800	6.0	4.500	9.2	8.500	12.4
0.500	3.6	2.000	6.3	5.000	9.7	9.000	12.8
0.600	3.6	2.200	6.6	5.500	10.1	9.500	13.2
0.800	4.1	2.400	6.8	6.000	10.5		
1.000	4.5	2.600	7.1	6.500	11.0		

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APPENDIX D
Correspondence

Thames Water, Clearwater Court, Vastern Rd, Reading RG1 8DB

Date: 27 July 2017

Dear Sir/Madam

Subject: Proposed Development Enquiry

ARCADIS (UK) LIMITED
Arcadis Cymru House
St Mellons Business Park
Fortran Road
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CF3 0EY
United Kingdom
Tel +44 (0)29 2092 6700
Fax +44 (0)29 2079 9275
arcadis.com

Arcadis have been commissioned by London Borough of Hillingdon to undertake the design of both the foul & surface water drainage for the proposed development. The proposed development will comprise of a new extension to the existing school to accommodate an additional 244 pupils, together with footpaths, grassed landscapes and hard surfaced courtyards.

By email

The site is located at OS Grid Ref: 510184,186097

From the existing site data and plans it can be seen that there are 150mm diameter foul and surface water drainage systems located along Sidmouth Drive to the north of the development. There is also a 1800mm surface water main that crosses the site along the western side of the existing school.

Foul Drainage

Preliminary foul calculations have indicated an additional peak flow of 1.5l/s will result from the additional 244 pupils. It is intended that this flow will enter the existing on-site foul water network which enters TW apparatus.

Surface Water

It is anticipated that the surface water connection, if required, will be subject to flow restrictions commensurate with the Greenfield runoff of the existing newly developed site area. As such appropriate attenuation of surface and roof water flows will be provided within a cellular underground storage as shown on the strategy plan. Surface runoff will be collected by means of gullies and or line drains for all hard standings and for rooftops via down pipes and discharge via gravity into existing adopted storm water culvert at a Greenfield rate of 5l/s

Please confirm that Thames Water agree to the proposed Drainage Strategy for the development in principal and would support a future Section 106 application

Yours faithfully

Sylvia Hicks
Assistant Engineer

Email: sylvia.hicks@arcadis.com

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From: DEVELOPER.SERVICES@THAMESWATER.CO.UK
To: [Sylvia Hicks](#)
Subject: IRef:1015250732 Ruislip High School
Date: 06 August 2017 14:56:16

Good Afternoon Sylvia,

Apologies for the delay I responding to your enquiry, after reviewing your plans they look fine in principle and therefore you can submit a S106 Application online [@thameswater.co.uk](#).

Regards,

Carol Barefoot

Technical Advisor – Sewer connections

0800 009 3921

developer.services@thameswater.co.uk

Clearwater Court, Vastern Road, Reading, RG1 8DB

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