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Proposed Artificial Grass Pitch Northfleet School for Girls Hall Road Northfleet Gravesend

Drainage Strategy

Revision 0: August 2024
R-DS-28616-01-0

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Proposed Artificial Grass Pitch
Northfleet School for Girls
Hall Road
Northfleet
Gravesend

Drainage Strategy

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Contents

1.0	Introduction.....	1
1.1	Background.....	1
1.2	Objectives.....	1
1.3	Reference documents	2
2.0	Description and history of the site and development proposals.....	3
2.1	Location and description of the site.....	3
2.2	History of the site	3
2.3	Proposed development.....	4
2.4	Site topography	4
2.5	Existing drainage infrastructure	4
2.6	Geology of the site and ground investigation data.....	5
3.0	Management of surface water.....	6
3.1	Current conditions.....	6
3.2	Surface water drainage outfalls	6
3.3	Surface water drainage strategy	7
3.4	SUDS assessment.....	7
3.5	Water quality.....	8
3.6	Surface water drainage design and management	8
3.7	Existing run-off rates	9
3.8	Attenuation requirements	9
3.9	Overland flows.....	11
4.0	Foul water drainage strategy	11
5.0	Maintenance.....	11
5.1	Surface water drainage maintenance	11
5.2	Foul water drainage maintenance	11
6.0	Summary and conclusions	12

Appendices

Appendix A	A
Topographical Survey	A
JPP Surveying drawing no. 27854Y-01	A
Appendix B	B
General Arrangement Plan.....	B
Labosport Ltd drawing no. 24-004(G-218481) 02	B
Appendix C.....	C
Southern Water Asset Plan	C



Appendix D D

 Extract of Ground InvestigationD

 JPP G&E report ref. R-SI-27677-01-00.....D

Appendix E..... E

 Proposed Drainage Strategy..... E

 JPP Consulting drawing no. 28616-FRA03..... E

Appendix F..... F

 Greenfield Calculations F

Appendix G G

 Proposed Drained Area G

 JPP Consulting drawing no. 28616-FRA02..... G

Appendix H H

 Attenuation Calculations: 1 in 30 year H

Appendix I..... I

 Attenuation Calculations: 1 in 100 year I

Appendix J J

 Attenuation Calculations: 1 in 100 year + 45% CC J

Appendix K..... K

 Overland Flows..... K

 JPP Consulting drawing no. 28616-FRA04..... K

Figures

Figure 1.1 Site Location Plan 1

Figure 2.1 Historic Aerial Imagery dated December 2003 3

Figure 2.2 Aerial Imagery dated March 2024..... 4

Tables

Table 2.1 Ground Investigation Information..... 5

Table 3.1 SUDS Assessment 7

Table 3.2 Pollution Hazard Indices for Different Land Use Classifications..... 8

Table 3.3 Indicative SuDS Mitigation Indices for Discharges to GroundwatersError! Bookmark not defined. 9

Table 3.4 Peak Rainfall Intensity Allowance..... 9

1.0 Introduction

1.1 Background

1.1.1 This report is a Drainage Strategy which has been prepared by JPP Consulting Ltd for the benefit of our Client, Labosport Ltd (to be utilised in conjunction with the Football Foundation AGP Framework), for a proposed Artificial Grass Pitch (AGP).

1.1.2 The proposed artificial grass pitch is located at Northfleet School for Girls, Hall Road, Northfleet, as shown in Figure 1.1 below. Northfleet is located to the south-east of London, east of Dartford, south of the River Thames and west of Gravesend. The National Grid Reference for the site is E562960 N172690. The proposed development has a total development area of 0.643ha (6,425m²).

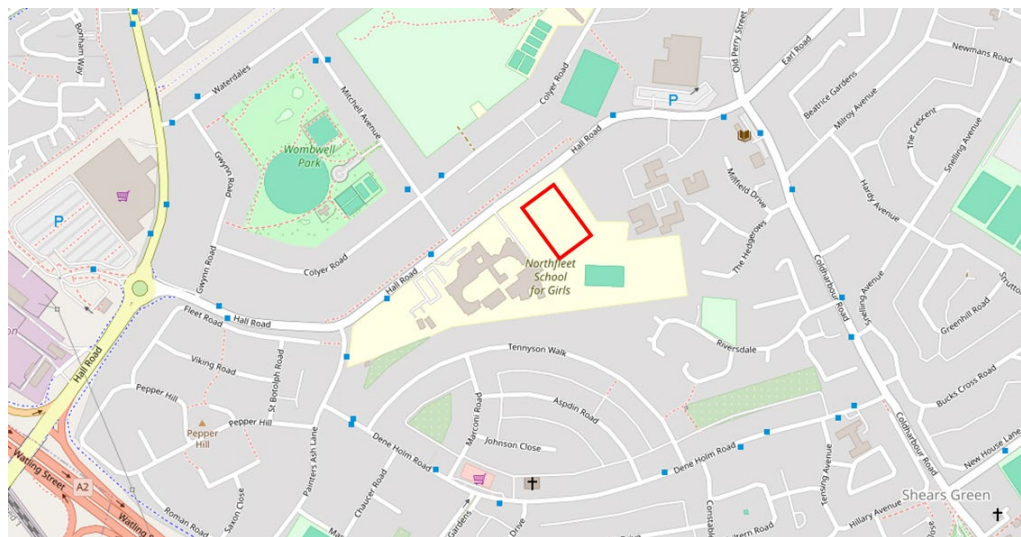


Figure 1.1 Site Location Plan

Source: OpenStreetMap

Obtained: 16/07/2024

1.2 Objectives

1.2.1 The objective of this report is to advise interested parties regarding the management of surface water run-off arising from the proposals.

1.2.2 This report has been prepared to support a detailed planning application.

1.3 Reference documents

1.3.1 This report has been prepared with reference to the following publications:-

- Ministry of Housing, Communities and Local Government (March 2012, updated December 2023), National Planning Policy Framework
- Ministry of Housing, Communities and Local Government (March 2014, updated August 2022), Planning Practice Guidance 'Flood Risk and Coastal Change'
- Department for Environment, Food and Rural Affairs (March 2015), Non-statutory technical standards for sustainable drainage systems
- Environment Agency (September 2013), Climate Change Allowances for Planners: Guidance to support the National Planning Policy Framework
- Environment Agency (October 2013), Delivering benefits through evidence: Rainfall runoff management for developments
- HM Government (2010), The Building Regulations (2010), Drainage and Waste Disposal, Approved Document H, The NBS, Newcastle Upon Tyne
- Wilson, Bray, Cooper (2004), Sustainable drainage systems: Hydraulic, structural and water quality advice, C609, CIRIA, London
- Woods-Ballard et al (2015), The SUDS Manual, C753, CIRIA, London
- CIRIA Report C624 Development and flood risk
- National SUDS Working Group (2004), Interim Code of Practice for Sustainable Drainage Systems,
- Institute of Hydrology (1999), Flood Estimation Handbook, Institute of Hydrology, Wallingford
- BS EN 752:2008 Drain and sewer systems outside buildings. Hydraulic design and environmental considerations
- BS 8533:2011 Assessing and managing flood risk in development – Code of Practice
- CIRIA Report C635 Designing for exceedance in urban drainage – good practice

2.0 Description and history of the site and development proposals

2.1 Location and description of the site

- 2.1.1 The proposed artificial grass pitch is located at Northfleet School for Girls, Hall Road, Northfleet, as shown in Figure 1.1 above. The site sits within the eastern part of the wider site for Northfleet School for Girls, with playing fields and courts to the south-east, and school buildings to the west. Hall Road is located to the north of the site, whilst trees are located to the east with Wombwell Hall Care Home beyond.

2.2 History of the site

- 2.2.1 The site is currently playing fields associated with the school, as shown on the topographical survey enclosed in **Appendix A**. We are not aware of any previous development on the site.
- 2.2.2 Aerial imagery dating back to December 2003 shows that the site was comparable at this time, see Figure 2.1 below.



Figure 2.1 Historic Aerial Imagery dated December 2003
Source: Google Earth Pro

- 2.2.3 The most recent aerial imagery of the site dated March 2024 is shown below in Figure 2.2.



Figure 2.2 Aerial Imagery dated March 2024
Source: Google Earth Pro

2.3 Proposed development

- 2.3.1 The proposed development will comprise an artificial grass pitch. The proposed development layout is shown on the plan enclosed in **Appendix B**.

2.4 Site topography

- 2.4.1 The topographical survey indicates that site levels within the footprint of the proposed AGP fall from the south corner (at approximately 33.0m) towards the north corner (lowest point of approximately 28.3m). The topographical survey is shown on the plan enclosed in **Appendix A**.

2.5 Existing drainage infrastructure

- 2.5.1 Southern Water's asset plan is enclosed in **Appendix C**. The asset plan identifies no adopted sewers within at the site location or across the wider school site. The nearest surface water is shown to the north-west at manhole reference MH9850 located in Hall Road. This is the head of the run and the sewer flows north away from the site.
- 2.5.2 The topographical survey, enclosed in **Appendix A**, identified no manholes within the footprint of the proposed pitch. A number manholes are shown along the western edge of the playing fields, understood to be existing drainage associated with the wider school site.

2.6 Geology of the site and ground investigation data

2.6.1 Inspection of the geological maps show that the upper-most bedrock geology which underlies the site is Thanet Formation – Sand. There are no superficial deposits recorded for the location of the site.

2.6.2 JPP Geotechnical & Environmental have completed a geotechnical investigation on the site with fieldwork carried out on the 9th February 2024, see report extract enclosed in **Appendix D**. This investigation found Topsoil overlying Made Ground which overlays Thanet Formation. Details of the encountered ground conditions are summarised in Table 2.1 below.

Summary of Ground Investigation Information							
Ground Conditions	Depth (m)						
	WS01	WS02	WS03	WS04	WS05	WS06	WS07
Topsoil	0.30	0.35	0.40	0.30	0.30	0.30	0.30
Made Ground	1.00	-	-	-	-	-	-
Thanet Formation	1.20	1.00	2.00	1.00	1.00	1.00	1.00
Source: JPP G&E ref. R-SI-27677-01-00							

Table 2.1 Ground Investigation Information

2.6.3 No groundwater was encountered during the investigation. The GI report notes:

‘...considered likely to be deep however there is always a potential for shallow perched groundwater to be present’.

2.6.4 The ground investigation highlights that there is a moderate risk of chalk dissolution within the pitch location. Design of the pitch, floodlight foundations and drainage should take into account the risk of chalk dissolution and encountering such features.

2.6.5 Infiltration testing was carried out in WS04. Based on the test results, the GI report states:

‘180mm fall in water levels over 143 minutes, remaining more than 50% full and therefore insufficient to derive an infiltration rate, however suggests that there could be some infiltration potential. It is thought that the fines (clay/silt) content may have limited the infiltration and the effect of smearing of these fines on the sides of the borehole may have also reduced the infiltration. The granular soils may therefore provide some infiltration potential however this would be subject to further testing in machine excavated trial pits to facilitate BRE 365 compliant soakaway testing.’

2.6.6 The GI concluded that:

‘Borehole soakaways could also be an option with borehole soakaway testing required at specific locations to assess this and derive rates for design.’

3.0 Management of surface water

3.1 Current conditions

- 3.1.1 The site is currently open with no existing development, and is therefore considered a greenfield site with no existing drainage. Therefore, greenfield run-off calculations shall be used to derive the allowable run off rate from the site.

3.2 Surface water drainage outfalls

- 3.2.1 It is a requirement of The Building Regulations (2010), Drainage and Waste Disposal, Approved Document H, to dispose of surface water collected by a development in accordance with the following, listed in order of priority:-

1. Infiltration systems where ground condition permit
2. To watercourses
3. To sewers

- 3.2.2 Each of these is considered separately below:

3.2.3 Infiltration systems

- 3.2.3.1 The geology of the site is described in 2.6 above. Based on the indicative infiltration testing undertaken to date and the risk of chalk dissolution, soakaways are not considered a viable method for managing surface water at the site.

3.2.4 Watercourses / Main River

- 3.2.4.1 There are no watercourses located within or adjacent to the boundary of the proposed development.

3.2.5 Sewers

- 3.2.5.1 Southern Water's asset plan is enclosed in **Appendix C**. The asset plan identifies no adopted sewers within the development area nor the wider school site.
- 3.2.5.2 It is anticipated that the established surface water drainage network associated with the wider school site outfalls to the Southern Water sewer network in Hall Road to the north.
- 3.2.5.3 Surface water from the proposed pitch will outfall to the existing surface water drainage network associated with the wider school site, subject to confirmation of the existing drainage arrangement and levels.
- 3.2.5.4 Any outfall to the adopted sewer network will be subject to consultation with Southern Water.

3.3 Surface water drainage strategy

- 3.3.1 Surface water discharge rates will be restricted to a minimum viable discharge rate of 2.5 l/s, utilising a vortex flow control device. Surface water will connect to the existing surface water drainage network associated with the wider site for Northfleet School for Girls. The permeable sub-base of the pitch will offer attenuation of surface water.
- 3.3.2 With reference to the risk chalk dissolution set out within the Ground Investigation report, the pitch will be appropriately sealed beneath the sub-base.
- 3.3.3 An indicative surface water layout plan is enclosed in **Appendix E**. The drawing shows that surface water attenuation can be accommodated on the site and the method of discharge on the basis that infiltration techniques are not viable. The detailed design parameters of the drainage are described below.

3.4 SUDS assessment

- 3.4.1 We have considered the suitability of SUDS for use on the development site. The review is set out in below Table 3.1.

SUDS Assessment		
SUDS Technique	Suitability	Justification
Rain Water Harvesting	No	Not applicable for the development type.
Green Roofs	No	Not applicable for the development type.
Infiltration	No	Underlying geology unviable.
Filter Strips / Filter Drains	No	Not suitable for the development type.
Swales	No	Not suitable for the development type.
Bioretention Systems	No	No open spaces
Trees	No	The development proposals simply comprise the proposed AGP – no new trees will be provided within the sub-base for the new pitch.
Pervious Pavements	Yes	Surface water attenuation will be provided within the sub-base of the AGP.
Attenuation Tanks	No	Surface water attenuation will be provided within the sub-base of the AGP.
Detention Basin	No	Surface water attenuation will be provided within the sub-base of the AGP.
Ponds and Wetlands	No	Surface water attenuation will be provided within the sub-base of the AGP.
Trapped Drainage	No	A sufficient level of water treatment will be provided through the permeable sub-base of the AGP.

Table 3.1 SUDS Assessment

3.5 Water quality

- 3.5.1 Chapter 26 of The SuDS Manual 2015 (CIRIA 753) provides guidance on the methods that should be used to design SuDS to meet the water quality design criteria and good practice design standards. Based on the simple index approach, the pollution hazard indices for different land use classifications are listed in Table 26.2, Chapter 26 of the SuDS Manual. Table 3.2 below summarises the pollution hazard indices that are applicable for residential land use development.

Pollution Hazard Indices for Different Land Use Classifications				
Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydro-carbons
Residential Roofs	Very low	0.2	0.2	0.05
Source: Table 26.2 of The SuDS Manual				

Table 3.2 Pollution Hazard Indices for Different Land Use Classifications

- 3.5.2 'Residential Roofs' is considered to be the most appropriate category for the proposed pitch, due to the minimal pollution hazard associated with the proposed 3G Artificial Turf Pitch, which will have no vehicle movements within its extent.
- 3.5.3 Surface water from the pitch will pass through the permeable sub-base of the proposed 3G AGP.
- 3.5.4 Table 26.3 of The SuDS Manual shows the mitigation indices for a range of SuDS components for discharges to surface waters. An extract of this is provided in Table 3.3 below for the components relevant to the proposed development.

Indicative SuDS Mitigation Indices for Discharges to Surface Waters			
Type of SuDS Component	Mitigation Indices		
	TSS	Metals	Hydro-carbons
Permeable pavement	0.7	0.6	0.7
Source: Table 26.3 of The SuDS Manual			

Table 3.3 Indicative SuDS Mitigation Indices for Discharges to Surface Waters

- 3.5.5 Based on the information and assessment set out above, the range of proposed SuDS features are considered to provide sufficient water treatment for the development proposals.

3.6 Surface water drainage design and management

- 3.6.1 Proposals are to design the surface water drainage system to accommodate storms up to the 1 in 100 year event plus an allowance of 45% for climate change. The Environment Agency's guidance 'Flood risk assessments: climate change allowances' to support the National Planning Policy Framework, which defines the climate change allowances. Table 3.4 below sets out the peak rainfall allowances for the Medway Management Catchment which the site is located within.

Peak Rainfall Intensity Allowance: Medway Management Catchment

Rainfall Event	Epoch	Central Allowance	Upper End Allowance
3.3%	2050s	+20%	+35%
	2070s	+20%	+35%
1%	2050s	+20%	+45%
	2070s	+20%	+40%

Source: Environment Agency - 2016

Table 3.4 Peak Rainfall Intensity Allowance

3.7 Existing run-off rates

3.7.1 To reflect the changes in the near surface geology across the site the greenfield run-off rates have been calculated. The method used to calculate the greenfield run off rates is the ICP SUDS and the calculations are presented in **Appendix F**.

3.7.2 The greenfield run off rate, for the application site, is:

Soil type	= 0.300 – obtained from the FEH parameters
SAAR	= 592mm – obtained from the FEH parameters
Urban	= 0.000
Region number	= 7
Proposed drained area	= 0.643ha
Q ₁	= 0.8 l/s
Q _{bar}	= 1.0 l/s
Q ₃₀	= 2.2 l/s
Q ₁₀₀	= 3.1 l/s

3.7.3 The Q_{bar} equivalent rate for the proposed development is 1.0 l/s. A restriction of 1.0 l/s could potentially result in a small aperture at the outfall which could increase the risk of blockage. To reduce the risk of blockage, surface water will be restricted to a run-off rate of 2.0 l/s.

3.8 Attenuation requirements

3.8.1 Surface water will discharge into the private drainage network associated with the wider site of Northfleet School for Girls and will be attenuated to a run-off rate of 2.0 l/s. To achieve this, surface water will be attenuated within the permeable sub-base of the pitch.

3.8.2 The proposed drained area of the development is 0.643 ha, as shown on the plan enclosed in **Appendix G**. Based on the proposed drained area and allowable discharge rate of 2.0 l/s, the storage requirement has been calculated utilising the following parameters.

Rainfall profile	= Flood Estimation Handbook
Drained area	= 6,425m ²
Pitch length	= 97m

Pitch width	= 61m
Fall across pitch (longitudinal)	= 1:300
Depth of permeable sub-base	= 300mm
Porosity of permeable sub-base	= 30 % voids
Control	= Hydrobrake

- 3.8.3 Storage calculations for the 1 in 30 year event have been undertaken based on the parameters set out above and below. Full calculations are enclosed in **Appendix H**. The results confirm that the permeable sub-base of the pitch is sufficient to accommodate all the storage required for the 1 in 30 year event.

Return period	= 1 in 30 year
Durations	= 60 to 10080 minutes
Climate change	= 0%
Max volume of flooding triggered	= 0m ³

- 3.8.4 Storage calculations for the 1 in 100 year event have been undertaken based on the parameters set out above and below. Full calculations are enclosed in **Appendix I**. The results confirm that the construction depth of the pitch is sufficient to accommodate all the storage required for the 1 in 100 year event.

Return period	= 1 in 100 year
Durations	= 60 to 10080 minutes
Climate change	= 0%
Max volume of flooding triggered	= 0m ³

- 3.8.5 Storage calculations for the 1 in 100 year plus 40% climate change event have been undertaken based on the parameters set out above and below. Full calculations are enclosed in **Appendix J**. The results confirm that the construction depth of the pitch is not sufficient to accommodate all the storage required for the 1 in 100 year plus 40% climate change event.

Return period	= 1 in 100 year plus 40%
Durations	= 60 to 10080 minutes
Climate change	= 45%
Max volume of flooding triggered	= 71.0m ³

- 3.8.6 The pitch will be surrounded by barriers that will offer containment of the above-ground flooding identified for the 1 in 100 year plus climate change event. This approach is considered acceptable based on the nature of the development.

- 3.8.7 A combination of methods for achieving the required attenuation can be considered at detailed design stage, such as geocellular storage, utilising the containment barriers to achieve above-ground storage, or including check dams within the sub-base. Sufficient attenuation will be provided on site for up to and including the 1 in 100 year plus 40% climate change event.

- 3.8.8 The indicative surface water drainage layout is shown on the plan enclosed in **Appendix E**.

3.9 Overland flows

- 3.9.1 Proposals are to design the surface water drainage to accommodate the 1 in 100 year storm event taking into account the predicted future effects of climate. Clearly there is a risk of this storm event being exceeded, albeit this risk is considered very low. In such an event the proposed drainage systems will become overwhelmed and overland flows could occur. Overland flows will be directed to follow the path that overland flows currently follow.
- 3.9.2 Predicted overland flow routes are shown on the plan enclosed in **Appendix K**.

4.0 Foul water drainage strategy

- 4.1 There will be no foul water drainage associated with the proposal.

5.0 Maintenance

5.1 Surface water drainage maintenance

- 5.1.1 The proposed surface water drainage will comprise a private network which will be maintained by Northfleet School for Girls.

5.2 Foul water drainage maintenance

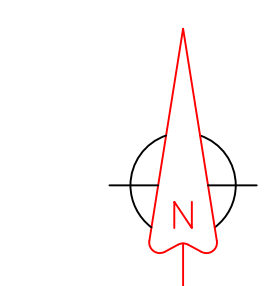
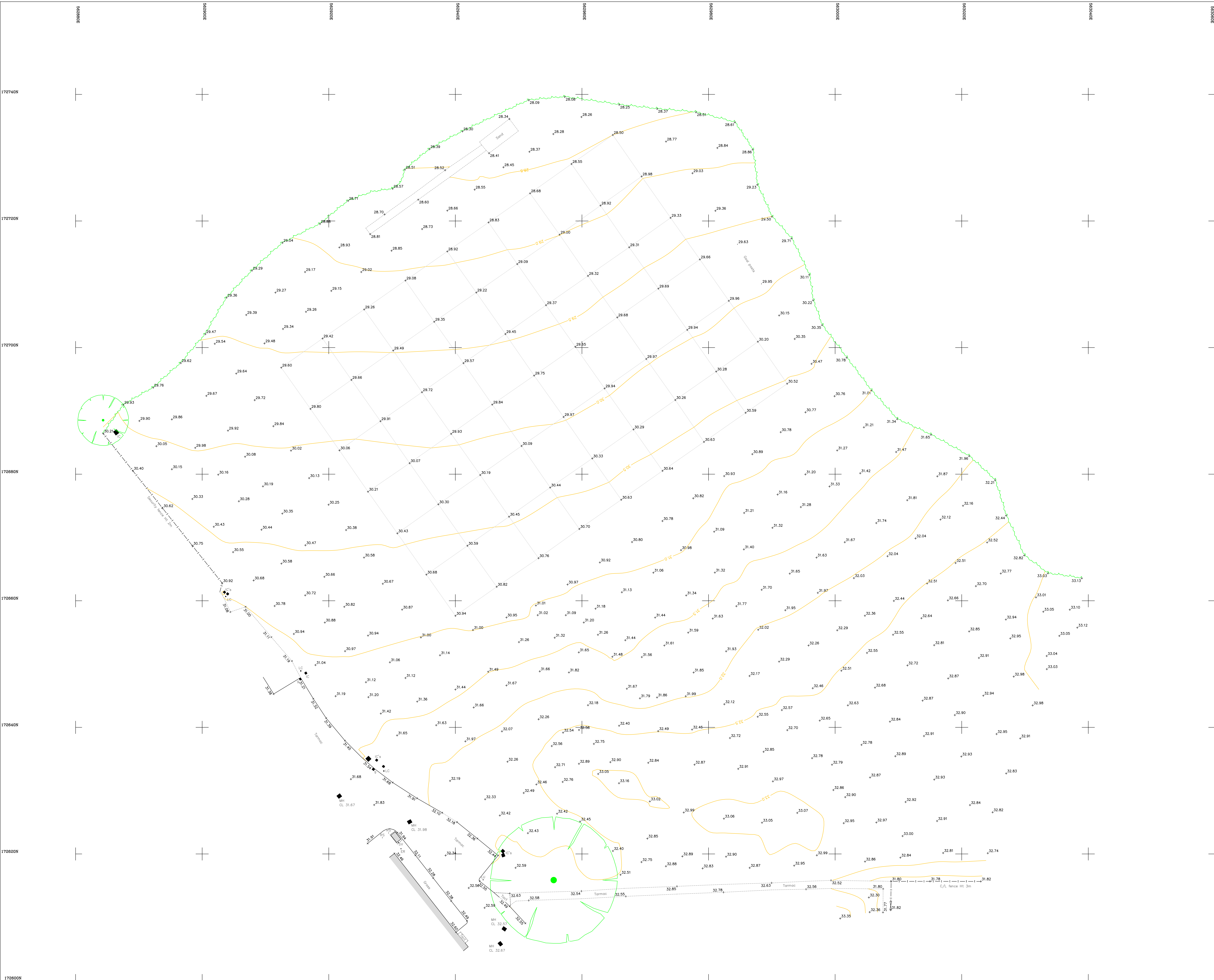
- 5.2.1 There is no foul drainage associated with the proposal.

6.0 Summary and conclusions

- 6.1 The proposed artificial grass pitch is located at Northfleet School for Girls, Hall Road, Northfleet. The site sits within the eastern part of the wider site for Northfleet School for Girls, with playing fields and courts to the south-east, and school buildings to the west. Hall Road is located to the north of the site, whilst trees are located to the east with Wombwell Hall Care Home beyond.
- 6.2 The proposed development will comprise of an artificial grass pitch.
- 6.3 The Ground Investigation conducted by JPP G&E identified that the site is underlain by Thanet Formation. Based on the indicative infiltration testing undertaken to date and the risk of chalk dissolution, soakaways are not considered a viable method for managing surface water at the site. With reference to the risk chalk dissolution set out within the Ground Investigation report, the pitch will be appropriately sealed beneath the sub-base.
- 6.4 The proposed surface water drainage strategy will centre around providing attenuation within the permeable sub-base of the pitch. An outfall will be provided to the existing private drainage network associated with the wider school site, located to the west of the pitch, restricted to 2.0 l/s.
- 6.5 The proposed AGP will include a 0.300m deep permeable sub-base, with a total construction depth of 0.405m. This is shown to be sufficient to accommodate all storms up to and including a 1 in 100 year event. For the 1 in 100 year plus 45% climate change event, 71m³ of above ground flooding is triggered. The pitch will be surrounded by barriers that will offer containment of the above-ground flooding identified for the 1 in 100 year plus climate change event. This approach is considered acceptable based on the nature of the development.
- 6.6 The proposals for a 3G Artificial Turf Pitch at Northfleet School for Girls, Hall Road, Northfleet are therefore fully compliant with policy in respect of development and flood risk, such that flood risk considerations do not constitute a barrier to the granting of planning consent.



Appendix A
Topographical Survey
JPP Surveying drawing no. 27854Y-01



General notes
Grid and levels have been aligned with OS National Grid (OSGB36) (15).
All dimensions and levels are in metres unless noted otherwise.
This plan should only be used for its original purpose. JPP accepts no responsibility if supplied to any other party than the original client.

AV	Air Valve	FL	Flood Light	P/R	Post & Rail Fence
Bal	Bollard	FW	Foul Water	P/W	Post & Wire Fence
BH	Borehole	G	Gully	RE	Rodding Eye
BL	Bed Level	GV	Gas Valve	RS	Road Sign
BT	BT Cover	H	Height	rw	Rainwater Pipe
CATV	Cable TV Cover	IC	Inspection Chamber	SV	Stop Valve
C/B	Close Boarded Fence	IL	Invert Level	swp	Soil & Vent Pipe
C/L	Chain Link Fence	IR	Iron Railing	SW	Surface Water
CL	Cover Level	ko	Kerb Outlet	TL	Traffic Light
COL	Column	LC	Lighting column	TP	Telegraph Pole
EI	Elsc	LU	Light unit	TW	Top of wall
ER	Earth Rod	MH	Manhole	ul	Unable To Lift
EP	Electricity Pole	Mkr	Marker Post	VP	Vent Pipe
FH	Fire Hydrant	O/H	Overhead	WL	Water Level
FL	Floor Level	PB	Post Box	WM	Water Meter
		Po	Post	wo	Wash Out

Building		Bottom of Bank	
Control Station		Top of Bank	
Tree		Vegetation	
Bore Hole		Change of surface	
Gate		Fence	
		Contours	
		OH Telecom	
		OH Electric	

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Client

Football Foundation

Project

Northfleet School for Girls

Title

Topographical Survey

Scale at A0

1:200

Drawn by

JJS

Checked by

TB

Date

8/2/24

Status

Project ref

27854Y

Drawing no.

01

Revision



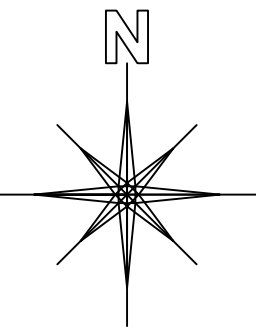
Appendix B
General Arrangement Plan
Labosport Ltd drawing no. 24-004(G-218481) 02

ARTIFICIAL GRASS PITCH (AGP) PROPOSAL



CHECK ALL DIMENSIONS PRIOR TO COMMENCEMENT OF WORK
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- SYNTHETIC TURF SURFACE
- 1.2M HIGH SPECTATOR FENCING
- 4.5M HIGH PERIMETER FENCING
- DOUBLE GATE
- SINGLE GATE
- STORAGE CONTAINER AREA
- 300MM MOWING STRIP
- 6NO.FLOODLIGHTING COLUMNS TO AGP
- 8NO.FLOODLIGHTING COLUMNS TO EXISTING TENNIS COURTS
- INDICATIVE LANDSCAPING BUND



LEGEND / KEY



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NORTHFLEET SCHOOL

CLIENT

ARTIFICIAL GRASS PITCH (AGP)
DEVELOPMENT

PROJECT

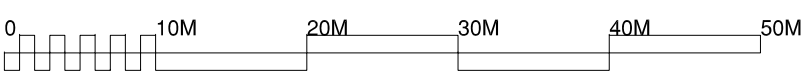
GENERAL ARRANGEMENT

DRAWING

STAGE LK 01

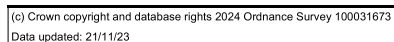
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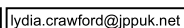


Appendix C
Southern Water Asset Plan

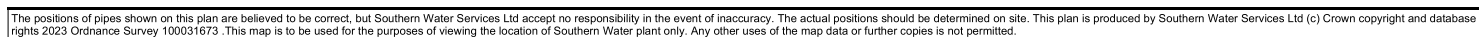


Wastewater Plan A3

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27677



WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.



Appendix D
Extract of Ground Investigation
JPP G&E report ref. R-SI-27677-01-00

- Structural Engineering
- Professional Advice
- Geotechnical & Environmental
- Infrastructure Design
- Development Planning
- Surveying



Proposed Artificial Grass Pitch Northfleet School for Girls Hall Road Northfleet DA11 8AQ



Site Investigation Report

Revision 00: March 2024
R-SI-27677-01-00

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1.0 Executive Summary

1.1.1 The following is provided as an overview and should not be relied upon in isolation to the main report.

Summary overview

Existing site	The proposed pitch is located within grassed playing fields located to the east of Northfleet School for Girls school buildings. There is a mature tree adjacent to the south west corner of the proposed pitch and the Root Protection Zone (RPZ) could dictate the positioning of the proposed pitch. There are also trees along the north and east boundaries of the playing fields close to the proposed pitch.
Proposals	Construction of a 3G Artificial Grass Pitch (AGP) with associated fencing, floodlights and drainage infrastructure. There is a significant fall across the proposed pitch footprint from south to north, of between around 3.5 to 4.9m and therefore some levelling earthworks (cut and fill) are anticipated to reduce the fall across the pitch. This includes some presumed artificial raising in the south west corner of the proposed pitch.
History	The location of proposed pitch appears to have remained undeveloped open space associated with Wombwell Hall prior to the playing fields with two circular features with deciduous trees recorded in the south. The school was constructed around 1950 and there appears to be a terraced/lower area in the north of the pitch as possible tennis courts and therefore potential for this to have been filled/relevelled. During the school construction works in 2011, the south west of the pitch appears to have been utilised as a car park and contractors' compound with soils mounded which were subsequently landscaped and now forms a slightly raised area.
UXO	A medium risk was determined by a site-specific risk review, and therefore support by a specialist EOD engineer was required for our intrusive investigations and will be necessary for the construction phase. A detailed UXO desk study report could be undertaken to refine the preliminary risk assessment, which may determine that supervision may not be necessary.
Geology	There are no superficial deposits recorded within or close to the site, with bedrock geology from the surface mapped as Thanet Formation (sand) over Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation.
Fieldwork	7 windowless sample boreholes to a maximum depth of 2.0m, 6 dynamic probes to a maximum depth of 3.8m and 5 TRL Dynamic cone penetration tests to measure insitu CBR values.
Ground conditions	In general, ground conditions comprised a covering of 0.3 to 0.4m of Topsoil. In WS01, located in the south west corner of the pitch, Made Ground was encountered to 1.0m depth bgl considered to have been artificially raised at the time of the school redevelopment. Beneath the Topsoil, deposits comprised very soft to firm clays in each of the boreholes apart from the south west and south east positions, to depths of between 0.85 to 1.45m bgl which could represent Head deposit or weathered Thanet Formation. Such clay deposits, and beneath the Made Ground in WS01 in the south west and beneath the topsoil in WS02 in the south east, were underlain by a sand or gravel deposit of Thanet Formation, within which each of the boreholes were terminated at 1.0 or 2.0m depth bgl due to the density and SPT refusal (N value of 50).
Groundwater	No groundwater was encountered during the investigation and groundwater is considered likely to be deep, however there is always a potential for shallow perched water to be present.
Chalk Dissolution Hazard and Deneholes	There is considered to be a moderate risk of chalk dissolution and of encountering unrecorded deneholes within the pitch location. Design of the pitch, floodlight foundations and drainage should take into account the risk of chalk dissolution and encountering such features. Should any unusual features such as voiding or particular loose soils be encountered during construction, that could be suggestive of a natural dissolution or manmade denehole feature, then further specialist advice should be sought before proceeding and to determine an appropriate course of action.

Summary overview

Floodlight foundations

Pad foundations are considered suitable with a minimum founding depth of 0.75m (beneath existing or proposed levels, where the deepest should apply following any levelling earthworks) into medium dense sands or gravels of Thanet Formation deposits, through the overlying clay deposits encountered in most positions, and deepening for trees and vegetation based on low volume change potential. Foundations should also be deepened to locate consistent soils at formation level and through any potentially loose deposits.

Larger size pads are recommended to be cautious with respect to the risk of chalk dissolution. Increased levels as part of the levelling earthworks are likely to result in significantly deepened foundations in the north of the pitch which could prove difficult to then excavate to form foundations following the earthworks. Therefore, it is recommended that any impacted floodlight foundations are constructed prior to the earthworks and built up to above the post level earthworks.

Should any unusual features such as voiding or particular loose soils be encountered during construction, that could be suggestive of a natural dissolution or manmade denehole feature, then further specialist advice should be sought before proceeding and to determine an appropriate course of action.

Earthworks

Based on the fall across the pitch of around 3.5 to 4.9m from south to north, some levelling earthworks (cut and fill) are anticipated to reduce the fall. This is also likely to require some sloped banks and retaining features. Retaining features and the levels and gradients of any sloped banks will need to be appropriately designed and considering the risk of slope instability of both the existing and new slope. Floodlighting foundation design and depths should also take into account the position in relation to any formed sloped or retaining features.

Concrete classification

A classification of DS-1 ACEC AC-1 is applicable for the Thanet Formation and Made Ground.

Pitch construction

A CBR value of 2.5% is recommended for the near surface natural soils, based on the clay soils and worst case insitu measurements, for design and to be reassessed during construction and <2% for any Made Ground. However, as the pitch footprint is likely to require some cut and fill earthworks, the CBR will be subject to the compaction earthworks and there is potential for adverse settlement where the pitch may span across variable competency natural deposits which could be more pronounced, and for spanning between natural formation soils and soils placed and compacted, following levelling earthworks. Ground improvement such as lime/cement stabilisation and/or use of geogrid reinforcement may be appropriate to improve the CBR and reduce the potential for adverse settlement to occur where the pitch spans across variable ground conditions both in composition and competency and following levelling earthworks.

Any loose or soft spots identified during the preparation of the formation level should be excavated and replaced with a suitably compacted fill. Any near surface clay soils within the influence of existing trees, containing roots or potentially desiccated should be removed and not reused within the pitch extent to reduce the potential for seasonal shrinkage and swelling.

A root barrier may be appropriate to reduce the potential for root ingress beneath the pitch footprint. The position of the pitch is likely to be dictated by the Root Protection Zones of nearby trees, in particular the tree located close to the south west corner. Specialist advice should be sought in regard to protecting nearby trees from the pitch construction and earthworks.

Infiltration potential/ Surface Water Drainage

Indicative infiltration testing within the granular Thanet Formation did not provide sufficient infiltration to derive a rate. It is possible that the fines (clay/silt) content limited the permeability or smearing of the borehole surface and that deeper deposits or testing in machine pits could show improved infiltration potential and determine the soils to be suitable for soakaways. This would require testing in machine pits to further assess. If soakaways are determined to be a suitable drainage solution, due to the potential risk of chalk dissolution, soakaways should be located sufficient distance (>10m) from any proposed or existing structures (including floodlights), site boundaries, and ideally the pitch footprint, and designed to minimise the risk from chalk dissolution.



Summary overview	
	There are no obvious drainage ditches within and around the site. A surface water sewer is located within Hall Road to the north of the school buildings and the school drainage may outfall into this sewer network. Further enquiries are recommended to establish the existing school drainage and ultimate outfall, whether this be to existing soakaways or to a positive outfall, with a view to connecting into for the proposed pitch or to guide the drainage strategy for the proposed pitch. Any outfall will be subject to seeking necessary approvals and a detailed drainage strategy.

Table 1.1

3.9.2 As such all-site personnel should be provided with a UXO Safety Awareness Talk before intrusive works commence, and any intrusive work (both site investigation and future construction) should be supported by specialist EOD services to clear working areas as the site is developed.

3.9.3 A detailed UXO risk assessment could be carried out to refine the risk which may reduce the risk and thus requirements for the construction phase.

3.10 Coal mining risk

3.10.1 The site is not located within an area at risk from Coal Mining.

3.11 Chalk dissolution risk, mining cavities and mineral sites

3.11.1 A Mining and Ground Stability report (presented in Appendix D) has been obtained for the site to assess the potential chalk dissolution risk at the site and quarrying/mineral pits on or near to the site.

3.11.2 The report indicates that there is one BGS Recorded Mineral Site within 250m of the site, one within 500m and eleven within 1km. The closest of these is Aspdin Road Denehole, approximately 205m to the south, a now ceased underground operation extracting chalk from the White Chalk Subgroup. The next closest is approximately 270m to the north west, and is at Wombell Road Denehole, also a ceased underground operation extracting chalk from the White Chalk Subgroup.

3.11.3 There is one man made mining cavity within 250m of the site, one within 500m and four within 1km. The commodities extracted were chalk in all of the cavities, either within the Thanet Formation of Chalk Group, with the closest being a chalkwell/Denehole approximately 180m to the south east of the site.

3.11.4 There is one recorded natural cavity located within 1km of the site. It is recorded to be approximately 755m to the south east and relates to six solution pipes.

3.11.5 With reference to the report and associated map defining the ground dissolution hazard (presented in Appendix D), the subject site area is indicated to have no hazard to low risk, along the south west, of chalk dissolution and a moderate risk 175m to the south, becoming high further south. This is likely as a result of the site being mapped as having no superficial deposits with Thanet Formation over the Chalk Formations, whilst from 175m to the south, the Thanet Formation is not mapped over the chalk. This would allow a direct pathway for water to percolate vertically to the chalk and potentially cause dissolution features to occur. However, as the Thanet Formation can be predominantly granular, this could allow a pathway for water to percolate vertically into the chalk and potentially cause dissolution features to occur and along with the potential for unrecorded manmade Denehole features, which are recorded where Thanet Formation is mapped above the chalk, we suggest there to be a **Moderate Risk** of chalk dissolution and manmade Denehole features.

4.0 Fieldwork

- 4.1.1 Fieldwork was carried out on the 9th February 2024 and comprised the following:
- 7 Windowless sample boreholes to 1.00 and 2.00m depth bgl due to the density of the ground conditions
 - 6 Dynamic probes to a maximum of 3.80m bgl, limited by the UXO clearance
 - 5 TRL Dynamic Cone Penetration tests to measure insitu CBR values.
- 4.1.2 Due to the medium risk of encountering buried UXO within the site, an EOD specialist engineer was present during our works, clearing each position prior and during the drilling process. The final drilled depth of the dynamic probes was limited by the clearance depth of the magnetometer, which could safely clear in a maximum of 2.0m increments. Where the magnetometer gives a slightly unclear reading, clearance can only be given in 1.0m increments. The dynamic probes were therefore only cleared up to 2.0m below the final depth of the adjacent boreholes, limiting the final depth of the probes to between 2.0m and 3.8m bgl.
- 4.1.3 Each position was scanned using a cable avoidance tool and signal generator prior to positioning and proceeding. Utilities searches were also obtained prior to the fieldwork to confirm the position of potential underground services (excluding private services). These are presented in Appendix F.
- 4.1.4 The approximate location of each exploratory hole position is shown on the plan (Drawing 01) and included within Appendix A.
- 4.1.5 The borehole positions were targeted outside of existing marked pitches.

5.0 Ground Conditions

5.1 Soils

Topsoil

- 5.1.1 Each of the exploratory boreholes encountered a brown slightly gravelly, slightly silty, sandy topsoil to between 0.30m and 0.40m bgl. Gravel generally comprised of sandstone, with brick encountered in WS04 and wood encountered in WS01.

Made Ground

- 5.1.2 Underlying the topsoil within WS01 (south west corner where the ground appears to have been raised at the time of the school construction works in 2011), Made Ground was encountered to 1.00m bgl. These soils initially comprised of a light greyish brown, sandy sandstone gravel to 0.40m bgl, over a brown, slightly gravelly, slightly sandy, silty clay with some roots and rootlets. The gravels within the clay comprised of sandstone, concrete and brick.

Possible Head Deposits/ Weathered Thanet Formation

- 5.1.3 Underlying the topsoil, in each of the positions apart from WS01 in the south west corner and WS02 in the south east corner, encountered presumed natural deposits comprising a very soft to firm slightly gravelly, sandy to very sandy, silty CLAY to depths of between 0.85m to 1.45m bgl. Gravels consisted of sandstone and flint, although the gravel content decreased towards the north of the proposed pitch. Such deposits have been considered to potentially be weathered Thanet Formation however these could represent a Head or other superficial deposit based on the low strength and flint gravels.

Thanet Formation

- 5.1.4 In the south of the proposed pitch, within WS01 and WS02, no clay was encountered underlying the topsoil or Made Ground in WS01. Underlying the topsoil within WS02 was a light yellowish brown, silty, sandy, sandstone and flint GRAVEL to 0.95m bgl, becoming clayey to the base of the borehole at 1.00m bgl where the borehole was terminated due to the density. The silty gravel was also encountered underlying the Made Ground in WS01 and beneath the clay from 0.85m depth within WS04 (located in the north east corner) to the base of the exploratory boreholes.
- 5.1.5 Underlying the clay within WS03 and WS05-07 to the base of the exploratory boreholes, an orangish brown and occasionally grey clayey, fine to medium SAND was encountered, with occasional clay lenses noted within the sand in WS03.
- 5.1.6 Hand pocket penetrometer tests converted to kPa recorded strength values of between 10 and 70kPa within the cohesive soils, indicating very low to medium strength deposits.

- 5.1.7 Standard Penetration Test (SPT) 'N' values undertaken recorded lowest values of 5 and 8 at 0.50m depth within the clay soils in WS06 and WS07. At 1.0m depth in WS03, located centrally along the east side of the proposed pitch, an SPT N value was measured as 26 with the clay deposits, which was the deepest borehole achieved. All other positions refused with SPT N values of 50 for 300mm penetration or 50 for less than the full test penetration of 300mm at 1.0m depth and in WS03 at 2.0m depth.

Dynamic probes

- 5.1.8 Dynamic Probe DP1, undertaken adjacent to WS01 showed relatively consistent blow counts of 3 blows per 100mm to 1.20m, with exceptions at 0.60m, 1.00m and 1.10m depth where 11, 32 and 2 blows per 100mm respectively were recorded. The low blow counts with localised increases are consistent with the encountered Made Ground with gravels, with the blow counts then increasing to 25 blows per 100mm at 1.60m bgl, where the probe rods kicked off from centre, resulting in an early termination of the test. The increase in blow counts correlates with the very dense gravels of the Thanet Formation.
- 5.1.9 Dynamic Probe DP2, undertaken adjacent to WS02 was completed to 2.00m bgl due to the EOD engineer being unable to clear to any greater depths. This probe showed low blow counts of 2 blows per 100mm to 0.40m bgl, the approximate base of the topsoil, increasing to generally between 5 and 12 blows per 100mm, with a peak of 15 at 1.10m bgl.
- 5.1.10 Dynamic Probe DP3 was undertaken adjacent to WS03 in the east of the proposed pitch, and was completed to 3.80m bgl before kicking off on a presumed cobble, although the EOD engineer could only clear to a maximum of 4.00m bgl. Once again, initial very low blow counts of between 0 and 1 blows per 100mm were recorded through the topsoil and into the initially soft underlying clays, increasing to between 2 and 3 blows per 100mm to 1.50m bgl, where the sands of the Thanet Formation were encountered. Blow counts then consistently increased to 18 blows per 100mm at 3.80m bgl, with a separate peak at 2.00m bgl of 14 blows per 100mm.
- 5.1.11 Dynamic Probe DP4, adjacent to WS04 recorded blow counts of 0 and 1 blows per 100mm to 0.90m bgl through the encountered soft clays, increasing to between 7 and 10 blows per 100mm by 2.00m bgl, where the test was terminated due to lack of UXO clearance.
- 5.1.12 Dynamic Probes DP5 and DP6, adjacent to WS05 and WS07 respectively were broadly similar, showing blow counts of between 0 and 2 blows per 100mm to 1.10m and 1.30m bgl respectively, increasing to 15 and 13 blows per 100mm by 1.40m and 2.00m bgl. Blow counts then decreased to as low as 3 blows per 100mm in DP05 and 4 blows per 100mm in DP6 by 2.40m and 2.60m bgl, increasing to 8 blows per 100mm by 3.00m bgl, the deepest the EOD engineer could clear the probes to.

5.2 Groundwater

- 5.2.1 No groundwater was encountered during the investigation and is considered likely to be deep however there is always a potential for shallow perched groundwater to be present.

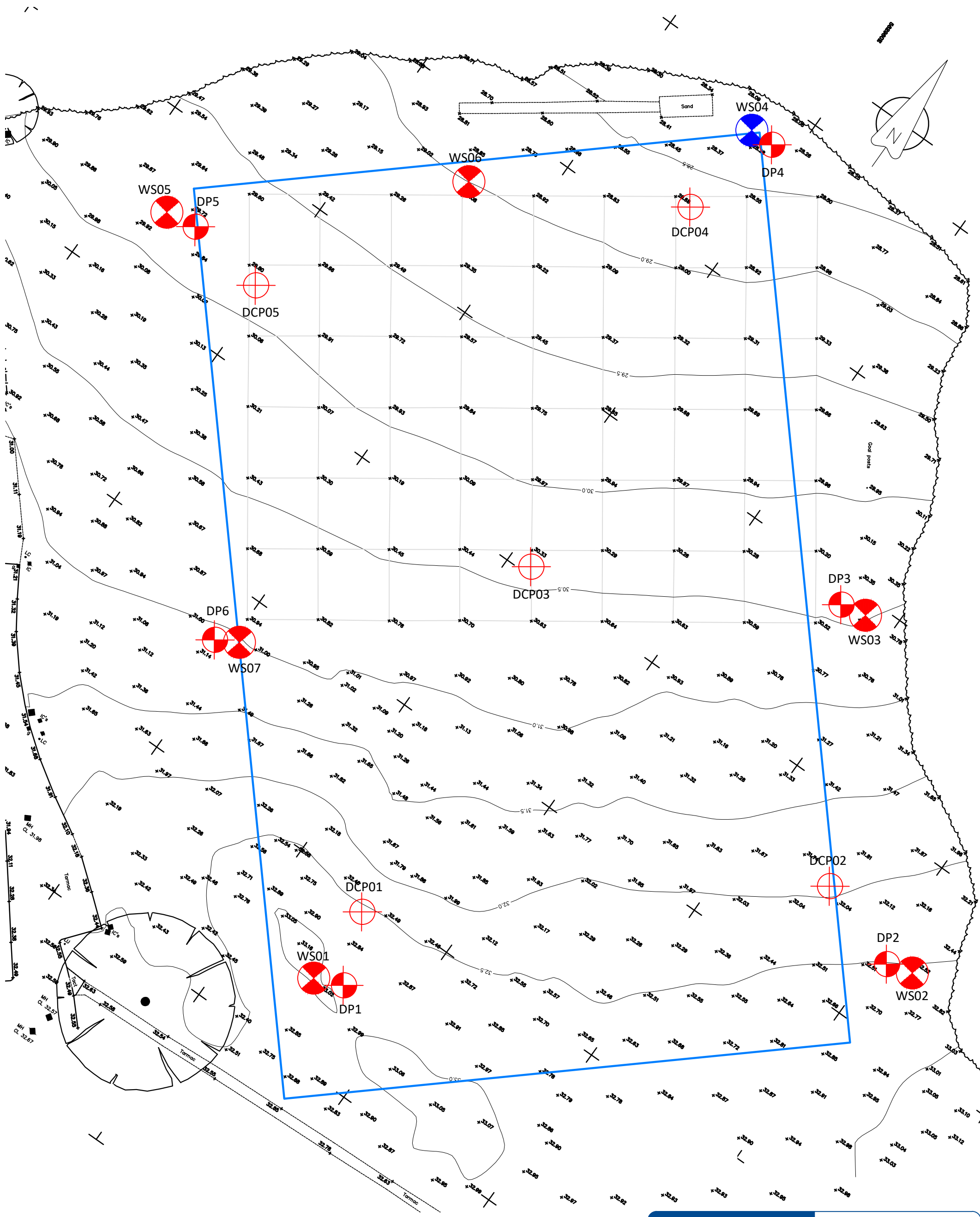
7.7 Earthworks

- 7.7.1 The topographical survey shows there to be a fairly significant fall across the proposed pitch footprint to the north, from a high of approximately 33.16m AOD in the south west corner (within the presumed artificially raised area) and approximately 32.85m in the south east corner to approximately 28.25m AOD in the north east corner. Suggesting a fall of approximately 4.9m from south east to north east (diagonally across the proposed pitch footprint) and 4.6m from the south east to the north east along the eastern side of the proposed pitch. The south west corner of the pitch appears to have been artificially raised by around 1.0m height which is considered likely to be formed from arisings during the school redevelopment in 2011.
- 7.7.2 Based on the fall across the pitch of around 3.5 to 4.9m from south to north, some levelling earthworks (cut and fill) are anticipated to reduce the fall. This is also likely to require some sloped banks and retaining features. Retaining features and the levels and gradients of any sloped banks will need to be appropriately designed and considering the risk of slope instability of both the existing and new slope. Floodlighting foundation design and depths should also take into account the position in relation to any formed sloped or retaining features. The slopes created will also need to consider the presence of trees and associated Root Protection Zones. Specialist advice should be sought in regard to protecting nearby trees from the pitch construction and earthworks.
- 7.7.3 The upper clay soils encountered on site are likely to soften extremely quickly when exposed to periods of sustained wet weather and where over trafficked. Care should be taken to work on the exposed soils in periods of dry weather and to not excessively track over the exposed subsoil/formation layer prior to laying the subbase, otherwise softening/dilation could occur which would lower the CBR values of the underlying soils. This should also be accounted for during the proposed earthworks and any excavated and exposed soils will need to be sufficiently protected.
- 7.7.4 Use of any excavated material as fill material will be subject to classification, grading and appropriate compaction following Series 600: Earthworks. Any topsoil/organic soil is not suitable for reuse as fill.

7.8 Infiltration potential and surface water drainage

- 7.8.1 Infiltration testing was carried out in WS04, the lowest point of the grassed playing fields in the north east corner, with an 180mm fall in water levels over 143 minutes, remaining more than 50% full and therefore insufficient to derive an infiltration rate however suggests that there could be some infiltration potential. It is thought that the fines (clay/silt) content may have limited the infiltration and the effect of smearing of these fines on the sides of the borehole may have also reduced the infiltration. The granular soils encountered may therefore provide some infiltration potential however this would be subject to further testing in machine excavated trial pits to facilitate BRE 365 compliant soakaway testing.

- 7.8.2 Borehole soakaways could also be an option with borehole soakaway testing required at specific locations to assess this and derive rates for design. However, these produce concentrated ingress which therefore produce a risk of forming dissolution features. Discharge into chalk, which is a principal aquifer and also a Source Protection Zone 2, is likely to be subject to approval of any design and pollution prevention controls by the Environment Agency. Chalk was not encountered during our investigations and is considered likely to be at significant depth.
- 7.8.3 Due to the risk of chalk dissolution, particularly where granular deposits overlie chalk and therefore a potential pathway for water to enter the chalk, it is recommended that any soakaway drainage is located remote from floodlight foundations and any other structures. Due to the variation in fines and granular content of deposits encountered by our investigations, soakaways as trenches beneath the pitch could result in localised/concentrated infiltration and therefore it is recommended that any such drainage is also located remote from the pitch or constructed with a geogrid reinforcement or crate system to reduce the potential for loss of support should any such features form or be present.
- 7.8.4 Concentrated ingress of water into chalk can create new dissolution features so it is important that drainage is sufficiently designed for this not to occur. It is suggested that drains should be sealed flexible joints or with concrete bedding and haunching to minimise the risk of future damage. Following CIRIA C574, the guidance suggests that where chalk is of low density (assumed to be the case for the site in the absence of testing to confirm otherwise) any soakaways/infiltration system into the ground should be sited at least 10m from foundations, structures and boundaries.
- 7.8.5 With reference to Southern Water records (included within Appendix F), a surface water drain is located off Hall Road to the north of the site, travelling along the eastern side of residential properties which could provide a potential outfall for surface water drainage subject to seeking approval of any drainage strategy.
- 7.8.6 No obvious drainage ditches were observed on or adjacent to site. Southern Water records show a surface water gravity sewer within Hall Road to the north east of the proposed pitch, north of the school buildings and a surface water gravity sewer also within Hall Road to the north east of the pitch. The school drainage may outfall into this sewer network. Further enquiries are recommended to establish the existing school drainage and ultimate outfall, whether this be to existing soakaways or to a positive outfall, with a view to connecting into for the proposed pitch or to guide the drainage strategy for the proposed pitch. Any outfall will be subject to seeking necessary approvals and a detailed drainage strategy.



- KEY
- WS Windowless sample borehole
 - WS Windowless sample borehole with infiltration test
 - DCP TRL - Dynamic cone penetration test
 - DP Dynamic probe

Approximate position of proposed 3G AGP pitch full extent 103 x 64m

Base Drawing:
Topographical survey by JPP Surveying.
dated: 09/02/2024, drawing number: 27854Y.

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Client The Football Foundation

Project Northfleet School for Girls, Northfleet

Title Investigation Positions over Topographical Survey

Scale at A3 NTS	Drawn by LB	Checked by AP	Date March 2024
Status	Project ref 27677	Drawing no. 01	Revision

JPP QA Document T07 R1

Key to Exploratory Hole Logs

General

Descriptions for soils and rocks generally following:

BS 5930:2015+A1:2020

BS EN ISO 14688-2:2004

BS EN ISO 14689-1:2003

Sampling

ES	Environmental Sample (taken in appropriate sampling container)
D	Disturbed Sample
B	Bulk Sample
C	Core Sample
U	Undisturbed Sample (number of blows indicated in results column)
UT	Thinwalled Undisturbed (number of blows indicated in results column)
W	Water Sample

Insitu Tests

SPT	Standard Penetration Test
SPT (C)	Cone Penetration Test
PID	Photo Ionisation Detector Results (ppm)
PP	Pocket Penetrometer reading converted to shear strength kPa
HV	Converted Shear Vane measurement kPa

Drilling Records

▼	Depth to standing water level
▽	Depth to water strike
TCR	Total Core Recovery (%)
SCR	Solid Core Recovery (%)
RQD	Rock Quality Designation (%)

Backfill Symbols

Arisings	
Concrete	
Blacktop	
Bentonite Seal	
Gravel Filter	
Sand Filter	

Pipe Symbols

Plain Pipe	
Slotted Pipe	
Filter Tip	

Principal Soil Types

Topsoil	
Made Ground	
Clay	
Silt	
Sand	
Gravel	
Peat	

Principal Rock Types

Mudstone	
Siltstone	
Sandstone	
Limestone	
Chalk	

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- Infrastructure Design
- Structural Engineering
- Planning Services
- Geotechnical & Environmental
- Surveying
- Professional Advice

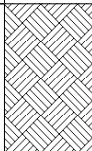
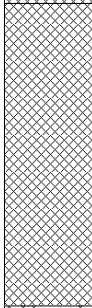
Key to Exploratory Hole Logs





Window Sample Log

Project Name: Northfleet School for Girls		Client: Football Foundation		Date: 09/02/2024	
Location: Northfleet		Contractor: Keystone Site Solutions Ltd			
Project No. : 27677		Crew Name:		Drilling Equipment: Premier 110	
Borehole Number WS01	Hole Type WLS	Level	Logged By TM	Scale 1:15	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.60	ES	N=50 (8,8/10,12,14,14)	0.30			Brown slightly gravelly slightly silty sandy TOPSOIL with some roots and rootlets. Gravel consists of subangular to angular fine sandstone and wood.	1
							0.40		
		1.00						Brown slightly gravelly slightly sandy silty CLAY with some roots and rootlets. Gravel consists of subangular to angular fine to medium sandstone, concrete and brick. (MADE GROUND)	
							1.20		
		End of Borehole at 1.200m							

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks	
No groundwater encountered.	



Remarks	
No groundwater encountered.	

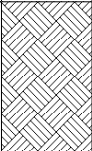
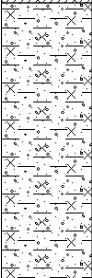


Remarks
No groundwater encountered.



Window Sample Log

Project Name: Northfleet School for Girls		Client: Football Foundation		Date: 09/02/2024	
Location: Northfleet		Contractor: Keystone Site Solutions Ltd			
Project No. : 27677		Crew Name:		Drilling Equipment: Premier 110	
Borehole Number WS04	Hole Type WLS	Level	Logged By TM	Scale 1:15	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30			Brown slightly gravelly slightly silty sandy TOPSOIL with some roots and rootlets. Gravel consists of subangular to angular fine sandstone and brick.	1
								Soft orangish brown slightly gravelly sandy silty CLAY with roots and rootlets. Gravel consists of subrounded to angular fine to medium sandstone and flint. (THANET FORMATION)	
		0.70 0.70	D PP	10.00				Very dense light yellowish brown silty sandy subangular to angular fine to coarse sandstone and flint GRAVEL. (THANET FORMATION)	
		0.90 1.00	D	N=50 (8,8/11,12,13,14)	0.85 1.00			End of Borehole at 1.000m	
									2
									3

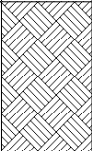
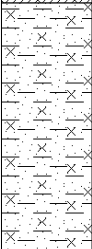
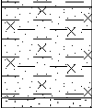
Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks	
No groundwater encountered.	



Window Sample Log

Project Name: Northfleet School for Girls		Client: Football Foundation		Date: 09/02/2024	
Location: Northfleet		Contractor: Keystone Site Solutions Ltd			
Project No. : 27677		Crew Name:		Drilling Equipment: Premier 110	
Borehole Number WS05	Hole Type WLS	Level	Logged By TM	Scale 1:15	Page Number Sheet 1 of 1

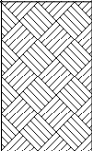
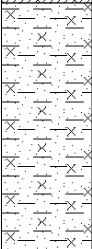
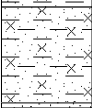
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								Brown slightly gravelly slightly silty sandy TOPSOIL with some roots and rootlets. Gravel consists of subangular to angular fine sandstone.	1
					0.30				
		0.50	D					Very soft orangish brown very sandy silty CLAY. (THANET FORMATION)	
		0.70	PP	15.00		0.80		Firm orangish brown sandy silty CLAY. (THANET FORMATION)	
		0.90	PP	55.00					
		1.00		N=50 (12,13/50 for 270mm)	0.98 1.00			Very dense orangish brown slightly clayey fine to medium SAND. (THANET FORMATION) End of Borehole at 1.000m	2
									3

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation
Remarks No groundwater encountered.											



Window Sample Log

Project Name: Northfleet School for Girls		Client: Football Foundation		Date: 09/02/2024	
Location: Northfleet		Contractor: Keystone Site Solutions Ltd			
Project No. : 27677		Crew Name:		Drilling Equipment: Premier 110	
Borehole Number WS06	Hole Type WLS	Level	Logged By TM	Scale 1:15	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								Brown slightly gravelly slightly silty sandy TOPSOIL with some roots and rootlets. Gravel consists of subangular to angular fine sandstone.	1
					0.30				
		0.50		N=8 (0,0/2,2,2,2)				Very soft orangish brown very sandy silty CLAY. (THANET FORMATION)	
		0.70	PP	20.00		0.80		Firm orangish brown sandy silty CLAY. (THANET FORMATION)	
		0.90 0.90 1.00	D PP	50.00 N=50 (9,9/50 for 265mm)	0.99 1.00			Very dense orangish brown slightly clayey fine to medium SAND. (THANET FORMATION) End of Borehole at 1.000m	
									2
									3

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation
Remarks No groundwater encountered.											



Window Sample Log

Project Name: Northfleet School for Girls		Client: Football Foundation		Date: 09/02/2024	
Location: Northfleet		Contractor: Keystone Site Solutions Ltd			
Project No. : 27677		Crew Name:		Drilling Equipment: Premier 110	
Borehole Number WS07	Hole Type WLS	Level	Logged By TM	Scale 1:15	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES		0.30			Brown slightly gravelly slightly silty sandy TOPSOIL with some roots and rootlets. Gravel consists of subangular to angular fine sandstone.	1
		0.50		N=5 (0,0/1,1,1,2)	0.95			Firm orangish brown sandy silty CLAY. (THANET FORMATION)	
		0.70	PP	30.00					
		0.90 0.90 1.00	D PP	50.00 N=50 (7,8/12,12,13,13)				Very dense orangish brown slightly clayey fine to medium SAND. (THANET FORMATION) End of Borehole at 1.000m	
					1.00				2
									3

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation
Remarks											
No groundwater encountered.											

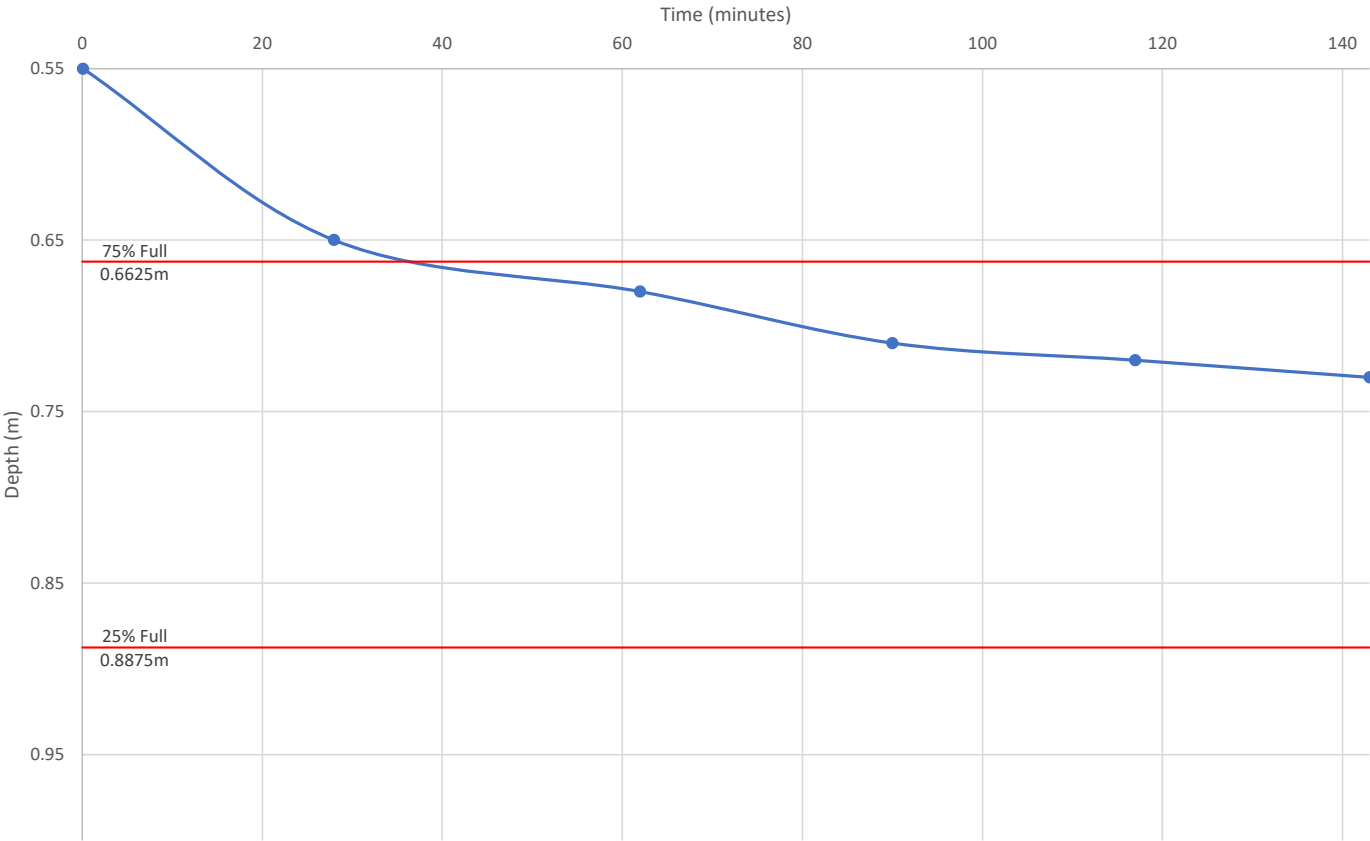
Indicative Soakage Test Results

Project Name:	Northfleet School for Girls
Project No:	27677
Client:	Football Foundation
Date:	09 February 2024
Revision:	0

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WS04 - Cycle 1



Borehole radius 0.05m
Borehole diameter 0.1m
Borehole depth 1m

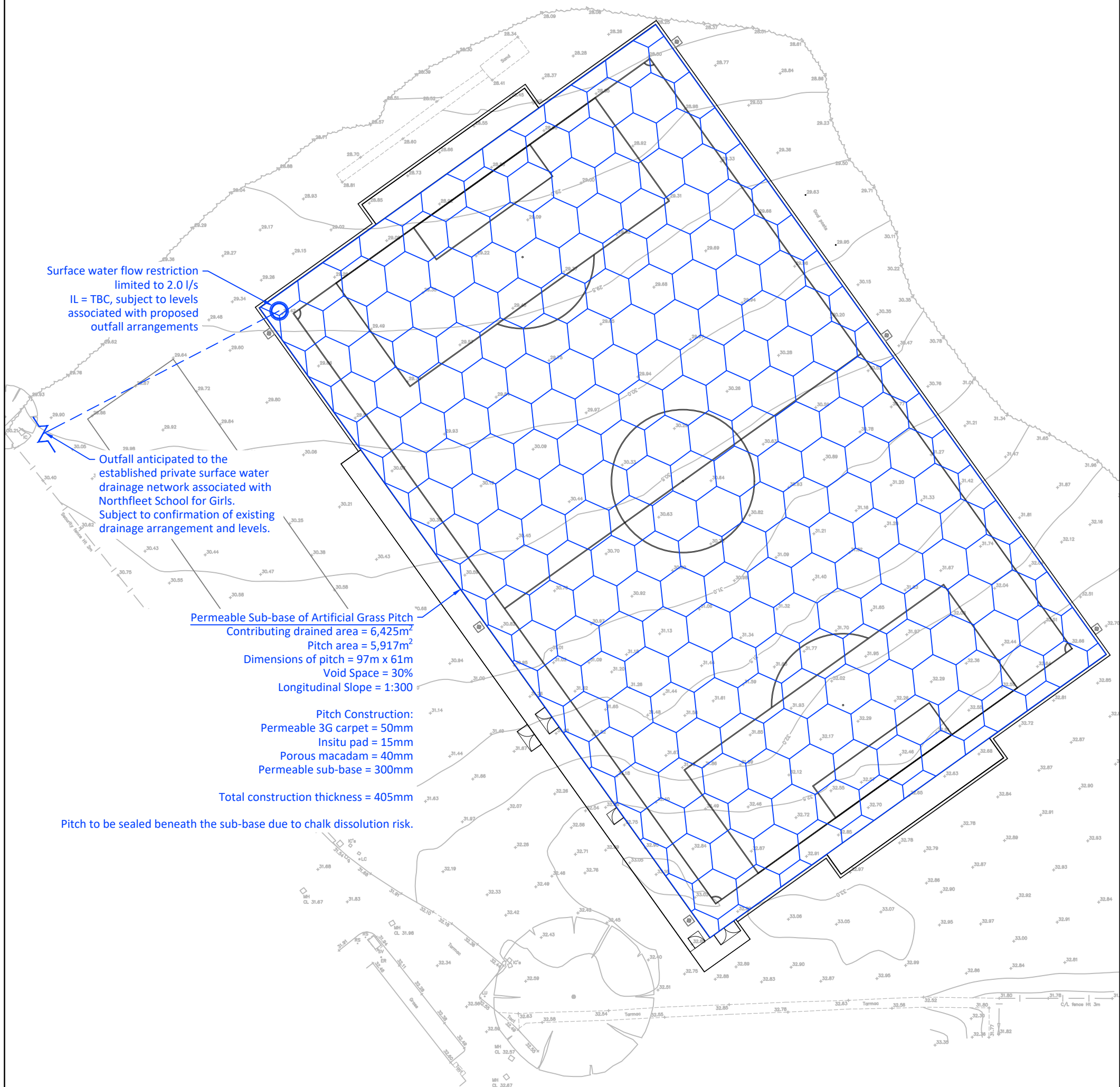
Soil infiltration rate $f = \frac{V_{p75-25}}{a_{s50} \times t_{p75-25}}$

Insufficient soakage achieved to derive rate

V_{p75-25} : the effective storage volume of water in the soakage borehole between 75% and 25% effective storage depth
 a_{s50} : the internal surface area of the soakage borehole up to 50% effective storage depth and including base area
 t_{p75-25} : the time for the water level to fall from 75% to 25% effective storage depth



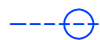
Appendix E
Proposed Drainage Strategy
JPP Consulting drawing no. 28616-FRA03

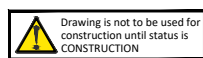


General Notes

- All dimensions are in metres unless otherwise stated.
- All levels are in metres.
- This drawing is to be read in conjunction with all relevant Engineers and Architect's drawings, Specifications, Reports and Engineering Details.
- Do not scale from this drawing.

Drawing Key

-  Extent of permeable sub-base = 5,917m²
-  Proposed Surface Water Drainage



This drawing has been based/developed using the following external drawings					
Type	Company	Drawing date	Drawing title	Date received	Rev
Site Layout	Labosport Ltd	17.05.2024	Proposed Plan	11.07.2024	-
Topographical Survey	JPP Surveying	09.02.2024	Topographical Survey	11.07.2024	-



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Client Labosport Ltd

Project Proposed AGP
Northfleet School for Girls
Hall Road, Northfleet, Gravesend

Title Proposed Drained Area

Scale at A3 1:500 Drawn by JPB Checked by KER Date 29.08.2024

Status **FOR PLANNING** Project ref 28616 Drawing no. FRA03 Revision -

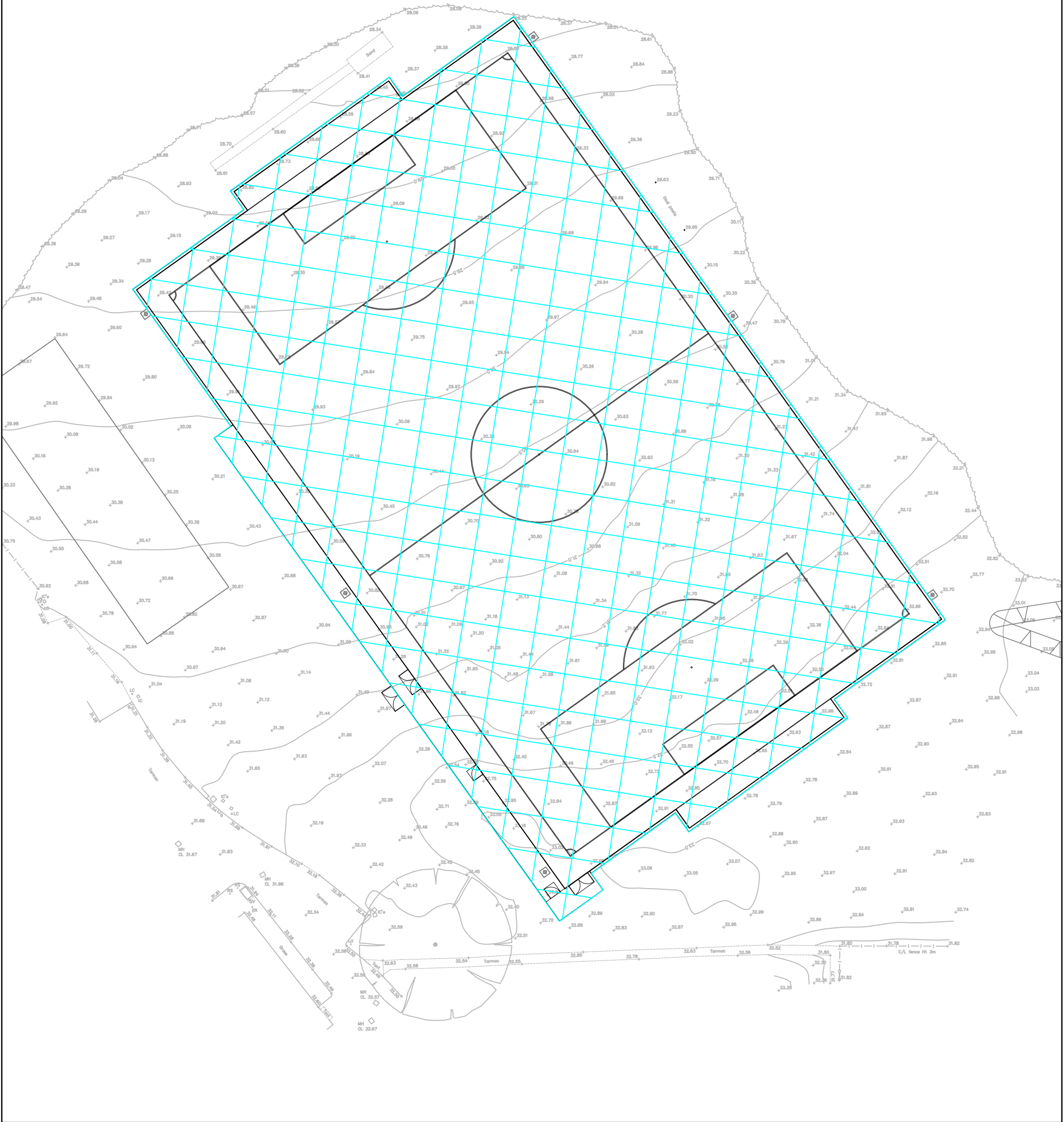
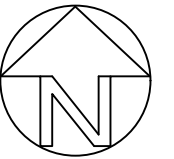


**Appendix F
Greenfield Calculations**

JPP Consulting Ltd		Page 1																								
4, Ironstone Way Brixworth Northampton, NN3 9UD																										
Date 17/07/2024 09:19 File	Designed by josh.beverly Checked by																									
Innovyze																										
Source Control 2018.1.1																										
<u>ICP SUDS Mean Annual Flood</u> Input <table><tr><td>Return Period (years)</td><td>1</td><td>Soil</td><td>0.300</td></tr><tr><td>Area (ha)</td><td>0.643</td><td>Urban</td><td>0.000</td></tr><tr><td>SAAR (mm)</td><td>592</td><td>Region Number</td><td>Region 7</td></tr></table> Results 1/s <table><tr><td>QBAR Rural</td><td>1.0</td></tr><tr><td>QBAR Urban</td><td>1.0</td></tr><tr><td>Q1 year</td><td>0.8</td></tr><tr><td>Q1 year</td><td>0.8</td></tr><tr><td>Q30 years</td><td>2.2</td></tr><tr><td>Q100 years</td><td>3.1</td></tr></table>			Return Period (years)	1	Soil	0.300	Area (ha)	0.643	Urban	0.000	SAAR (mm)	592	Region Number	Region 7	QBAR Rural	1.0	QBAR Urban	1.0	Q1 year	0.8	Q1 year	0.8	Q30 years	2.2	Q100 years	3.1
Return Period (years)	1	Soil	0.300																							
Area (ha)	0.643	Urban	0.000																							
SAAR (mm)	592	Region Number	Region 7																							
QBAR Rural	1.0																									
QBAR Urban	1.0																									
Q1 year	0.8																									
Q1 year	0.8																									
Q30 years	2.2																									
Q100 years	3.1																									
©1982-2018 Innovyze																										



Appendix G
Proposed Drained Area
JPP Consulting drawing no. 28616-FRA02



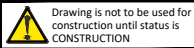
General Notes

- 1. All dimensions are in metres unless otherwise stated.
- 2. All levels are in metres.
- 3. This drawing is to be read in conjunction with all relevant Engineers and Architect's drawings, Specifications, Reports and Engineering Details.
- 4. Do not scale from this drawing.

Drawing Key

 Proposed Drained Area = 6,425m²

This drawing has been based/developed using the following external drawings					
Type	Company	Drawing date	Drawing title	Date received	Rev
Site Layout	Labosport Ltd	17.05.2024	Proposed Plan	11.07.2024	-
Topographical Survey	JPP Surveying	09.02.2024	Topographical Survey	11.07.2024	-





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- Infrastructure Design
- Structural Engineering
- Development Planning
- Professional Advice
- Geotechnical & Environmental
- Surveying

Client Labosport Ltd

Project Proposed AGP
Northfleet School for Girls
Hall Road, Northfleet, Gravesend

Title Proposed Drained Area

Scale at A3 1:500	Drawn by JPB	Checked by KER	Date 21.08.2024
Status FOR PLANNING	Project ref 28616	Drawing no. FRA02	Revision -



Appendix H
Attenuation Calculations: 1 in 30 year

JPP Consulting Ltd				Page 1																																																																																																																																																																																																																																																																																				
4, Ironstone Way Brixworth Northampton, NN3 9UD			Proposed AGP Northfleet School for Girls 1 in 30 yr, 2.0 l/s																																																																																																																																																																																																																																																																																					
Date 29/08/2024 14:31 File			Designed by JPB Checked by KER																																																																																																																																																																																																																																																																																					
Innovyze			Source Control 2018.1.1																																																																																																																																																																																																																																																																																					
<u>Summary of Results for 30 year Return Period</u> Half Drain Time : 1069 minutes. <table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Control (l/s)</th><th>Max Σ Outflow (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>15 min Summer</td><td>29.853</td><td>0.200</td><td>0.0</td><td>1.8</td><td>1.8</td><td>109.9</td><td>Flood Risk</td></tr><tr><td>30 min Summer</td><td>29.869</td><td>0.216</td><td>0.0</td><td>1.8</td><td>1.8</td><td>127.9</td><td>Flood Risk</td></tr><tr><td>60 min Summer</td><td>29.885</td><td>0.232</td><td>0.0</td><td>1.9</td><td>1.9</td><td>147.1</td><td>Flood Risk</td></tr><tr><td>120 min Summer</td><td>29.899</td><td>0.246</td><td>0.0</td><td>1.9</td><td>1.9</td><td>166.6</td><td>Flood Risk</td></tr><tr><td>180 min Summer</td><td>29.907</td><td>0.254</td><td>0.0</td><td>1.9</td><td>1.9</td><td>177.4</td><td>Flood Risk</td></tr><tr><td>240 min Summer</td><td>29.912</td><td>0.259</td><td>0.0</td><td>1.9</td><td>1.9</td><td>184.0</td><td>Flood Risk</td></tr><tr><td>360 min Summer</td><td>29.917</td><td>0.264</td><td>0.0</td><td>1.9</td><td>1.9</td><td>191.2</td><td>Flood Risk</td></tr><tr><td>480 min Summer</td><td>29.919</td><td>0.266</td><td>0.0</td><td>1.9</td><td>1.9</td><td>193.7</td><td>Flood Risk</td></tr><tr><td>600 min Summer</td><td>29.919</td><td>0.266</td><td>0.0</td><td>1.9</td><td>1.9</td><td>193.7</td><td>Flood Risk</td></tr><tr><td>720 min Summer</td><td>29.917</td><td>0.264</td><td>0.0</td><td>1.9</td><td>1.9</td><td>191.9</td><td>Flood Risk</td></tr><tr><td>960 min Summer</td><td>29.921</td><td>0.268</td><td>0.0</td><td>1.9</td><td>1.9</td><td>197.9</td><td>Flood Risk</td></tr><tr><td>1440 min Summer</td><td>29.925</td><td>0.272</td><td>0.0</td><td>1.9</td><td>1.9</td><td>203.3</td><td>Flood Risk</td></tr><tr><td>2160 min Summer</td><td>29.925</td><td>0.272</td><td>0.0</td><td>1.9</td><td>1.9</td><td>203.0</td><td>Flood Risk</td></tr><tr><td>2880 min Summer</td><td>29.923</td><td>0.270</td><td>0.0</td><td>1.9</td><td>1.9</td><td>199.8</td><td>Flood Risk</td></tr><tr><td>4320 min Summer</td><td>29.899</td><td>0.246</td><td>0.0</td><td>1.9</td><td>1.9</td><td>166.7</td><td>Flood Risk</td></tr><tr><td>5760 min Summer</td><td>29.877</td><td>0.224</td><td>0.0</td><td>1.9</td><td>1.9</td><td>137.7</td><td>Flood Risk</td></tr><tr><td>7200 min Summer</td><td>29.855</td><td>0.202</td><td>0.0</td><td>1.8</td><td>1.8</td><td>112.0</td><td>Flood Risk</td></tr><tr><td>8640 min Summer</td><td>29.834</td><td>0.181</td><td>0.0</td><td>1.8</td><td>1.8</td><td>89.5</td><td>Flood Risk</td></tr><tr><td>10080 min Summer</td><td>29.813</td><td>0.160</td><td>0.0</td><td>1.8</td><td>1.8</td><td>70.0</td><td>Flood Risk</td></tr><tr><td>15 min Winter</td><td>29.868</td><td>0.215</td><td>0.0</td><td>1.8</td><td>1.8</td><td>126.8</td><td>Flood Risk</td></tr></table> <table><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Discharge Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>15 min Summer</td><td>116.964</td><td>0.0</td><td>111.2</td><td>19</td></tr><tr><td>30 min Summer</td><td>66.466</td><td>0.0</td><td>130.3</td><td>34</td></tr><tr><td>60 min Summer</td><td>37.770</td><td>0.0</td><td>151.9</td><td>64</td></tr><tr><td>120 min Summer</td><td>21.463</td><td>0.0</td><td>176.0</td><td>124</td></tr><tr><td>180 min Summer</td><td>15.421</td><td>0.0</td><td>191.2</td><td>182</td></tr><tr><td>240 min Summer</td><td>12.197</td><td>0.0</td><td>202.6</td><td>242</td></tr><tr><td>360 min Summer</td><td>8.763</td><td>0.0</td><td>219.6</td><td>362</td></tr><tr><td>480 min Summer</td><td>6.931</td><td>0.0</td><td>231.9</td><td>482</td></tr><tr><td>600 min Summer</td><td>5.778</td><td>0.0</td><td>241.7</td><td>600</td></tr><tr><td>720 min Summer</td><td>4.980</td><td>0.0</td><td>249.6</td><td>720</td></tr><tr><td>960 min Summer</td><td>4.106</td><td>0.0</td><td>275.4</td><td>840</td></tr><tr><td>1440 min Summer</td><td>3.129</td><td>0.0</td><td>279.1</td><td>1110</td></tr><tr><td>2160 min Summer</td><td>2.384</td><td>0.0</td><td>357.9</td><td>1516</td></tr><tr><td>2880 min Summer</td><td>1.966</td><td>0.0</td><td>390.1</td><td>1932</td></tr><tr><td>4320 min Summer</td><td>1.396</td><td>0.0</td><td>402.1</td><td>2728</td></tr><tr><td>5760 min Summer</td><td>1.095</td><td>0.0</td><td>406.8</td><td>3520</td></tr><tr><td>7200 min Summer</td><td>0.907</td><td>0.0</td><td>406.5</td><td>4320</td></tr><tr><td>8640 min Summer</td><td>0.778</td><td>0.0</td><td>404.3</td><td>5016</td></tr><tr><td>10080 min Summer</td><td>0.683</td><td>0.0</td><td>399.0</td><td>5752</td></tr><tr><td>15 min Winter</td><td>116.964</td><td>0.0</td><td>128.1</td><td>19</td></tr></table>								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	15 min Summer	29.853	0.200	0.0	1.8	1.8	109.9	Flood Risk	30 min Summer	29.869	0.216	0.0	1.8	1.8	127.9	Flood Risk	60 min Summer	29.885	0.232	0.0	1.9	1.9	147.1	Flood Risk	120 min Summer	29.899	0.246	0.0	1.9	1.9	166.6	Flood Risk	180 min Summer	29.907	0.254	0.0	1.9	1.9	177.4	Flood Risk	240 min Summer	29.912	0.259	0.0	1.9	1.9	184.0	Flood Risk	360 min Summer	29.917	0.264	0.0	1.9	1.9	191.2	Flood Risk	480 min Summer	29.919	0.266	0.0	1.9	1.9	193.7	Flood Risk	600 min Summer	29.919	0.266	0.0	1.9	1.9	193.7	Flood Risk	720 min Summer	29.917	0.264	0.0	1.9	1.9	191.9	Flood Risk	960 min Summer	29.921	0.268	0.0	1.9	1.9	197.9	Flood Risk	1440 min Summer	29.925	0.272	0.0	1.9	1.9	203.3	Flood Risk	2160 min Summer	29.925	0.272	0.0	1.9	1.9	203.0	Flood Risk	2880 min Summer	29.923	0.270	0.0	1.9	1.9	199.8	Flood Risk	4320 min Summer	29.899	0.246	0.0	1.9	1.9	166.7	Flood Risk	5760 min Summer	29.877	0.224	0.0	1.9	1.9	137.7	Flood Risk	7200 min Summer	29.855	0.202	0.0	1.8	1.8	112.0	Flood Risk	8640 min Summer	29.834	0.181	0.0	1.8	1.8	89.5	Flood Risk	10080 min Summer	29.813	0.160	0.0	1.8	1.8	70.0	Flood Risk	15 min Winter	29.868	0.215	0.0	1.8	1.8	126.8	Flood Risk	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	15 min Summer	116.964	0.0	111.2	19	30 min Summer	66.466	0.0	130.3	34	60 min Summer	37.770	0.0	151.9	64	120 min Summer	21.463	0.0	176.0	124	180 min Summer	15.421	0.0	191.2	182	240 min Summer	12.197	0.0	202.6	242	360 min Summer	8.763	0.0	219.6	362	480 min Summer	6.931	0.0	231.9	482	600 min Summer	5.778	0.0	241.7	600	720 min Summer	4.980	0.0	249.6	720	960 min Summer	4.106	0.0	275.4	840	1440 min Summer	3.129	0.0	279.1	1110	2160 min Summer	2.384	0.0	357.9	1516	2880 min Summer	1.966	0.0	390.1	1932	4320 min Summer	1.396	0.0	402.1	2728	5760 min Summer	1.095	0.0	406.8	3520	7200 min Summer	0.907	0.0	406.5	4320	8640 min Summer	0.778	0.0	404.3	5016	10080 min Summer	0.683	0.0	399.0	5752	15 min Winter	116.964	0.0	128.1	19
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																																																																																																																																																																																																																																																																																	
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480 min Summer	29.919	0.266	0.0	1.9	1.9	193.7	Flood Risk																																																																																																																																																																																																																																																																																	
600 min Summer	29.919	0.266	0.0	1.9	1.9	193.7	Flood Risk																																																																																																																																																																																																																																																																																	
720 min Summer	29.917	0.264	0.0	1.9	1.9	191.9	Flood Risk																																																																																																																																																																																																																																																																																	
960 min Summer	29.921	0.268	0.0	1.9	1.9	197.9	Flood Risk																																																																																																																																																																																																																																																																																	
1440 min Summer	29.925	0.272	0.0	1.9	1.9	203.3	Flood Risk																																																																																																																																																																																																																																																																																	
2160 min Summer	29.925	0.272	0.0	1.9	1.9	203.0	Flood Risk																																																																																																																																																																																																																																																																																	
2880 min Summer	29.923	0.270	0.0	1.9	1.9	199.8	Flood Risk																																																																																																																																																																																																																																																																																	
4320 min Summer	29.899	0.246	0.0	1.9	1.9	166.7	Flood Risk																																																																																																																																																																																																																																																																																	
5760 min Summer	29.877	0.224	0.0	1.9	1.9	137.7	Flood Risk																																																																																																																																																																																																																																																																																	
7200 min Summer	29.855	0.202	0.0	1.8	1.8	112.0	Flood Risk																																																																																																																																																																																																																																																																																	
8640 min Summer	29.834	0.181	0.0	1.8	1.8	89.5	Flood Risk																																																																																																																																																																																																																																																																																	
10080 min Summer	29.813	0.160	0.0	1.8	1.8	70.0	Flood Risk																																																																																																																																																																																																																																																																																	
15 min Winter	29.868	0.215	0.0	1.8	1.8	126.8	Flood Risk																																																																																																																																																																																																																																																																																	
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)																																																																																																																																																																																																																																																																																				
15 min Summer	116.964	0.0	111.2	19																																																																																																																																																																																																																																																																																				
30 min Summer	66.466	0.0	130.3	34																																																																																																																																																																																																																																																																																				
60 min Summer	37.770	0.0	151.9	64																																																																																																																																																																																																																																																																																				
120 min Summer	21.463	0.0	176.0	124																																																																																																																																																																																																																																																																																				
180 min Summer	15.421	0.0	191.2	182																																																																																																																																																																																																																																																																																				
240 min Summer	12.197	0.0	202.6	242																																																																																																																																																																																																																																																																																				
360 min Summer	8.763	0.0	219.6	362																																																																																																																																																																																																																																																																																				
480 min Summer	6.931	0.0	231.9	482																																																																																																																																																																																																																																																																																				
600 min Summer	5.778	0.0	241.7	600																																																																																																																																																																																																																																																																																				
720 min Summer	4.980	0.0	249.6	720																																																																																																																																																																																																																																																																																				
960 min Summer	4.106	0.0	275.4	840																																																																																																																																																																																																																																																																																				
1440 min Summer	3.129	0.0	279.1	1110																																																																																																																																																																																																																																																																																				
2160 min Summer	2.384	0.0	357.9	1516																																																																																																																																																																																																																																																																																				
2880 min Summer	1.966	0.0	390.1	1932																																																																																																																																																																																																																																																																																				
4320 min Summer	1.396	0.0	402.1	2728																																																																																																																																																																																																																																																																																				
5760 min Summer	1.095	0.0	406.8	3520																																																																																																																																																																																																																																																																																				
7200 min Summer	0.907	0.0	406.5	4320																																																																																																																																																																																																																																																																																				
8640 min Summer	0.778	0.0	404.3	5016																																																																																																																																																																																																																																																																																				
10080 min Summer	0.683	0.0	399.0	5752																																																																																																																																																																																																																																																																																				
15 min Winter	116.964	0.0	128.1	19																																																																																																																																																																																																																																																																																				
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Page 2

4, Ironstone Way
Brixworth
Northampton, NN3 9UD

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Innovyze

Proposed AGP
Northfleet School for Girls
1 in 30 yr, 2.0 l/s

Designed by JPB
Checked by KER

Source Control 2018.1.1

Micro
Drainage

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	29.884	0.231	0.0	1.9	1.9	147.1	Flood Risk
60 min Winter	29.901	0.248	0.0	1.9	1.9	168.8	Flood Risk
120 min Winter	29.917	0.264	0.0	1.9	1.9	191.2	Flood Risk
180 min Winter	29.925	0.272	0.0	1.9	1.9	203.7	Flood Risk
240 min Winter	29.931	0.278	0.0	1.9	1.9	211.6	Flood Risk
360 min Winter	29.937	0.284	0.0	1.9	1.9	220.9	Flood Risk
480 min Winter	29.939	0.286	0.0	1.9	1.9	225.0	Flood Risk
600 min Winter	29.940	0.287	0.0	1.9	1.9	226.2	Flood Risk
720 min Winter	29.940	0.287	0.0	1.9	1.9	225.5	Flood Risk
960 min Winter	29.945	0.292	0.0	1.9	1.9	234.3	Flood Risk
1440 min Winter	29.948	0.295	0.0	1.9	1.9	239.3	Flood Risk
2160 min Winter	29.948	0.295	0.0	1.9	1.9	238.2	Flood Risk
2880 min Winter	29.943	0.290	0.0	1.9	1.9	231.2	Flood Risk
4320 min Winter	29.911	0.258	0.0	1.9	1.9	182.8	Flood Risk
5760 min Winter	29.879	0.226	0.0	1.9	1.9	139.7	Flood Risk
7200 min Winter	29.846	0.193	0.0	1.8	1.8	102.3	Flood Risk
8640 min Winter	29.813	0.160	0.0	1.8	1.8	70.6	Flood Risk
10080 min Winter	29.780	0.127	0.0	1.8	1.8	44.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	66.466	0.0	149.5	33
60 min Winter	37.770	0.0	173.6	62
120 min Winter	21.463	0.0	200.8	122
180 min Winter	15.421	0.0	218.0	180
240 min Winter	12.197	0.0	231.0	238
360 min Winter	8.763	0.0	249.9	356
480 min Winter	6.931	0.0	264.0	470
600 min Winter	5.778	0.0	275.1	584
720 min Winter	4.980	0.0	284.2	694
960 min Winter	4.106	0.0	293.6	914
1440 min Winter	3.129	0.0	286.1	1196
2160 min Winter	2.384	0.0	407.5	1644
2880 min Winter	1.966	0.0	444.9	2104
4320 min Winter	1.396	0.0	460.8	2984
5760 min Winter	1.095	0.0	468.2	3808
7200 min Winter	0.907	0.0	471.0	4544
8640 min Winter	0.778	0.0	471.4	5272
10080 min Winter	0.683	0.0	468.7	5952

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4, Ironstone Way Brixworth Northampton, NN3 9UD	Proposed AGP Northfleet School for Girls 1 in 30 yr, 2.0 l/s	
Date 29/08/2024 14:31 File	Designed by JPB Checked by KER	
Innovyze	Source Control 2018.1.1	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	1999
Site Location	562900 172050 TQ 62900 72050
C (1km)	-0.027
D1 (1km)	0.276
D2 (1km)	0.421
D3 (1km)	0.247
E (1km)	0.324
F (1km)	2.535
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.643

Time (mins)	Area (ha)
From: 0	To: 4 0.643

JPP Consulting Ltd		Page 4
4, Ironstone Way Brixworth Northampton, NN3 9UD	Proposed AGP Northfleet School for Girls 1 in 30 yr, 2.0 l/s	
Date 29/08/2024 14:31 File	Designed by JPB Checked by KER	
Innovyze	Source Control 2018.1.1	
Model Details Storage is Online Cover Level (m) 30.058 Porous Car Park Structure Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 61.0 Membrane Percolation (mm/hr) 1000 Length (m) 97.0 Max Percolation (l/s) 1643.6 Slope (1:X) 300.0 Safety Factor 2.0 Depression Storage (mm) 5 Porosity 0.30 Evaporation (mm/day) 3 Invert Level (m) 29.653 Membrane Depth (m) 0 Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0064-2000-1200-2000 Design Head (m) 1.200 Design Flow (l/s) 2.0 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 64 Invert Level (m) 28.858 Minimum Outlet Pipe Diameter (mm) 100 Suggested Manhole Diameter (mm) 1200 Control Points Head (m) Flow (l/s) Design Point (Calculated) 1.200 2.0 Flush-Flo™ 0.282 1.8 Kick-Flo® 0.573 1.4 Mean Flow over Head Range - 1.6 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 1.5 1.200 2.0 3.000 3.0 7.000 4.5 0.200 1.7 1.400 2.1 3.500 3.3 7.500 4.7 0.300 1.8 1.600 2.3 4.000 3.5 8.000 4.8 0.400 1.7 1.800 2.4 4.500 3.7 8.500 5.0 0.500 1.6 2.000 2.5 5.000 3.9 9.000 5.1 0.600 1.5 2.200 2.6 5.500 4.0 9.500 5.2 0.800 1.7 2.400 2.7 6.000 4.2 1.000 1.8 2.600 2.8 6.500 4.4 ©1982-2018 Innovyze		



Appendix I
Attenuation Calculations: 1 in 100 year

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4, Ironstone Way Brixworth Northampton, NN3 9UD			Proposed AGP Northfleet School for Girls 1 in 100 yr, 2.0 l/s			
Date 29/08/2024 14:30 File			Designed by JPB Checked by KER			
Innovyze			Source Control 2018.1.1			

Summary of Results for 100 year Return Period

Half Drain Time : 1575 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	29.914	0.261	0.0	1.9	1.9	187.6	Flood Risk
30 min Summer	29.930	0.277	0.0	1.9	1.9	210.5	Flood Risk
60 min Summer	29.945	0.292	0.0	1.9	1.9	234.6	Flood Risk
120 min Summer	29.960	0.307	0.0	1.9	1.9	258.7	Flood Risk
180 min Summer	29.968	0.315	0.0	1.9	1.9	271.8	Flood Risk
240 min Summer	29.972	0.319	0.0	1.9	1.9	280.0	Flood Risk
360 min Summer	29.977	0.324	0.0	1.9	1.9	289.0	Flood Risk
480 min Summer	29.980	0.327	0.0	1.9	1.9	292.6	Flood Risk
600 min Summer	29.980	0.327	0.0	1.9	1.9	293.2	Flood Risk
720 min Summer	29.979	0.326	0.0	1.9	1.9	291.8	Flood Risk
960 min Summer	29.984	0.331	0.0	1.9	1.9	301.5	Flood Risk
1440 min Summer	29.988	0.335	0.0	1.9	1.9	307.1	Flood Risk
2160 min Summer	29.987	0.334	0.0	1.9	1.9	305.6	Flood Risk
2880 min Summer	29.984	0.331	0.0	1.9	1.9	300.8	Flood Risk
4320 min Summer	29.959	0.306	0.0	1.9	1.9	257.4	Flood Risk
5760 min Summer	29.937	0.284	0.0	1.9	1.9	220.9	Flood Risk
7200 min Summer	29.915	0.262	0.0	1.9	1.9	188.5	Flood Risk
8640 min Summer	29.894	0.241	0.0	1.9	1.9	159.7	Flood Risk
10080 min Summer	29.874	0.221	0.0	1.9	1.9	133.8	Flood Risk
15 min Winter	29.932	0.279	0.0	1.9	1.9	213.8	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	181.510	0.0	157.6	19
30 min Summer	100.824	0.0	158.5	34
60 min Summer	56.005	0.0	239.8	64
120 min Summer	31.110	0.0	269.1	124
180 min Summer	22.056	0.0	287.4	184
240 min Summer	17.281	0.0	300.9	242
360 min Summer	12.252	0.0	311.1	362
480 min Summer	9.599	0.0	309.7	482
600 min Summer	7.944	0.0	307.9	602
720 min Summer	6.806	0.0	305.7	722
960 min Summer	5.559	0.0	303.0	960
1440 min Summer	4.180	0.0	295.6	1256
2160 min Summer	3.143	0.0	489.6	1648
2880 min Summer	2.567	0.0	529.3	2048
4320 min Summer	1.799	0.0	527.6	2852
5760 min Summer	1.398	0.0	546.8	3640
7200 min Summer	1.149	0.0	546.9	4464
8640 min Summer	0.979	0.0	543.9	5192
10080 min Summer	0.856	0.0	539.7	5952
15 min Winter	181.510	0.0	159.2	19

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Proposed AGP
Northfleet School for Girls
1 in 100 yr, 2.0 l/s

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Source Control 2018.1.1

Page 2



Summary of Results for 100 year Return Period

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	29.948	0.295	0.0	1.9	1.9	239.6	Flood Risk
60 min Winter	29.965	0.312	0.0	1.9	1.9	266.7	Flood Risk
120 min Winter	29.981	0.328	0.0	1.9	1.9	294.5	Flood Risk
180 min Winter	29.989	0.336	0.0	1.9	1.9	309.8	Flood Risk
240 min Winter	29.995	0.342	0.0	1.9	1.9	319.6	Flood Risk
360 min Winter	30.001	0.348	0.0	2.0	2.0	331.1	Flood Risk
480 min Winter	30.004	0.351	0.0	2.0	2.0	336.5	Flood Risk
600 min Winter	30.005	0.352	0.0	2.0	2.0	338.5	Flood Risk
720 min Winter	30.005	0.352	0.0	2.0	2.0	338.2	Flood Risk
960 min Winter	30.013	0.360	0.0	2.0	2.0	352.3	Flood Risk
1440 min Winter	30.019	0.366	0.0	2.0	2.0	363.6	Flood Risk
2160 min Winter	30.018	0.365	0.0	2.0	2.0	360.6	Flood Risk
2880 min Winter	30.014	0.361	0.0	2.0	2.0	353.5	Flood Risk
4320 min Winter	29.981	0.328	0.0	1.9	1.9	294.4	Flood Risk
5760 min Winter	29.950	0.297	0.0	1.9	1.9	241.5	Flood Risk
7200 min Winter	29.919	0.266	0.0	1.9	1.9	194.3	Flood Risk
8640 min Winter	29.889	0.236	0.0	1.9	1.9	152.5	Flood Risk
10080 min Winter	29.858	0.205	0.0	1.8	1.8	115.8	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	100.824	0.0	160.3	34
60 min Winter	56.005	0.0	272.3	64
120 min Winter	31.110	0.0	305.0	122
180 min Winter	22.056	0.0	316.4	180
240 min Winter	17.281	0.0	316.8	240
360 min Winter	12.252	0.0	316.2	356
480 min Winter	9.599	0.0	314.8	474
600 min Winter	7.944	0.0	313.1	590
720 min Winter	6.806	0.0	311.1	702
960 min Winter	5.559	0.0	308.6	932
1440 min Winter	4.180	0.0	301.6	1370
2160 min Winter	3.143	0.0	555.0	1756
2880 min Winter	2.567	0.0	594.5	2216
4320 min Winter	1.799	0.0	551.8	3112
5760 min Winter	1.398	0.0	625.1	3976
7200 min Winter	1.149	0.0	628.2	4760
8640 min Winter	0.979	0.0	627.8	5536
10080 min Winter	0.856	0.0	625.1	6256

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4, Ironstone Way Brixworth Northampton, NN3 9UD	Proposed AGP Northfleet School for Girls 1 in 100 yr, 2.0 l/s	
Date 29/08/2024 14:30 File	Designed by JPB Checked by KER	
Innovyze Source Control 2018.1.1		

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	562900 172050 TQ 62900 72050
C (1km)	-0.027
D1 (1km)	0.276
D2 (1km)	0.421
D3 (1km)	0.247
E (1km)	0.324
F (1km)	2.535
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.643

Time (mins)	Area (ha)
From: 0	To: 4 0.643

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4, Ironstone Way Brixworth Northampton, NN3 9UD	Proposed AGP Northfleet School for Girls 1 in 100 yr, 2.0 l/s	
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Innovyze Source Control 2018.1.1		

Model Details

Storage is Online Cover Level (m) 30.058

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	61.0
Membrane Percolation (mm/hr)	1000	Length (m)	97.0
Max Percolation (l/s)	1643.6	Slope (1:X)	300.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	29.653	Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0064-2000-1200-2000
Design Head (m)	1.200
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	64
Invert Level (m)	28.858
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	2.0
Flush-Flo™	0.282	1.8
Kick-Flo®	0.573	1.4
Mean Flow over Head Range	-	1.6

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	1.5	1.200	2.0	3.000	3.0	7.000	4.5
0.200	1.7	1.400	2.1	3.500	3.3	7.500	4.7
0.300	1.8	1.600	2.3	4.000	3.5	8.000	4.8
0.400	1.7	1.800	2.4	4.500	3.7	8.500	5.0
0.500	1.6	2.000	2.5	5.000	3.9	9.000	5.1
0.600	1.5	2.200	2.6	5.500	4.0	9.500	5.2
0.800	1.7	2.400	2.7	6.000	4.2		
1.000	1.8	2.600	2.8	6.500	4.4		

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Appendix J

Attenuation Calculations: 1 in 100 year + 45% CC

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4, Ironstone Way Brixworth Northampton, NN3 9UD		Proposed AGP Northfleet School for Girls 1 in 100 yr + 45% CC, 2.0 l/s	
Date 29/08/2024 14:28 File		Designed by JPB Checked by KER	
Innovyze		Source Control 2018.1.1	

Summary of Results for 100 year Return Period (+45%)

Half Drain Time : 2587 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	29.976	0.323	0.0	1.9	1.9	285.9	Flood Risk
30 min Summer	29.995	0.342	0.0	1.9	1.9	319.7	Flood Risk
60 min Summer	30.015	0.362	0.0	2.0	2.0	355.6	Flood Risk
120 min Summer	30.036	0.383	0.0	2.0	2.0	392.6	Flood Risk
180 min Summer	30.048	0.395	0.0	2.0	2.0	413.8	Flood Risk
240 min Summer	30.056	0.403	0.0	2.0	2.0	427.9	Flood Risk
360 min Summer	30.063	0.410	0.0	2.0	2.0	445.3	FLOOD
480 min Summer	30.066	0.413	0.0	2.0	2.0	455.2	FLOOD
600 min Summer	30.068	0.415	0.0	2.0	2.0	460.4	FLOOD
720 min Summer	30.069	0.416	0.0	2.0	2.0	462.8	FLOOD
960 min Summer	30.078	0.425	0.0	2.0	2.0	486.2	FLOOD
1440 min Summer	30.087	0.434	0.0	2.0	2.0	510.6	FLOOD
2160 min Summer	30.090	0.437	0.0	2.0	2.0	519.0	FLOOD
2880 min Summer	30.090	0.437	0.0	2.0	2.0	517.6	FLOOD
4320 min Summer	30.067	0.414	0.0	2.0	2.0	457.8	FLOOD
5760 min Summer	30.047	0.394	0.0	2.0	2.0	412.2	Flood Risk
7200 min Summer	30.024	0.371	0.0	2.0	2.0	372.4	Flood Risk
8640 min Summer	30.004	0.351	0.0	2.0	2.0	336.4	Flood Risk
10080 min Summer	29.985	0.332	0.0	1.9	1.9	303.2	Flood Risk
15 min Winter	29.997	0.344	0.0	2.0	2.0	324.0	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	263.189	0.0	163.1	19
30 min Summer	146.195	0.0	164.1	34
60 min Summer	81.208	0.0	323.7	64
120 min Summer	45.109	0.0	326.5	124
180 min Summer	31.982	0.0	327.4	184
240 min Summer	25.057	0.0	327.7	244
360 min Summer	17.765	5.0	327.3	362
480 min Summer	13.919	8.8	326.2	482
600 min Summer	11.518	10.5	324.8	602
720 min Summer	9.868	11.2	323.0	722
960 min Summer	8.061	20.3	321.1	962
1440 min Summer	6.061	29.1	315.5	1440
2160 min Summer	4.557	32.7	636.1	1968
2880 min Summer	3.723	32.1	628.8	2332
4320 min Summer	2.609	9.6	588.1	3068
5760 min Summer	2.027	0.0	837.7	3864
7200 min Summer	1.666	0.0	846.5	4680
8640 min Summer	1.420	0.0	850.3	5448
10080 min Summer	1.241	0.0	851.0	6256
15 min Winter	263.189	0.0	164.8	19

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Proposed AGP
Northfleet School for Girls
1 in 100 yr + 45% CC, 2.0 l/s

Designed by JPB
Checked by KER

Source Control 2018.1.1

Page 2



Summary of Results for 100 year Return Period (+45%)

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	30.019	0.366	0.0	2.0	2.0	361.8	Flood Risk
60 min Winter	30.041	0.388	0.0	2.0	2.0	402.5	Flood Risk
120 min Winter	30.063	0.410	0.0	2.0	2.0	444.6	FLOOD
180 min Winter	30.072	0.419	0.0	2.0	2.0	469.1	FLOOD
240 min Winter	30.078	0.425	0.0	2.0	2.0	485.6	FLOOD
360 min Winter	30.086	0.433	0.0	2.0	2.0	506.7	FLOOD
480 min Winter	30.090	0.437	0.0	2.0	2.0	519.1	FLOOD
600 min Winter	30.093	0.440	0.0	2.0	2.0	526.6	FLOOD
720 min Winter	30.095	0.442	0.0	2.0	2.0	530.9	FLOOD
960 min Winter	30.107	0.454	0.0	2.0	2.0	560.6	FLOOD
1440 min Winter	30.121	0.468	0.0	2.0	2.0	595.3	FLOOD
2160 min Winter	30.129	0.476	0.0	2.1	2.1	614.9	FLOOD
2880 min Winter	30.129	0.476	0.0	2.1	2.1	614.8	FLOOD
4320 min Winter	30.098	0.445	0.0	2.0	2.0	537.6	FLOOD
5760 min Winter	30.074	0.421	0.0	2.0	2.0	476.2	FLOOD
7200 min Winter	30.051	0.398	0.0	2.0	2.0	419.7	Flood Risk
8640 min Winter	30.022	0.369	0.0	2.0	2.0	367.3	Flood Risk
10080 min Winter	29.994	0.341	0.0	1.9	1.9	318.9	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	146.195	0.0	166.0	34
60 min Winter	81.208	0.0	328.2	64
120 min Winter	45.109	4.3	331.0	122
180 min Winter	31.982	13.3	331.9	182
240 min Winter	25.057	19.7	332.3	240
360 min Winter	17.765	27.6	332.0	358
480 min Winter	13.919	32.8	330.9	476
600 min Winter	11.518	35.5	329.5	592
720 min Winter	9.868	36.6	327.8	708
960 min Winter	8.061	48.6	326.0	942
1440 min Winter	6.061	62.8	320.2	1398
2160 min Winter	4.557	71.1	647.7	2056
2880 min Winter	3.723	71.0	640.0	2680
4320 min Winter	2.609	39.4	607.2	3288
5760 min Winter	2.027	16.2	951.1	4208
7200 min Winter	1.666	0.0	963.2	5112
8640 min Winter	1.420	0.0	969.8	5960
10080 min Winter	1.241	0.0	973.7	6760

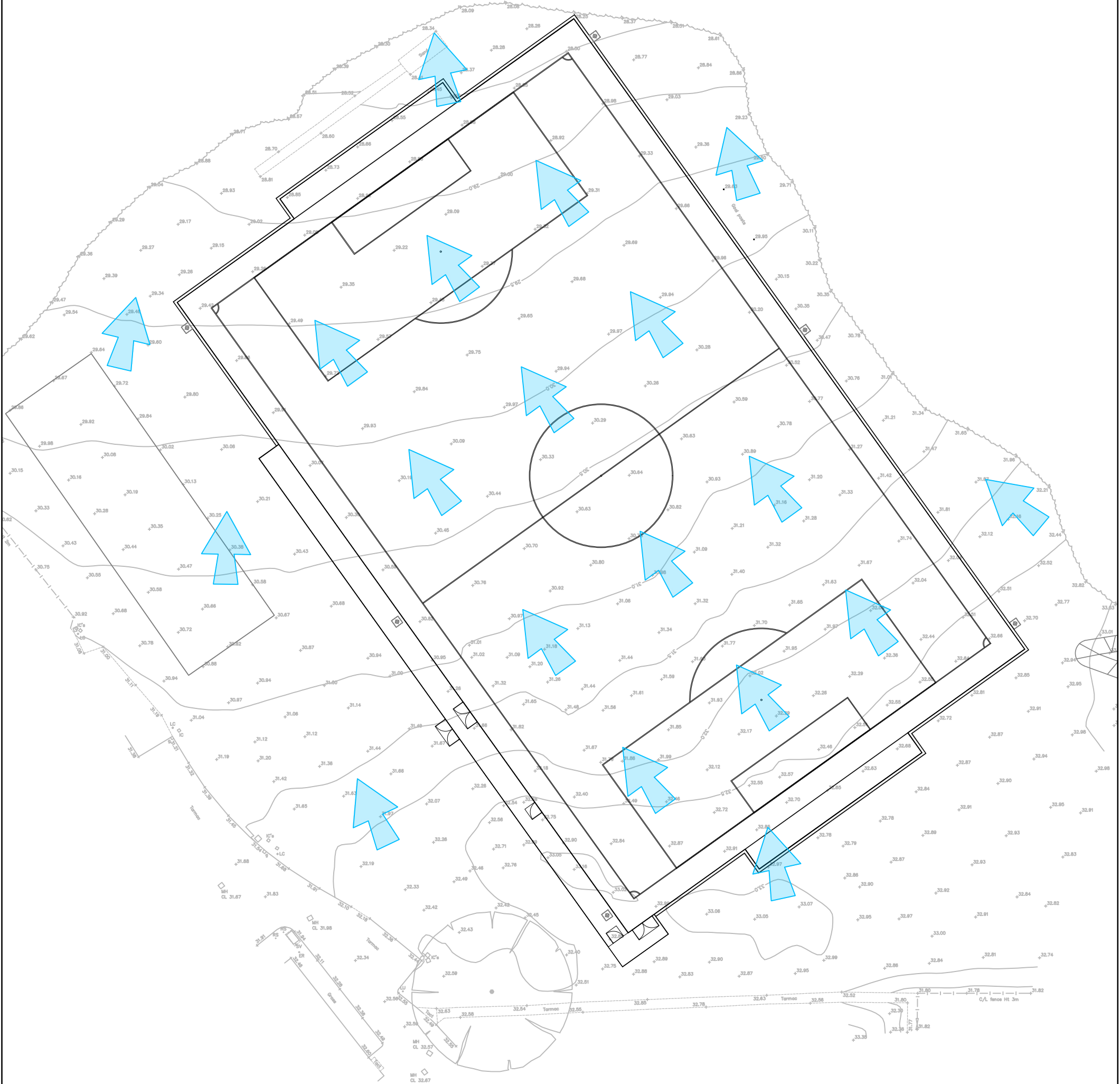
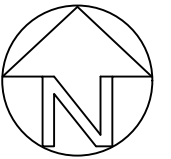
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4, Ironstone Way Brixworth Northampton, NN3 9UD	Proposed AGP Northfleet School for Girls 1 in 100 yr + 45% CC, 2.0 l/s	
Date 29/08/2024 14:28 File	Designed by JPB Checked by KER	
Innovyze	Source Control 2018.1.1	

JPP Consulting Ltd		Page 4
4, Ironstone Way Brixworth Northampton, NN3 9UD	Proposed AGP Northfleet School for Girls 1 in 100 yr + 45% CC, 2.0 l/s	
Date 29/08/2024 14:28 File	Designed by JPB Checked by KER	
Innovyze	Source Control 2018.1.1	
Model Details Storage is Online Cover Level (m) 30.058 Porous Car Park Structure Infiltration Coefficient Base (m/hr)0.00000Width (m)61.0 Membrane Percolation (mm/hr)1000Length (m)97.0 Max Percolation (l/s)1643.6Slope (1:X)300.0 Safety Factor2.0Depression Storage (mm)5 Porosity0.30Evaporation (mm/day)3 Invert Level (m)29.653Membrane Depth (m)0 Hydro-Brake® Optimum Outflow Control Unit ReferenceMD-SHE-0064-2000-1200-2000 Design Head (m)1.200 Design Flow (l/s)2.0 Flush-Flo™Calculated ObjectiveMinimise upstream storage ApplicationSurface Sump AvailableYes Diameter (mm)64 Invert Level (m)28.858 Minimum Outlet Pipe Diameter (mm)100 Suggested Manhole Diameter (mm)1200 Control PointsHead (m)Flow (l/s) Design Point (Calculated)1.2002.0 Flush-Flo™0.2821.8 Kick-Flo®0.5731.4 Mean Flow over Head Range-1.6 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) 0.1001.5 0.2001.7 0.3001.8 0.4001.7 0.5001.6 0.6001.5 0.8001.7 1.0001.8 1.2002.0 1.4002.1 1.6002.3 1.8002.4 2.0002.5 2.2002.6 2.4002.7 2.6002.8 3.0003.0 3.5003.3 4.0003.5 4.5003.7 5.0003.9 5.5004.0 6.0004.2 6.5004.4 7.0004.5 7.5004.7 8.0004.8 8.5005.0 9.0005.1 9.5005.2 ©1982-2018 Innovyze		



Appendix K
Overland Flows
JPP Consulting drawing no. 28616-FRA04



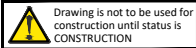
General Notes

- 1. All dimensions are in metres unless otherwise stated.
- 2. All levels are in metres.
- 3. This drawing is to be read in conjunction with all relevant Engineers and Architect's drawings, Specifications, Reports and Engineering Details.
- 4. Do not scale from this drawing.

Drawing Key

 Predicted Overland Flows

This drawing has been based/developed using the following external drawings					
Type	Company	Drawing date	Drawing title	Date received	Rev
Site Layout	Labosport Ltd	17.05.2024	Proposed Plan	11.07.2024	-
Topographical Survey	JPP Surveying	09.02.2024	Topographical Survey	11.07.2024	-





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- Infrastructure Design
- Structural Engineering
- Development Planning
- Professional Advice
- Geotechnical & Environmental
- Surveying

Client Labosport Ltd

Project Proposed AGP
Northfleet School for Girls
Hall Road, Northfleet, Gravesend

Title Predicted Overland Flows

Scale at A3 1:500	Drawn by JPB	Checked by KER	Date 21.08.2024
Status FOR PLANNING	Project ref 28616	Drawing no. FRA04	Revision -