
Sandgate Nurseries, Henfield

Flood Risk Assessment, Drainage Strategy and Water Neutrality Report

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Job Number:	30512

Date	Revision	Notes/Amendments/Issue Purpose
January 2023	P01	For Information
April 2023	P02	Drainage strategy amended and water neutrality added

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Acronyms	
AOD	Above Ordnance Datum
CIRIA	Construction Industry Research and Information Association
DCG	Design and Construction Guidance
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
FRA	Flood Risk Assessment
LLFA	Lead Local Flood Authority
NPPF	National Planning Policy Framework
PPG	Planning Practice Guidance
SFRA	Strategic Flood Risk Assessment
SWMP	Surface Water Management Plan
SuDS	Sustainable Drainage Systems

1 Introduction

Price & Myers have been commissioned to undertake a Flood Risk Assessment (FRA), Drainage Strategy and Water Neutrality Assessment report for the proposed development at Sandgate Nurseries, located off West End Lane which forms part of West Sussex County Council and Horsham District Council.

The National Planning Policy Framework (NPPF) states that an appropriate FRA will be required for all development proposals of 1 ha or greater in Flood Zone 1 and for any development within Flood Zones 2 or 3.

The EA's flood risk map for planning shows that the site is in Flood Zone 1, however the total site area is greater than 1 ha. This assessment will therefore focus on the flood risk stormwater management, as well as assessing the flood risk from all other sources.

This report will also outline the proposed drainage strategy for the site including a detailed SuDS assessment and consider water neutrality.

1.1 Relevant Policy

This FRA has been carried out in accordance with the NPPF and the accompanying Planning Practice Guidance (PPG) "Flood Risk and Coastal Change". This FRA also incorporates advice and guidance from the Environment Agency (EA), the Horsham District Council Strategic Flood Risk Assessment (SFRA) (2010), The West Sussex LLFA Policy for the Management of Surface Water (2018) and CIRIA documents.

The surface water drainage strategy is in accordance with:

- the Department for Environment, Food and Rural Affairs (DEFRA) "Non-Statutory Technical Standards for Sustainable Drainage Systems".
- the Lead Local Flood Authority (LLFA) guidance document on SuDS/Drainage.

2 Site Description and Location

The site is located off West End Road, within West Sussex County Council and Horsham District Council. The full site address is Sandgate Nurseries, West End Lane, Henfield, Horsham, West Sussex, BN5 9UL. The OS grid reference is 520425 X, 116061 Y.

The site occupies an area of approximately 38,007m² (3.80 ha), the majority of which comprises of soft landscaping. The site can be accessed via an access road from West End Lane which leads to the existing vacant garden nurseries and associated structures (sheds and glasshouses).

The site is bound by West End Lane to the North, residential dwellings to the east, Hollands Lane to the south and a residential dwelling and agricultural land to the west.

The topographical survey for the site (available in Appendix A) shows that the levels in the northern half of the site generally fall from east to west, with levels ranging from approximately 21mAOD to 17mAOD. The southern half of the site generally slopes to the south towards a level of 16mAOD.

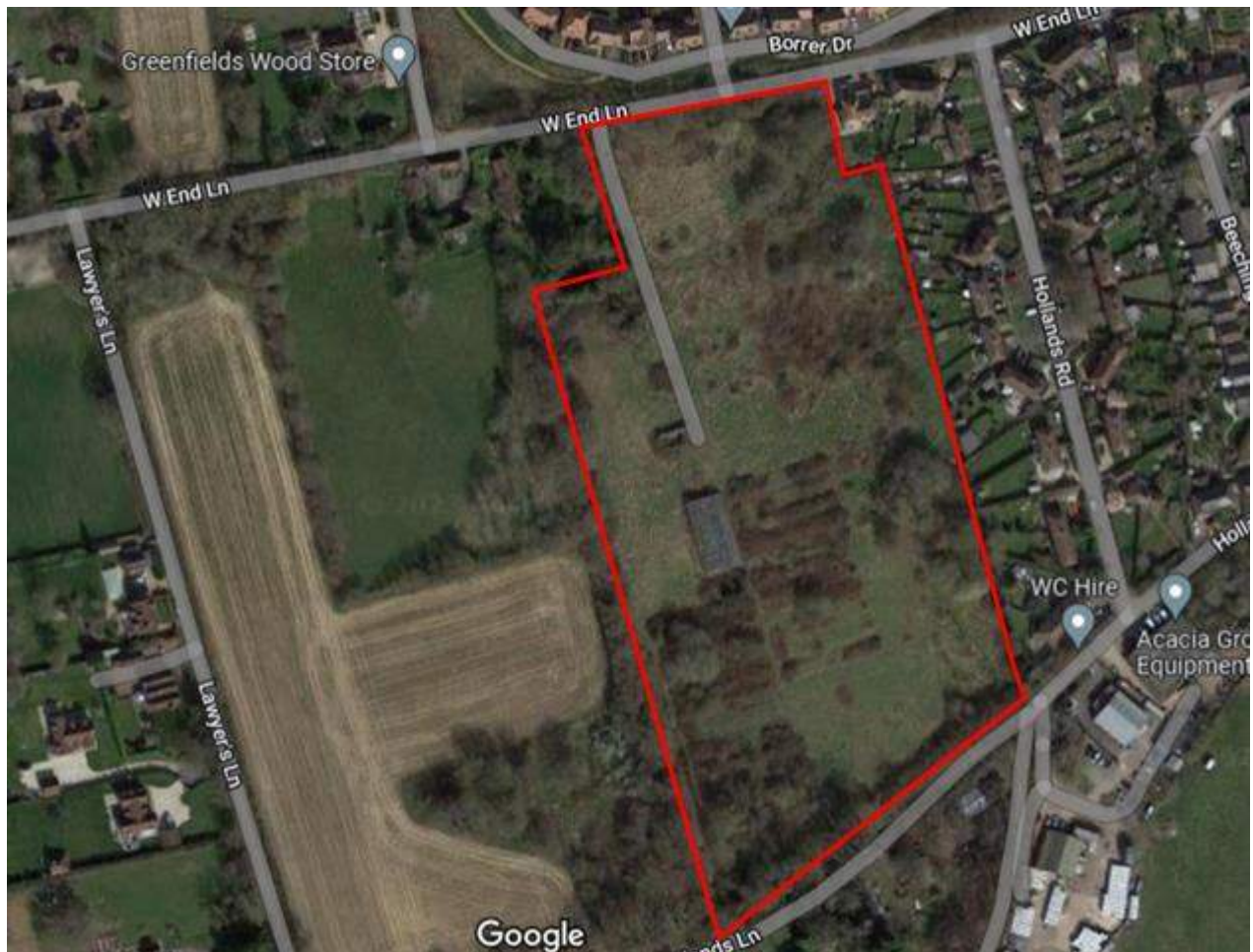


Figure 2.1: Existing site, showing site boundary

2.1 Existing Drainage

Due to the nature of the existing structures, it is assumed that there is no private drainage that serves the existing site.

The Southern Water Sewer Records show that the closest public sewer to the site is a 225mm diameter public foul water sewer and foul pumping chamber that is located in Hollands Lane to the south-east corner of the site.

The Southern Water Sewer Records are available in full in Appendix B.



Figure 2.2: Southern Water Sewer Records.

3 Development Proposal

The development proposals comprise of the demolition of the existing vacant garden nurseries and erection of a continuing care retirement community of up to 72 units of accommodation (Use Class C2) and up to 10 starter homes (Use Class C3) with associated community facilities including medical centre and on-site laundry and catering facilities, with access, infrastructure, open space, landscaping and associated works (all matters reserved except for access).

The proposed development proposals are available in full in Appendix C.



Figure 3.1: Proposed layout

4 Flood Risk Assessment

4.1 Flood Risk from Watercourses

The EA's flood map for planning shows that the site is located in Flood Zone 1 and is at very low risk of flooding (less than 0.1% annual probability of river or sea flooding) from watercourses. Developments in this flood zone do not have any restrictions, provided they do not increase the risk of flooding elsewhere.

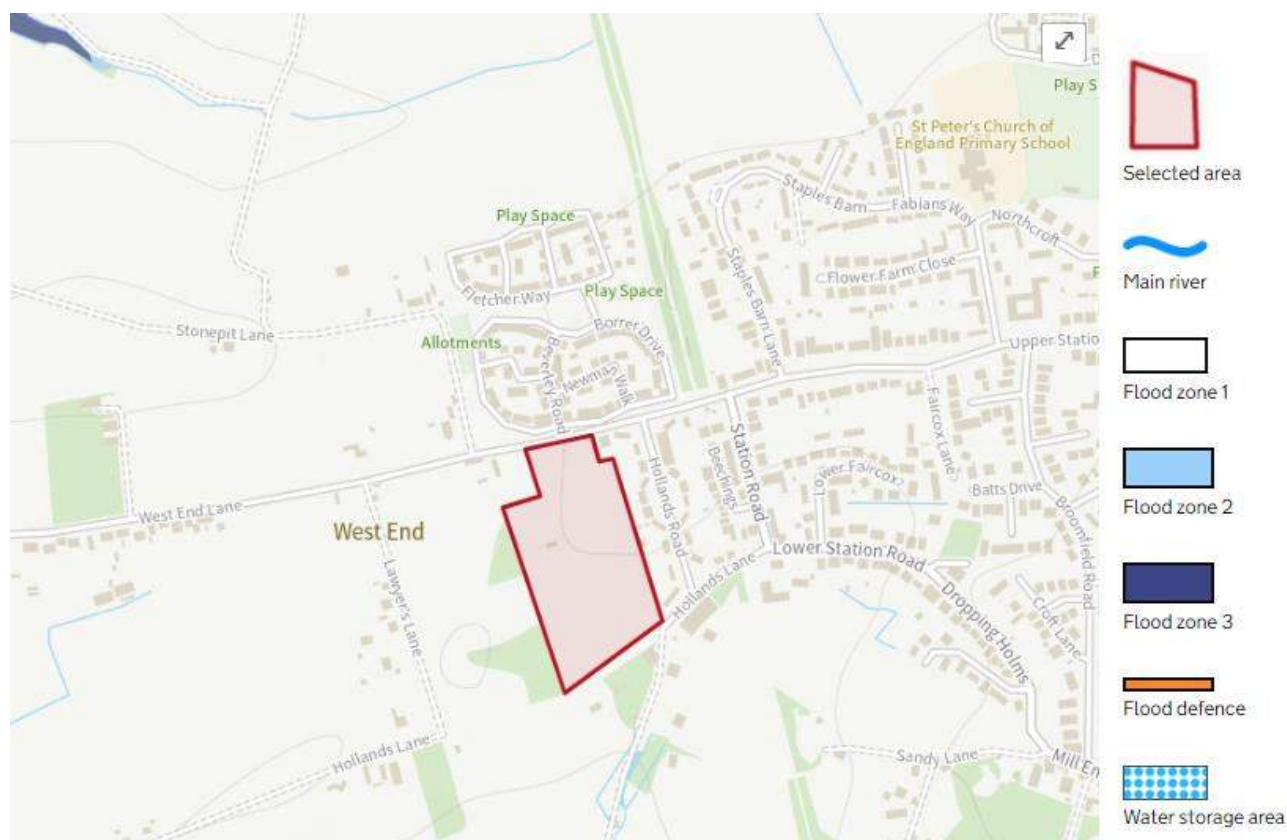


Figure 4.1: EA Flood Map for Planning

4.2 Flood Risk from Groundwater

Groundwater flooding occurs when water originating from sub-surface permeable strata emerges from the ground, typically after prolonged rainfall.

A Preliminary Risk Assessment (PRA) was carried out by Aviron Associates Ltd in August 2022. The report includes information on the anticipated geology based on information provided by the British Geological Survey (BGS). The BGS data shows that the site comprises of superficial deposits of Brighton and Worthing (clay, silt, sand and gravel). The bedrock geology comprises of Lower Greensand Group (sandstone).

The report contains recorded borehole logs for historical drilling or excavation works within 1000m of the site. Out of the five closest borehole logs, the shallowest groundwater level was recorded at a depth of 7.4m below ground level (bgl).

Furthermore, the proposals do not comprise of lower ground floor or basements which are more prone to groundwater flooding. Therefore, the risk of flooding from groundwater is considered to be very low.

4.3 Flood Risk from Surface Water and Overland Flows

Surface water flooding occurs when intense rainfall is unable to soak into the ground or enter a drainage system due to blockages or the capacity of the system being exceeded. Overland flows can also be generated by burst water mains, failed dams and any failure in a system storing or transferring water.

The EA's indicative Surface Water Flooding Map, Figure 4.2, shows that the site is at very low risk (a chance of flooding of less than 0.1% each year) of surface water flooding.



Figure 4.2: Environment Agency Surface Water Flood Risk Map

4.4 Flood Risk from Reservoirs

The EA provides information on flood risk from reservoirs. The map showing the maximum extent of flooding from reservoirs was updated in 2021 and now shows the combined effects of flooding from reservoirs and rivers. The Figure 4.3 overleaf shows that the site is at very low risk of reservoir flooding.



Figure 4.3: Environment Agency Risk of Reservoir Flooding Map

4.5 Flood Risk from Sewers

Sewer flooding occurs when the flow entering the sewerage network is greater than the capacity of the sewers.

There are no surface water sewers in close proximity to the site. Therefore, the risk from sewer flooding is very low.

5 Surface Water Run-off Assessment

The total site area is approximately 38,000m² or 3.80 ha which can largely be described as greenfield land. The existing greenfield run-off rates for storm events of several different return periods were calculated using the Greenfield Run-off Estimator tool from uksuds.com, as shown below. Supporting documentation is contained in Appendix D.

Q1 _{ex Gr}	= 11.0 l/s
Q _{BAR}	= 12.9 l/s
Q30 _{ex Gr}	= 41.2 l/s
Q100 _{ex Gr}	= 48.4 l/s

5.1.1 Climate Change

The EA's Climate Change Allowances for Peak Rainfall in England Maps show that the site is within the Adur and Ouse Management Area. These maps show that a 45% allowance must be used in the hydraulic calculations for the proposed development.

6 SuDS Strategy

In accordance with EA guidelines and CIRIA documents, surface water run-off should be managed as close to its source as possible. The West Sussex LLFA Policy for the Management of Surface Water states that the following drainage hierarchy should be used to determine run-off destination.

6.1.1 Infiltration Into the Ground

Infiltration testing to BRE365 was carried out on site in March 2023 by Land Science. Three tests were carried out but it was not possible to determine an infiltration rate as the water level did not fall sufficiently (see Appendix E). Therefore, soakaways or other infiltration systems are not considered to be viable for surface water disposal.

6.1.2 To a Surface Water Body

The topographical survey (available in Appendix A) shows that there is an existing watercourse located along the southern boundary of the site, to the north of Hollands Lane. The watercourse has a base level of 14.85m AOD at its origin to the south of the site which reduces to 13.25m AOD at the south east corner of the site. As the site topography slopes from north to south, it is likely that the watercourse receives surface water runoff from the site.

The topographical survey does not identify where the watercourse outfalls to. Further investigation is required at detailed design stage to confirm that the watercourse connects to the downstream network and ultimately to the River Adur.

It is proposed to make a new connection to the watercourse from the proposed surface water drainage system that will serve the development. The discharge rate will be restricted to the Q_1 greenfield runoff rate of 11.0 l/s for all storm events up to and including the 100 year plus 45% climate change event, in line with the West Sussex LLFA Policy for the Management of Surface Water.

Based on a development impermeable area of 1.65 ha and allowing for 10% urban creep, preliminary calculations have been carried out to determine the volume of attenuation storage required to restrict the discharge rate to 11.0 l/s for the 100 year plus 45% climate change event which show that approximately 1,500m³ of storage is required (see Appendix F). The majority of the attenuation storage will be provided in three detention basins located along the western boundary of the site, together with a below ground attenuation tank. Permeable paving is proposed to be incorporated for the private driveways and hardstanding areas. Rainwater harvesting will also be incorporated (discussed further in Section 9) and the use of hybrid systems that provide attenuation and rainwater harvesting will be incorporated at detailed design stage. The below ground drainage strategy drawing is available in Appendix G.

6.1.3 To a Surface Water Sewer, Highway Drain, or Another Drainage System

The Southern Water sewer records show that there are no surface water sewers in close proximity to the site.

6.1.4 To a Combined Sewer

The Southern Water sewer records show that there are no combined water sewers in close proximity to the site.

6.2 Water Quality

SuDS have the potential to provide water quality benefits to run-off entering the environment. The SuDS Manual states that SuDS should be designed to treat run-off to reduce the risk of environmental pollution. Chapter 26 of The SuDS Manual sets out the 'simple index approach' to water quality risk management. This approach has been used to quantify the benefits of the proposed SuDS scheme on water quality.

Step 1 of the simple index approach is to identify the pollution hazard indices for the proposed land use. The proposed residential development is considered to have a 'very low' pollution hazard level and Table 6.1 below shows the associated pollution hazard indices:

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very Low	0.2	0.2	0.05
Other roofs	Low	0.3	0.2	0.05
Individual property driveways, residential car parks, low traffic roads and non-residential car parking with infrequent change	Low	0.5	0.4	0.4

Table 6.1: Pollution Hazard Indices, taken from Table 26.2 of The SuDS Manual (CIRIA, 2015)

Step 2 of the simple index approach is to select SuDS with a total pollution mitigation index that equals or exceeds the pollution hazard index.

As the destination of the runoff is to a watercourse, the surface water pollution mitigation indices should be used as shown in Table 6.2 below:

Type of SuDS Component	TSS	Metals	Hydrocarbons
Permeable Pavement	0.7	0.6	0.7
Detention Basin	0.5	0.5	0.6

Table 6.2 Surface Water Pollution Mitigation Indices, taken from Table 26.3 of The SuDS Manual

Provided that the mitigation indices of the treatment techniques are greater than or equal to the hazard indices for the proposed development then there should be no reduction in the overall water quality within the receiving watercourse or groundwater body. Therefore, the incorporation of a permeable paving and detention basins will provide suitable prevention from pollution to the receiving surface water bodies.

7 Surface Water Maintenance Strategy

The successful implementation and operation of a SuDS system depends on a robust and clear maintenance strategy being implemented. The following measures should form part of the site's proposed management plan.

It is envisaged that the majority of the SuDS will be maintained by the client and will form part of the overall maintenance regime for the site.

SuDS Element	Maintenance		
	Activity	Required Action	Typical Frequency
Detention Basins	Monitoring / Inspections	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
		Inspect banksides, structures, pipework etc. for evidence of physical damage	
		Inspect infiltration surfaces for compaction and ponding	
		Inspect inlets and pre-treatment systems for silt accumulation; establish appropriate silt removal frequencies	Half yearly
	Regular Maintenance	Remove litter, debris and trash	Monthly
		Cut grass – for landscaped areas and access routes	Monthly during growing season or as required
		Cut grass – meadow grass in and around basin	Half yearly: before nesting season in spring and in autumn
		Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Occasional Maintenance	Reseed areas of poor vegetation growth	Annually, or as required
		Prune and trim trees and remove cuttings	As required
		Remove sediment from pre-treatment system when 50% full	
	Remedial Actions	Repair erosion or other damage by reseedling or re-turfing	As required
		Realign the rip-rap	
		Repair or rehabilitate inlets, outlets and overflows	
		Rehabilitate infiltration surface using scarifying and spiking techniques if performance deteriorates	
		Relevel uneven surfaces and reinstate design levels	

SuDS Element	Maintenance		
	Activity	Required Action	Typical Frequency
Permeable Paving	Monitoring / Inspections	Initial inspection	Monthly for three months after installation
		Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 hours after large storms in first six months
		Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
		Monitor inspection chambers	Annually
	Regular Maintenance	Brushing and vacuuming -standard cosmetic sweep over whole surface	Once a year after autumn leaf fall
		Rubbish and litter removal	As required
	Remedial Actions	Remediate any landscaping which through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving.	As required
		Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	
		Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required

Table 7.1: SuDS Maintenance Strategy

Effective SuDS design must assess all foreseeable risks during construction and maintenance. These must be mitigated during the detailed design stages where effective design will aim to avoid, reduce and mitigate risks.

This process will also require input from the principal contractor who will ensure the construction of SuDS components are carried out in a safe and sustainable manner.

8 Foul Water Assessment

As outlined in Section 2.1, it is assumed that there is no private drainage that serves the existing site. Therefore, the foul water drainage from the site is proposed to connect to the public foul water sewer located in Hollands Lane via gravity.

All proposed networks will be designed to Adoptable Standards as outlined in the Design and Construction Guidance (Appendix C of the Sewerage Sector Guidance in relation to the adoption of sewerage assets) (DCG) and in accordance with Build Regulations Part H.

The proposed peak foul water flows from the site are calculated using the figure of 4000 l/dwelling/day as outlined in the DCG.

The development will include the construction of 82 residential dwellings which, assuming a total gravity connection, equates to a potential proposed peak foul water flow of:

$$82 \text{ dwellings} \times 4000 \text{ l/dwelling/d} = 3.8 \text{ l/s}$$

A 'Pre-development Enquiry' will be submitted to Southern Water to confirm capacity exists within the receiving public sewers.

A Section 106 application will be made to the Water Authority for consent to connect to the public sewer.

9 Water Neutrality Assessment

9.1 Introduction

This section aims to calculate the water demand for the proposed development and provide measures to ensure that the proposals will have no impact on Southern Water's existing potable water infrastructure.

9.2 Background

The proposed development is a retirement community of up to 72 units of accommodation and up to 10 starter homes with associated community facilities including medical centre and on-site laundry and catering facilities. New potable water mains will be required to serve the proposed development.

9.3 Baseline Calculations

The water consumption rate for the existing situation is 0 litres/year as the site is undeveloped.

9.4 Proposal Demand

An accommodation schedule is not yet available as the application is outline. Therefore, it has been assumed that the development will consist of three-bedroom dwellings in order to estimate the baseline water consumption, as follows:

82 dwellings: $82 \times 2.47 \text{ occupants} \times 135 \text{ l/person} = 27,343 \text{ litres}$

Therefore, the proposed development requires 27,343 litres/day or 9,980,159 litres per year.

9.5 Water Reduction Measures

Water efficient and smart metering devices will be provided, aiming to reduce the water consumption of the development to 85 litres/person/day. Using the local authority's occupancy data, the proposed developments total occupancy was calculated as 202.5. Therefore, the proposed development will require 17,216 litres/day or 6,283,804 litres/year after introducing water efficient and smart metering devices.

A rainwater harvesting tank is proposed to be located in the rear garden of each of the dwellings. Horsham District Council guidance on water neutrality states that 24% of water in the home is used for flushing the toilet and 4% is used externally in the garden. Assuming that approximately 12% of water is used by washing machines, the total percentage of water that can be provided by recycled water is 40% which equates to 6,886 litres/day or 2,513,522 litres/year. Therefore, the volume of potable water required for the proposed development will be reduced to 10,330 litres/day or 3,770,282 litres/year.

9.6 Offsetting measures

Offsetting measures will be required to reduce water consumption on other land and property in order to achieve water neutrality. Local organisations, housing associations, businesses, churches and charities will be approached to explore options for water offsetting schemes. Typical options include:

- Donate/pay a fee to a housing association to retrofit their homes or existing businesses.
- Fixing leaks over and above planned work by water companies.
- Retrofitting school buildings or local hotels to improve water efficiency.
- Retrofitting water reuse schemes such as in public buildings or schools or private institutions like hotels in the area.
- Installing smart meters (above what was already planned by water companies) can also help encourage water saving behaviours and provide information on how much water is being used.

Details of offsetting agreements will be confirmed at planning condition stage once the development has been designed in detail.

9.7 Conclusion

The development will achieve water neutrality through a range of measures including fitting water efficient devices, harvesting and reusing rainwater, and offsetting measures to reduce water consumption on other land and property in the area.

10 Conclusions

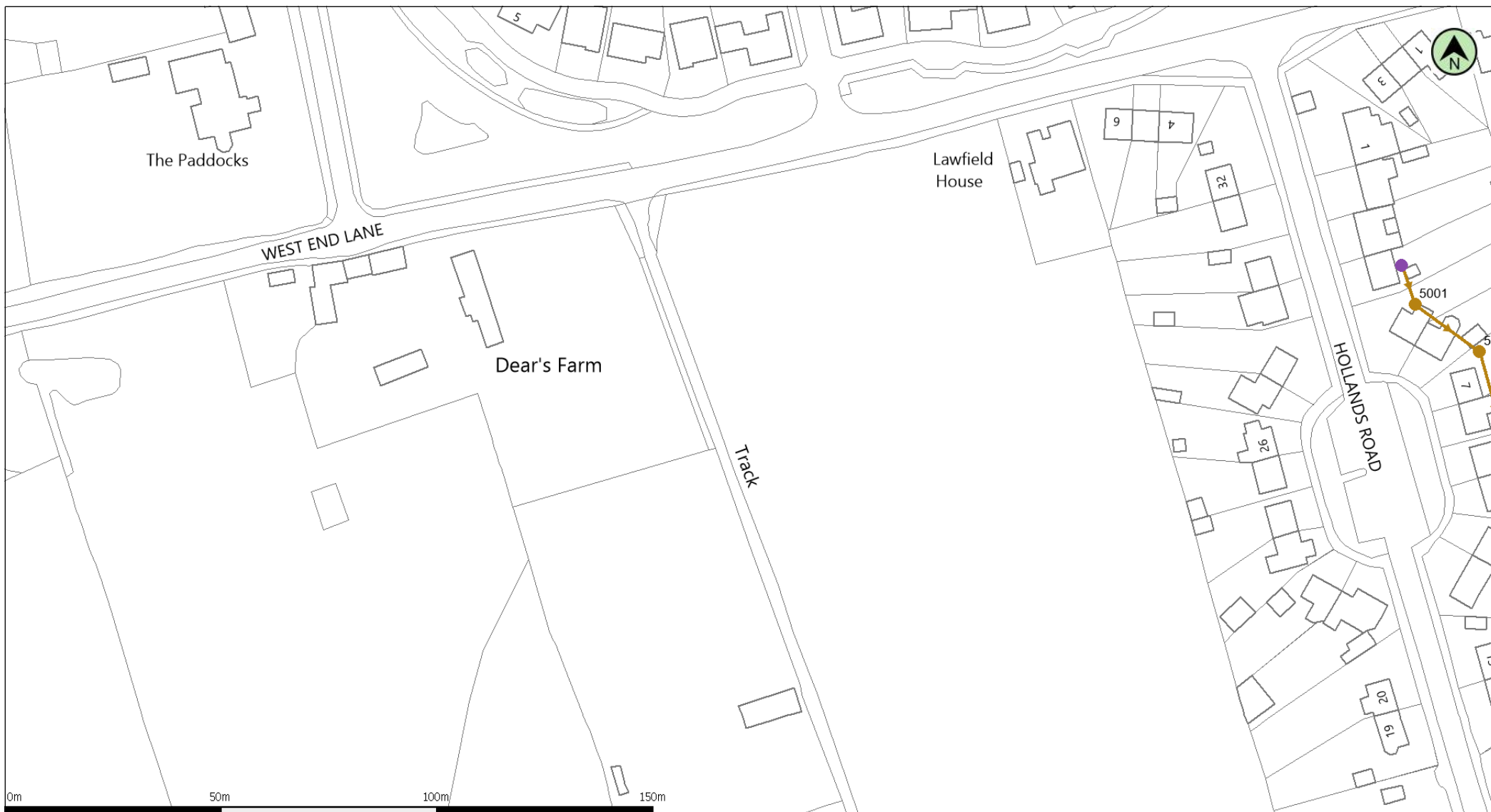
- The site is located off West End Road, within West Sussex County Council and Horsham District Council. The full site address is Sandgate Nurseries, West End Lane, Henfield, Horsham, West Sussex, BN5 9UL. The OS grid reference is 520425 X, 116061 Y.
- The development proposals comprise of the erection of a continuing care retirement community of up to 72 units of accommodation and up to 10 starter homes with associated community facilities including medical centre and on-site laundry and catering facilities, with access, infrastructure, open space, landscaping and associated works (all matters reserved except for access).
- The EA's flood map for planning shows that the site is located in Flood Zone 1 and is at very low risk of flooding (less than 0.1% annual probability of river or sea flooding).
- The development is considered to be at very low risk of flooding from groundwater, surface water, reservoirs and sewers.
- The surface water drainage strategy includes shallow permeable paving for all driveways. The remainder of the hardstanding areas are to be separated into three catchments based on the existing site levels. Each catchment is proposed to discharge into an infiltration basin that comprises of a below ground soakaway beneath. The infiltration basins and soakaways are designed to accommodate the 1 in 100 year plus 45% climate change storm event.
- The foul water drainage from the site is proposed to connect to the public foul water sewer located in Hollands Lane via gravity.

Appendix A

Topographical Survey

Appendix B

Southern Water Sewer Records



(c) Crown copyright and database rights 2022 Ordnance Survey 100031673

Date: 18/08/22

Scale: 1:1250

Map Centre: 520408,116070

Data updated: 21/07/22

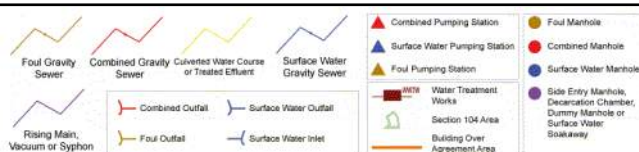
Our Ref: 929279 - 2

Wastewater Plan A4

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2022 Ordnance Survey 100031673. This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

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



nauvinen@pricemyers.com

30512 Sandgate Nur2





(c) Crown copyright and database rights 2022 Ordnance Survey 100031673 Date: 18/08/22 Scale: 1:1250 Map Centre: 520423,115883 Data updated: 21/07/22 Our Ref: 929279 - 1 Wastewater Plan A4

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2022 Ordnance Survey 100031673 .This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

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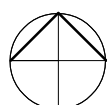
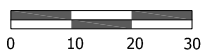
nauvinen@pricemyers.com

30512 Sandgate Nur1



Appendix C

Proposed Development Plans



**SANDGATE NURSERIES,
WEST END LANE, HENFIELD BN5 9RD**

LOCATION PLAN

Scale 1:1250 at A3

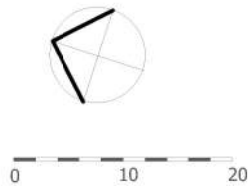
Drawing No. SNH / P23 / 01

**SANDGATE NURSERIES,
WEST END LANE, HENFIELD BN5 9RD**

PROPOSED SITE LAYOUT

Scale 1:1000 at A3

Drawing No. SNH / P23 / 02



Appendix D

Greenfield Run-off Rates

[Print](#)[Close Report](#)

Greenfield runoff rate estimation for sites

www.uksubs.com | Greenfield runoff tool

Calculated by: Tom Spawton

Site name: Sandgate Nurseries

Site location: Henfield

Site Details

Latitude: 50.93084° N

Longitude: 0.28774° W

Reference: 3485491075

Date: Jan 27 2023 17:04

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

Runoff estimation approach **IH124**

Site characteristics

Total site area (ha): 3.8

Methodology

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

SPR estimation method: Calculate from SOIL type

Soil characteristics

SOIL type: 3 3

HOST class: N/A N/A

SPR/SPRHOST: 0.37 0.37

Hydrological characteristics

SAAR (mm): 809 809

Hydrological region: 7 7

Growth curve factor 1 year: 0.85 0.85

Growth curve factor 30 years: 2.3 2.3

Growth curve factor 100 years: 3.19 3.19

Growth curve factor 200 years: 3.74 3.74

Notes

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

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

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

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

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

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

Greenfield runoff rates

Q_{BAR} (l/s): 12.93 12.93

1 in 1 year (l/s): 10.99 10.99

1 in 30 years (l/s): 29.74 29.74

1 in 100 year (l/s): 41.25 41.25

1 in 200 years (l/s): 48.36 48.36

Appendix E

Infiltration Test Results

Site : Sandgate Nurseries

Client : Solve Planning

Engineer: Land Science

Job Number
LS6786

Sheet
1 / 3

Location	Date	Level	Location
TP01	06/03/2023		

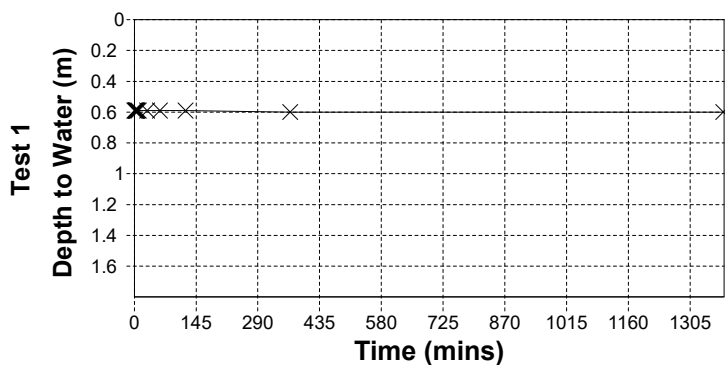
Pit Width (m)	0.40
Pit Depth (m)	1.80
Pit Length (m)	1.50

Soil type at test level
Groundwater
Drain discharge depth
Sidewall stability
Stone filled or open pit

	1
Effective depth (m)	1.21
Volume outflowing between 75% & 25% (m3)	
Mean surface area through which outflow occurs (m2)	
Time for outflow between 75% & 25% (min)	
SOIL INFILTRATION RATE (ms⁻¹), f	Test Failed

Remarks

Elapsed time (mins)	Depth to Water Test 1
0	0.59
2	0.59
3	0.59
4	0.59
5	0.59
6	0.59
7	0.59
10	0.59
30	0.59
60	0.59
120	0.59
366	0.60
1383	0.60



Site : Sandgate Nurseries

Client : Solve Planning

Engineer: Land Science

Job Number
LS6786

Sheet
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Location	Date	Level	Location
TP02	06/03/2023		

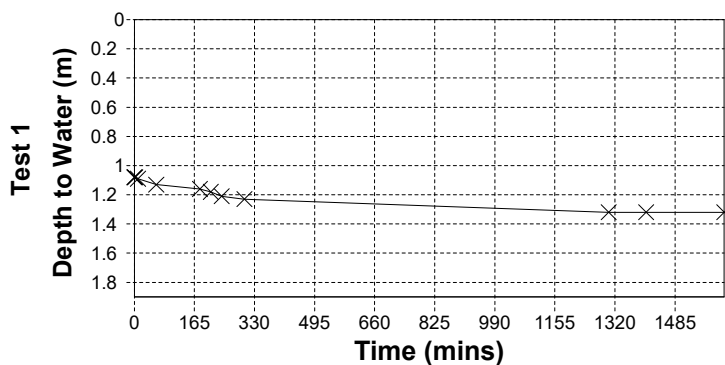
Pit Width (m)	0.40
Pit Depth (m)	1.90
Pit Length (m)	1.50

Soil type at test level
Groundwater
Drain discharge depth
Sidewall stability
Stone filled or open pit

	1
Effective depth (m)	0.82
Volume outflowing between 75% & 25% (m3)	
Mean surface area through which outflow occurs (m2)	
Time for outflow between 75% & 25% (min)	
SOIL INFILTRATION RATE (ms⁻¹), f	Test Failed

Remarks

Elapsed time (mins)	Depth to Water Test 1
0	1.08
1	1.08
2	1.08
10	1.09
60	1.13
180	1.16
210	1.18
240	1.21
302	1.23
1303	1.32
1406	1.32
1620	1.32



Site : Sandgate Nurseries

Client : Solve Planning

Engineer: Land Science

Job Number
LS6786

Sheet
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Location	Date	Level	Location
TP03	06/03/2023		

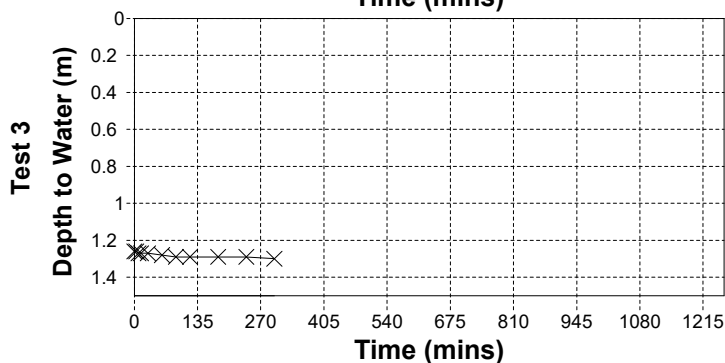
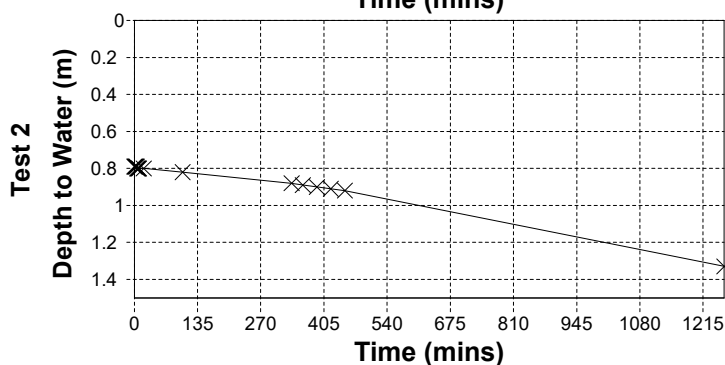
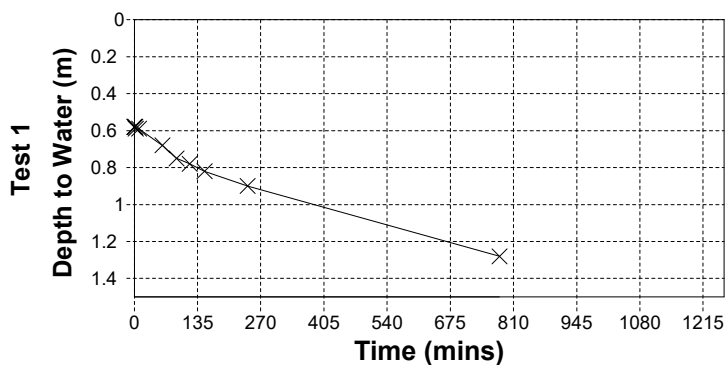
Pit Width (m)	0.40
Pit Depth (m)	1.50
Pit Length (m)	1.90

Soil type at test level
Groundwater
Drain discharge depth
Sidewall stability
Stone filled or open pit

	1	2	3
Effective depth (m)	0.92	0.71	0.24
Volume outflowing between 75% & 25% (m3)	0.35	0.27	
Mean surface area through which outflow occurs (m2)	2.88	2.39	1.31
Time for outflow between 75% & 25% (min)	623.84	701.34	
SOIL INFILTRATION RATE (ms-1), f	3.24E-6	2.68E-6	

Remarks

Elapsed time (mins)	Depth to Water Test 1	Depth to Water Test 2	Depth to Water Test 3
0	0.58	0.79	1.26
1	0.58	0.79	
2	0.58	0.79	
3	0.59	0.79	
4		0.79	1.26
5		0.79	
6		0.80	
7		0.80	
8		0.80	
9		0.80	1.27
10	0.59	0.80	
14			1.27
20		0.80	
29			1.27
59			1.28
60	0.68		
89			1.29
90	0.75		
103		0.82	
118	0.78		
119			1.29
150	0.82		
179			1.29
239			1.29
242	0.90		
299			1.30
336		0.88	
360		0.89	
390		0.90	
420		0.91	
450		0.92	
780	1.28		
1260		1.33	



Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.10	Dark brown, slightly clayey SILT. (TOPSOIL)		
					0.10 0.20	Light brown, slightly grey, slightly clayey, slightly sandy SILT. Sands are fine to medium. (HEAD DEPOSITS)		
					0.30	Golden brown, slightly sandy, silty CLAY. Sands are fine to medium. (HEAD DEPOSITS)		
					(1.20)			
					1.50	Complete at 1.50m		
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								

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Appendix F

Below Ground Drainage Layout



NOTES :

- This drawing is to be read in conjunction with all relevant Architect's, Engineer's and specialists' drawings and specifications.
- Do not scale from this drawing in either paper or digital form. Use written dimensions only. To check that this drawing has been printed to the intended scale this bar should be 50mm long @ A1 or 25mm long @ A3.
- Health & Safety :
All specific drawing notes are to be read in conjunction with the project "Information Pack" and "Site Rules".



DRAINAGE KEY	
	Permeable Paving
	Catchment 1
	Catchment 2
	Catchment 3
	Detention Basin
	Attenuation Tank

DRAINAGE LEGEND	
Site Boundary	
Existing Rising Main	
Existing Foul Sewer	

P02	20.04.23	TS	TS	Revised following infiltration testing
P01	27.01.23	SE	YA	Issued for Information
Rev	Date	Drawn	Eng	Amendment

SANDGATE NURSERIES
HENFIELD

BELOW GROUND
DRAINAGE LAYOUT

Status
FOR INFORMATION
NOT FOR CONSTRUCTION

Drawn	SE	Eng	YA
Scales	1:500 at A1	1:1000 at A3	
Drawing No	30512/6000	Rev	P02

**PRICE &
MYERS**

Consulting Engineers
37 Alfred Place
London
WC1E 7DP
020 7631 5128
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Appendix G

Hydraulic Calculations

Price & Myers		Page 1
37 Alfred Place London WC1E 7DP	Sandgate Nurseries Henfield	
Date 21/04/2023 12:15 File Whole site - 11 l.s.srcx	Designed by Tom Spawton Checked by	
Innovyze Source Control 2018.1		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	13.971	0.471	11.0	470.9	O K
30 min Summer	14.137	0.637	11.0	636.9	O K
60 min Summer	14.317	0.817	11.0	817.1	O K
120 min Summer	14.492	0.992	11.0	991.9	O K
180 min Summer	14.590	1.090	11.0	1090.3	O K
240 min Summer	14.655	1.155	11.0	1155.0	O K
360 min Summer	14.732	1.232	11.0	1232.0	Flood Risk
480 min Summer	14.770	1.270	11.0	1270.0	Flood Risk
600 min Summer	14.787	1.287	11.0	1286.5	Flood Risk
720 min Summer	14.790	1.290	11.0	1289.9	Flood Risk
960 min Summer	14.773	1.273	11.0	1273.0	Flood Risk
1440 min Summer	14.716	1.216	11.0	1216.1	Flood Risk
15 min Winter	14.029	0.529	11.0	528.6	O K
30 min Winter	14.215	0.715	11.0	715.2	O K
60 min Winter	14.419	0.919	11.0	919.3	O K
120 min Winter	14.617	1.117	11.0	1116.7	O K
180 min Winter	14.729	1.229	11.0	1228.9	Flood Risk
240 min Winter	14.804	1.304	11.0	1303.9	Flood Risk
360 min Winter	14.896	1.396	11.0	1395.7	Flood Risk
480 min Winter	14.944	1.444	11.0	1443.8	Flood Risk
600 min Winter	14.968	1.468	11.0	1467.8	Flood Risk
720 min Winter	14.977	1.477	11.0	1477.1	Flood Risk
960 min Winter	14.969	1.469	11.0	1469.3	Flood Risk
1440 min Winter	14.899	1.399	11.0	1398.9	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	141.636	0.0	456.8	26
30 min Summer	96.164	0.0	619.9	41
60 min Summer	62.307	0.0	834.7	70
120 min Summer	38.527	0.0	1032.0	130
180 min Summer	28.787	0.0	1155.4	188
240 min Summer	23.320	0.0	1246.2	248
360 min Summer	17.228	0.0	1376.4	366
480 min Summer	13.828	0.0	1466.4	484
600 min Summer	11.628	0.0	1532.2	604
720 min Summer	10.078	0.0	1580.3	722
960 min Summer	8.020	0.0	1626.0	936
1440 min Summer	5.772	0.0	1569.2	1156
15 min Winter	141.636	0.0	512.1	26
30 min Winter	96.164	0.0	691.6	40
60 min Winter	62.307	0.0	935.0	70
120 min Winter	38.527	0.0	1154.8	128
180 min Winter	28.787	0.0	1291.7	186
240 min Winter	23.320	0.0	1391.5	244
360 min Winter	17.228	0.0	1531.3	360
480 min Winter	13.828	0.0	1620.9	476
600 min Winter	11.628	0.0	1673.0	590
720 min Winter	10.078	0.0	1688.5	702
960 min Winter	8.020	0.0	1668.7	922
1440 min Winter	5.772	0.0	1598.1	1314

Price & Myers		Page 2
37 Alfred Place London WC1E 7DP	Sandgate Nurseries Henfield	
Date 21/04/2023 12:15 File Whole site - 11 l.s.srcx	Designed by Tom Spawton Checked by	
Innovyze Source Control 2018.1		

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 520350 115600 TQ 20350 15600
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	1440
Climate Change %	+45

Time Area Diagram

Total Area (ha) 1.815

Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)
0	4	0.605	4	8	0.605	8	12	0.605

Price & Myers		Page 3
37 Alfred Place London WC1E 7DP	Sandgate Nurseries Henfield	
Date 21/04/2023 12:15 File Whole site - 11 l.s.srcx	Designed by Tom Spawton Checked by	
Innovyze	Source Control 2018.1	

Model Details

Storage is Online Cover Level (m) 15.000

Tank or Pond Structure

Invert Level (m) 13.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1000.0	1.500	1000.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0145-1100-1500-1100	
Design Head (m)	1.500
Design Flow (l/s)	11.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	145
Invert Level (m)	13.500
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	11.0	Kick-Flo®	0.939	8.8
Flush-Flo™	0.442	11.0	Mean Flow over Head Range	-	9.6

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)	Depth (m)	Flow (l/s)
0.100	5.2	0.800	10.1	2.000	12.6	4.000	17.5	7.000	22.9
0.200	9.9	1.000	9.1	2.200	13.2	4.500	18.5	7.500	23.7
0.300	10.7	1.200	9.9	2.400	13.7	5.000	19.5	8.000	24.4
0.400	11.0	1.400	10.6	2.600	14.3	5.500	20.4	8.500	25.2
0.500	10.9	1.600	11.3	3.000	15.3	6.000	21.3	9.000	25.9
0.600	10.8	1.800	12.0	3.500	16.4	6.500	22.1	9.500	26.5