SUDS DRAINAGE

(Sustainable Water Management)

Conditions Discharge Report

Condition 12 of approved planning: 77319/APP/2023/1106
Extension to existing dwelling to create additional dwelling

London Plan (March, 2021) Policy SI.13 SUDS Compliant

AT

2 Colbrook Avenue, Hayes, UB3 1TG

June 2024

Ark Environmental Consultancy Ltd

Table of Contents

If this report has been released electronically, the appendices referred to herein can be found in the annexed zip folder/s as .pdf or .dwg files. If this report has been released in hard copy the appendices will be bound into the back of this report. Plans may be annexed separately as A1 or A0 copies where a bound-in A3 copy is not appropriate.

Contents

1.0 Scope

This report contains the details of a SUDS Drainage Strategy for Conditions Discharge carried out by Ark Environmental Consulting Limited ("ARK Ltd") for 2 Colbrook Avenue, Hayes, UB3 1TG, henceforth referred to as "the site" in this report.

This report has been prepared for H J UK PROPERTY LTD and must not be relied upon by any other party without the explicit written permission of ARK Ltd.

All parties to this report do not intend any of the terms of the Contracts (Right of Third Parties Act 1999) to apply to this report.

Please note this report does not purport to provide definitive legal advice nor can it be used to demonstrate that the site will never flood in the future or provide exact specifications / warranties for the products used.

2.0 Introduction

The information source used to undertake this FRA & SUDS / Drainage Strategy has been collected from the following sources:

- British Geological Survey Website & iGeology App
- EA Website & Data
- London Borough of Hillingdon Strategic Flood Risk Assessment
- London Borough of Hillingdon Preliminary Flood Risk Assessment
- London Borough of Hillingdon SUDS Guidance and Policies
- London Plan SUDS Policies
    - London Plan SUDS compliant for Plan Policy SI.13
- Internet mapping and searches

3.0 Existing Site, Drainage and Greenfield Rates

3.1 Site Status

The site location is provided in Appendix A.

The site is currently occupied by an existing dwelling (donor site) and a large part impermeable part porous overgrown rear garden / soft landscaping.

The donor and new dwelling site would be c. 230.0m2 each.

The area of actual works for the extension (new dwelling) is c. 95m2 including the proposed permeable front garden.

There are no existing SUDS on the site. There is an existing connection to the sewers with a manhole located within the site; the sewer in the road has an invert of c. 1.2m below ground level.

Greenfield Runoff is nominal at Qbar of 0.03l/s; this is simply because the site is very small.

Furthermore:

IT IS NOT POSSIBLE FOR THE SITE TO DISCHARGE GREATER THAN 0.13 l/s EVEN IN THE 1IN200YEAR BECAUSE THIS, AS A SIMPLE FACT, IS A FUNCTION OF THE SITE BEING VERY SMALL.

A copy of the calculation output is included in Appendix C as evidence.

It is not possible to restrict discharge rates to a Qbar of this low value, or even 3 times this Qbar, which is another standard applied to larger sites.

3.2 Geology & SUDS Infiltration Viability

Based on BGS mapping and boreholes (and known area conditions) :

Bedrock: London Clay

Superficial deposits: potential for Langley Silt Member - Clay and silt

The London Clay and Langley Silt strata are not a water bearing stratum. There are no lost / underground rivers documented at the site or near the site nor identifiable by the local geology mapping.

Furthermore, given the relatively very small size of the site and proximity to other properties (achieving the 5.0m distance from footprint and 2.0m distance from borders would not be feasible), the SUDS strategy necessarily needs to be storage on site with restricted discharge to sewer.

No infiltration testing or BRE365 tests are required and it is an appropriate risk management strategy to design the SUDS as if infiltration were not feasible in order to oversize the SUDS storage as a worse case.

There is an existing connection to the sewer hence a viable discharge point is confirmed and an alternative method does not require additional assessment.

3.3 SUDS Hierarchy: Connections to Discharge

- Soakaways are not feasible (as above Section 3.4
- There are no rivers of seas to connect to adjacent or within easy reach of the site
- The only viable option is the available sewer network
- The scheme is an extension of an existing dwelling which is connected to the Thames Water sewer network and is in an area of London where all properties are connected to the sewer.
- **The only, proven viable and highest form of connection for surface water discharge is the Thames Water Sewer.**

3.4 Planning Stage Approval

The scheme is an approved new dwelling with maximised porous and permeable areas.

“Erection of a two storey side extension to facilitate the creation of a two-bedroom dwellinghouse with front porch, alterations to existing boundary wall, provision of car and cycle parking, bin storage, subdivision of amenity space and associated landscaping.”

There are existing manholes for the existing property which will either be connected by modifications to for the new dwelling or a new manhole will be added in accordance with Thames Water and Building Regulations design requirements (all standard).

So it is unequivocal:

- The scheme includes a maximisation of porous / permeable areas based on the site constraints and the constrained nature of the site for where the building has been approved
- The permeable / porous amenity area provides the required source control for existing, proposed and greater than proposed impermeable areas
- The scheme includes oversized SUDS storage at the permeable front garden area
- No additional landscaping information is required for the SUDS strategy
- The SUDS will store on site for 100% of the 1in100year+40%cc scenario
- The scheme includes the following SUDS:
    - Rain Gardens: surface storage no maintenance SUDS
    - Water Butts with overflow to:
    - Permeable paving (“Source Control”)
    - Granular storage system, lined and with connection to an approved specification of connection to

the sewer
    - Given the size of the site: it is impossible for the site to discharge greater than the 1.0l/s
- This is compliant with the planning condition as per Waltham Forest and London Plan requirements

The scheme results in a betterment and reduces flood risk posed from the infrastructure to surrounding properties also.

3.5 Note on Drainage Rates Building Regs Part H and BS EN 752-4

The joint DEFRA/EA R&D rainfall runoff management for developments Report-SC030219 states that

"a practicable minimum limit on the discharge rate from a flow attenuation device is often a compromise between attenuating to a satisfactorily low flow rate while keeping the risk of blockage to an acceptable level. This limit is set at 5 litres per second, using an appropriate vortex or other flow control device".

Technology has indeed moved on and there are manufacturers providing improved flow control devices since the DEFRA/EA report was published, permitting flows lower than 5 l/sec through their devices without increasing the flood risk from blockages.

Drainage rates are a function of the size of the site, rainfall inputs, nature of the site and the likely coefficients / geology, etc.

It is impossible for this site based on the function of the size to discharge even close to 1.0 l/s in the 1in200year event.

Thus, this and other very small sites (single dwelling plots usually) will have a maximum feasible discharge rate significantly lower than the lowest allowed restriction rate; this is a fact and is controlled by the official guidance. That is why a pragmatic sustainable response is required.

In accordance with Building Regs Part H, for surface water drainage, a self-cleansing velocity of 0.7 l/sec must be maintained in all pipes and all pipes sizes are required to be of a minimum pipe size of 75mm. Thus, peak flow rates lower than 3 l/sec will fail to meet BS EN 752-4 and/or the Building Regulations Part H requirements.

The reason for the Building Regs and BS is simple: "mitigate at source" and "design out the risk" i.e. it is logical to not design modern systems with pipes / restriction devices that could be too easily blocked over time as these will cause greater risks of flooding and make any expensive and heavily engineered SUDS schemes totally pointless.

4.0 Planning Conditions: Surface Water SUDS Designs

4.1 Connections

The existing surface water / combined sewer in London Road is to be used but with the betterment as per above and detailed below.

As per confirmation of the existing manhole invert level:

- Ground and upper levels (rainwater downpipes) to be gravity drained
- All connections, pipe materials / sizes / falls as per Building Regs

Refer to Appendix B SUDS Drainage Layouts for pipe connections.

4.2 SUDS Calculations

Calculations were prepared based on the Micro Drainage software package to assess the size of structure required for the appropriate amount of impermeable areas, climate change and size the storage based on a 1.0 l/s restriction.

Assume for the calculations 100% of the site not just the amount of impermeable areas.

- Likely impermeable areas as a result of the scheme: < 85m2 given the front and rear garden are to be retained and majority porous / permeable
- Regardless, assume 100% of the 230m2 area of the site

- Assume 65% of the total area
- This is a 30% oversizing
- This demonstrates the scheme will therefore be accommodating for more impermeable area than the proposed in total
- Compliant with London Plan Policy SI.13
- Design event for storage - 100 year (with climate change; see below)
- Climate change allowance - 40%
- Max. residual Discharge rate – 2.0 l/s for storage sizing
    - No formal restriction device is considered necessary for this site given the small size and the fact that all the pipe sizes need to be larger for Building Regs
    - The storage in itself is sufficient to restrict the discharge
    - However, if required by Building Regs, a suitably designed orifice plate could be used, but this would require additional maintenance / more engineered approaches
    - In any case, it is not suitable for a smaller restriction as this would potentially be a future flood risk in itself because the size of aperture required is very small; there are other products on the market, but from practical experience, these have not been proven to be robust
    - Some councils in fact do not allow for restriction below 3.0 l/s for this reason

- **IT IS NOT POSSIBLE FOR THE SITE TO DISCHARGE GREATER THAN THE LOWEST RESTRICTION FEASIBLE, BECAUSE THIS, AS A SIMPLE FACT, IS A FUNCTION OF THE SITE BEING VERY SMALL (SEE THE GREENFIELD CALCS)**
    - Lowest suitable discharge rate achieved: size of impermeable areas is very small and the SUDS store on site for 100% of the 1in100year+40%cc
    - The calculation output is included within Appendix C.
    - **Storage required: 2.0m3**

4.3 SUDS Specifications

The SUDS storage have been allocated to maximise surface storage and Source Control measures.

Formal SUDS Type	Source Control	Dimensions	Storage Volume
Rain Garden in Front Planted Area with raised perimeter Front Rainwater Downpipe with diverter	YES	2.4m by 0.8m = 1.6m2 Use a 0.2m raised perimeter / kerb edged = 0.384m3	0.384m3
Permeable Paving in front garden Large exclusion zone for excavated SUDS due to Root Protection Zone	YES	n/a	n/a
Cellular Storage Front Rainwater pipe to connect via rain garden / permeable paving then to cellular storage	YES	2.0m by 2.0m by 0.4m depth = 1.6m3 Assume 95% void ratio = 1.52m3	1.52m3
Granular Storage Rear Patio with non return valve on IC Lined under the rear permeable paving	YES	3.5m by 1.8m with 0.2m depth = 1.26m3 Use 30% void space 0.378m3	0.378m3
		Total	2.282m3 Greater than the 2.0m3 requirements including for 40% climate change and storing for the 1in100year for 100% of the site

- The **total void space** is accommodated in the calculations by applying only a 30% void space for Type 3 granular angular no fines storage

The SUDS drainage layout plan included within Appendix D shows locations for the SUDS structures.

Inverts and Connections

Front Granular Storage:

- The rear patio needs to be the shallowest
- This has a 0.1m makeup (see the EA Specification)
- This has 200mm depth of storage
- Hence the invert of SW01 manhole of 0.3m is appropriate

Rear Granular Storage

- The front cellular storage is the deepest at 0.4 depth
- Assume a 300mm cover make-up and requirement to be deeper to accept the discharge from the rear of the house
- This is 700mm depth
    - Hence the invert of SW04 Manhole of 1.1m depth is appropriate
    - This is still above the existing sewer invert level hence gravity drainage is confirmed

Thames Water can confirm their preference for the connection as part of the Building Regs inspection sign off and enabling works stage.
It will not alter this drainage strategy given the existing connection.

- If the existing connection is found to be appropriate it will be re-used.
- If it is not, a new one will be created in accordance with Thames Waters designs, guidance and using their preferred contractor as is standard.

Note of SUDS Hierarchy for clarity

The SUDS approach has been approved on similar schemes based on the very small size of the site, the site specific flood and geology conditions and scheme specifics.

With respect to other SUDS techniques, the proposed building will have a pitched roof which would not be suitable for the use of a sedum, blue or green roof but given the ability to incorporate other suitable SUDS high up in the hierarchy, this is no necessary. Whilst internal rainwater harvesting is not proposed, it is recommended that rainwater pipes are fitted with water butts wherever feasible. Whilst the use of water butts won't reduce the design criteria of the receiving below ground drainage system, their use will reduce the time of entry and provide a supply of water for irrigation.

It will be necessary for the surface water drainage system to comply with the Environment Agency's pollution prevention guidance:

- Roof run-off is classified as uncontaminated and, in accordance with EA pollution prevention guidance, will not require any treatment.
- Any surface water run-off draining through the raingarden, permeable paving and granular material will receive an adequate level of filtration through the associated substrate.

4.4 Maintenance

With respect to maintenance, the proposed SUDS techniques should be maintained in accordance with the appropriate regimes set out within the SUDS manual and the manufacturers guidance and will be the responsibility of the owner / management company.

- The specifications have been deliberately chosen to be low maintenance, resilient and easy to access inspect & clean.

A SUDS maintenance schedule is included within Appendix E.

4.5 How scheme reduces Potable Water Use

See Appendix D

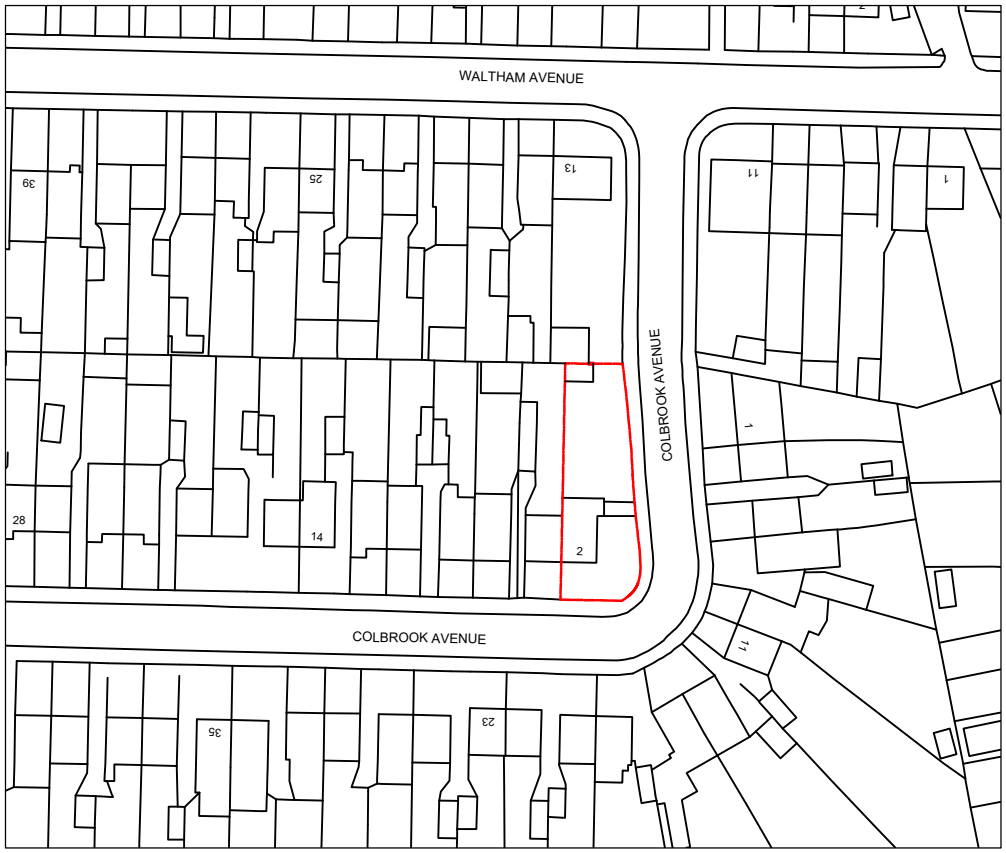
The scheme incorporates a rainwater butt with diverter from the rear RWP incorporated into the cycle storage area; this is all part of the SUDS approach also.

The exact specification of the butt and diverter will be a client decision and given the plethora of off the shelf specifications, further assessment is not considered necessary.

The scheme also includes a rain garden which will therefore make the front planting (species chosen deliverately) be more self-irrigating using the RWP diverter.

APPENDICES

APPENDIX A



LOCATION PLAN

1 : 1250 SCALE

0m 10m 20m 30m 40m 50m 60m 70m 80m 90m 100m

SCALE @ 1:1250

NOTES :

	Date	Revisions

SJR DESIGN LTD.

(ARCHITECTURAL DESIGN & CONSULTANT)

Client: MR. JAGTAR SINGH

Job Title

2 COLBROOK AVENUE
HAYES
UB3 1TG

Drawing Title

LOCATION PLAN

Scale: 1 : 100 (A4)

Date: MARCH 2023

Checked by: | Drawn by: RS

Drg No. TP/466/NH01

Rev.

COLBROOK AVENUE

EXISTING CROSSOVER

EXISTING CROSSOVER

COLBROOK AVENUE

NO. 2

NO. 4

EXISTING CROSSOVER

EXISTING SITE PLAN

SCALE - 1:200

COLBROOK AVENUE

EXISTING CROSSOVER

EXISTING CROSSOVER

FRONT SPACE -44m²

FRONT SPACE -34.5m²

Lockable cycles x 8 units

SIDE SPACE -15m²

NO.2A

NO. 2A

NO. 2

AMENITY SPACE -90.0m²

AMENITY SPACE -157.0m²

NO. 4

NEW 1.8m HIGH TIMBER FENCE

EXISTING CROSSOVER

PROPOSED SITE PLAN

SCALE - 1:200

0m 5m 10m 15m 20m

SCALE @ 1:200

NOTES :

N

A	SEP 2023	PLANTING DETAILS ADDED AND LANDSCAPING REVISED
	Date	Revisions

SJR DESIGN LTD.
(ARCHITECTURAL DESIGN & CONSULTANT)

Client: MR. JAGTAR SINGH

Job Title

2 COLBROOK AVENUE
HAYES
UB3 1TG

Drawing Title

EXISTING AND PROPOSED SITE PLANS

Scale: 1 : 200 (A3)

Date: MARCH 2023

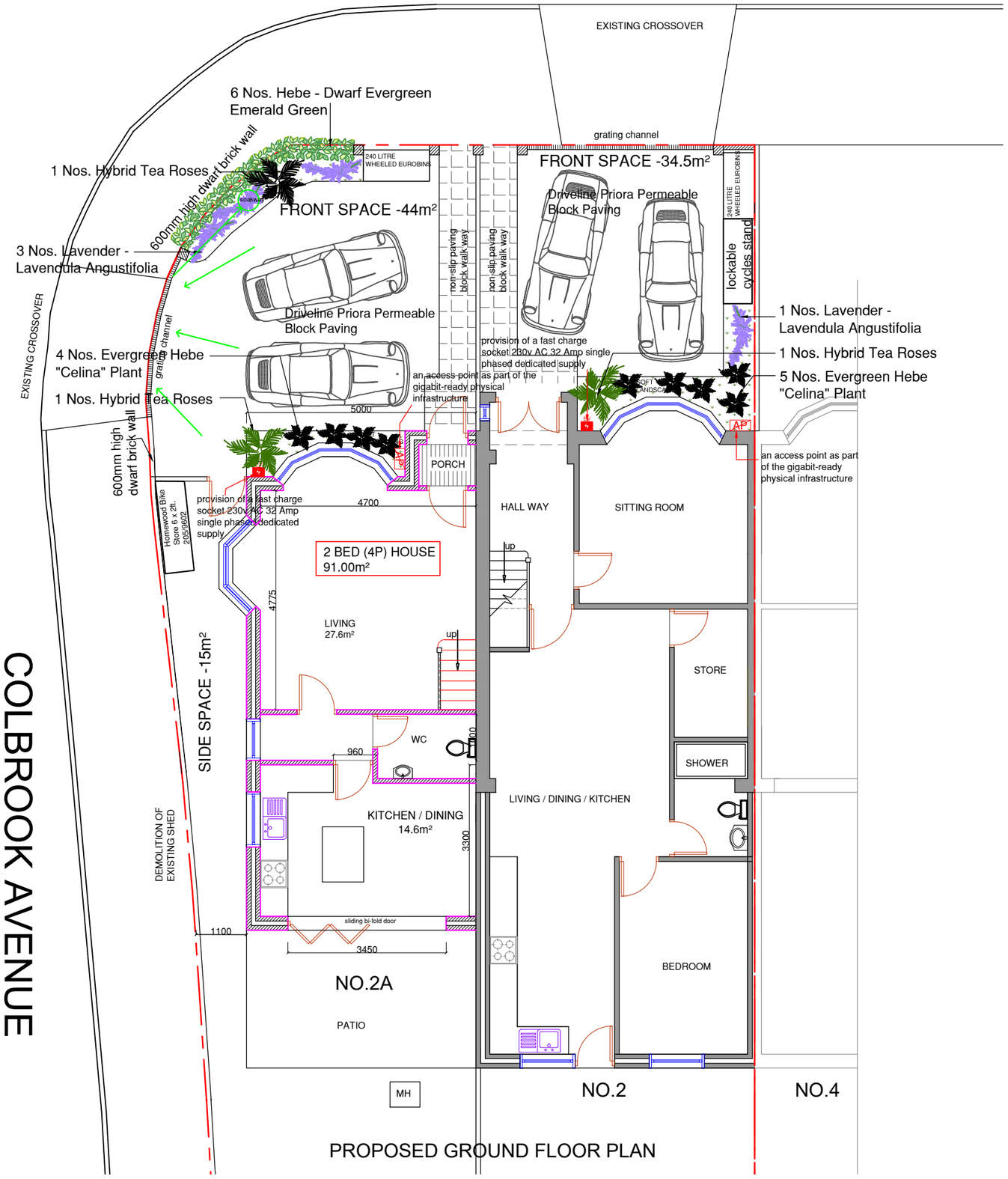
Checked by: | Drawn by: RS

Drg No. TP/466/NH02

Rev. A

APPENDIX B

COLBROOK AVENUE



PROPOSED GROUND FLOOR PLAN

PLANTING SCHEDULE

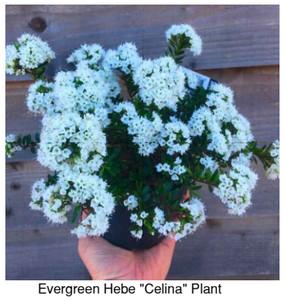
SPECIES	POT SIZE	QUAN-TITY	HEIGHT (M)	SPREAD (M)	RECOMMENDED MIM. DENSITY
LAVENDER - LAVENDULA ANGUSTIFOLIA	5L	4	0.1-0.5	0.1-0.5	3-4 p/m
HYBRID TEA ROSES Colour Red, Orange, Red, Pink, Blue	5L	2	0.6 -0.8	0.3-0.4	N/A
HEBE - DWARF EVERGREEN EMERALD GREEN	2-3L	6	0.1-0.5	0.1-0.5	3-5 p/m
EVERGREEN HEBE "CELINA" PLANT		9	0.1-0.3	0.1-0.4	

NOTE : ALL PLANTS TO BE PLANTED DURING THE FIRST PLANTING SEASONS AND IN ACCORDANCE WITH PLANTING INSTRUCTION FOR EACH SPECIES.

1.8M HIGH TIMBER FENCE

DRIVELINE PRIORA PERMEABLE BLOCK PAVING

DRIVELINE PRIORA PERMEABLE BLOCK PAVING AND BORDER - COLOR CHARCOAL OR SIMILAR BY MARSHALLS LAYING COURSE 50MM DEPTH OF 6MM CLEAN CRUSHED STONE AND SUB BASE 200MM DEPTH OF 20MM CLEAN CRUSHED STONE WITH WELL DEFINED EDGES. THE SURFACE WATER FROM CHANNEL DRAIN TO DISCHARGE INTO A SOAK AWAY LOCATED WITHIN THE SOFT LANDSCAPING AREA AND NOT INTO THE SURFACE WATER OR FOUL WATER SEWER.


Evergreen Hebe "Celina" Plant


Hybrid Tea Roses


Hebe - Dwarf Evergreen Emerald Green


Lavender - Lavendula Angustifolia

0m 1m 2m 3m 4m 5m

SCALE @ 1:100

NOTES :

2 BED (4P) HOUSE
91.00m²

N

	Date	Revisions

SJR DESIGN LTD.
(ARCHITECTURAL DESIGN & CONSULTANT)

Client: MR. JAGTAR SINGH

Job Title

2 COLBROOK AVENUE
HAYES
UB3 1TG

Drawing Title

PROPOSED SITE PLAN / SOFT AND HARD LANDSCAPING

Scale: 1 : 100 (A3)

Date: MARCH 2023

Checked by: | Drawn by: RS

Drg No. TP/466/NH10 | Rev.

COLBROOK AVENUE

EXISTING CROSSOVER

EXISTING CROSSOVER

COLBROOK AVENUE

NO. 2

NO. 4

EXISTING CROSSOVER

EXISTING SITE PLAN

SCALE - 1:200

COLBROOK AVENUE

EXISTING CROSSOVER

EXISTING CROSSOVER

FRONT SPACE -44m²

FRONT SPACE -34.5m²

Lockable cycles x 8 units

SIDE SPACE -15m²

NO.2A

NO. 2A

NO. 2

AMENITY SPACE -90.0m²

AMENITY SPACE -157.0m²

NO. 4

NEW 1.8m HIGH TIMBER FENCE

EXISTING CROSSOVER

PROPOSED SITE PLAN

SCALE - 1:200

0m 5m 10m 15m 20m

SCALE @ 1:200

NOTES :

N

A	SEP 2023	PLANTING DETAILS ADDED AND LANDSCAPING REVISED
	Date	Revisions

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(ARCHITECTURAL DESIGN & CONSULTANT)

Client: MR. JAGTAR SINGH

Job Title

2 COLBROOK AVENUE
HAYES
UB3 1TG

Drawing Title

EXISTING AND PROPOSED SITE PLANS

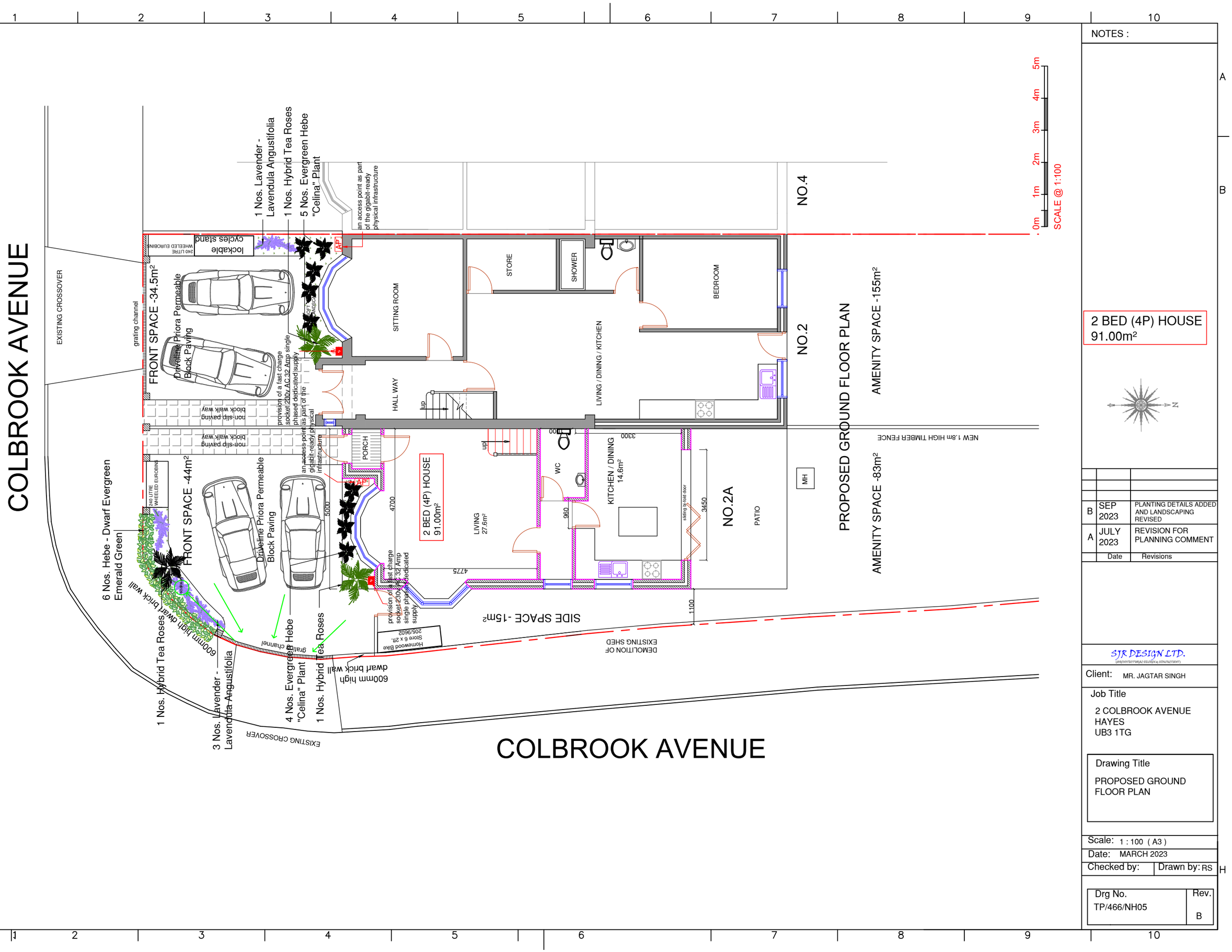
Scale: 1 : 200 (A3)

Date: MARCH 2023

Checked by: | Drawn by: RS

Drg No. TP/466/NH02

Rev. A



NOTES :

2 BED (4P) HOUSE
91.00m²

B	SEP 2023	PLANTING DETAILS ADDED AND LANDSCAPING REVISED
A	JULY 2023	REVISION FOR PLANNING COMMENT
	Date	Revisions

SJR DESIGN LTD.
(ARCHITECTURAL DESIGN & CONSULTANT)

Client: MR. JAGTAR SINGH

Job Title

2 COLBROOK AVENUE
HAYES
UB3 1TG

Drawing Title

PROPOSED GROUND FLOOR PLAN

Scale: 1 : 100 (A3)
Date: MARCH 2023
Checked by: | Drawn by: RS

Drg No. TP/466/NH05
Rev. B

APPENDIX C

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	George Locke
Site name:	2 Colbrook, UB3 1TG
Site location:	2 Colbrook, UB3 1TG

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	51.50086° N
Longitude:	0.43215° W
Reference:	1712851987
Date:	Jun 15 2024 07:02

Site characteristics

Total site area (ha):	0.023
Significant public open space (ha):	0
Area positively drained (ha):	0.023
Impermeable area (ha):	0.01495
Percentage of drained area that is impermeable (%):	65
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.02
Net impermable area for storage volume design (ha):	0.02
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	2	2
SPR:	0.3	0.3

Hydrological characteristics

	Default	Edited
Rainfall 100 yrs 6 hrs:	--	63
Rainfall 100 yrs 12 hrs:	--	97.79
FEH / FSR conversion factor:	1.27	1.27
SAAR (mm):	617	617
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.4	0.4
Hydological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 10 year:	1.62	1.62
Growth curve factor 30 year:	2.3	2.3

Design criteria

Climate change allowance factor:	1.4		Growth curve factor 100 years:	3.19	3.19
Urban creep allowance factor:	1.1		Q_{BAR} for total site area (l/s):	0.04	0.04
Volume control approach	Use long term storage		Q_{BAR} for net site area (l/s):	0.04	0.04
Interception rainfall depth (mm):	5				
Minimum flow rate (l/s):	2				

Site discharge rates

	Default	Edited
1 in 1 year (l/s):	2	2
1 in 30 years (l/s):	2	2
1 in 100 year (l/s):	2	2

Estimated storage volumes

	Default	Edited
Attenuation storage 1/100 years (m^3):	2	2
Long term storage 1/100 years (m^3):	0	0
Total storage 1/100 years (m^3):	2	2

APPENDIX D

2 Colbrook SUDS Layout

Combined Connection is the only option: hence Source Control SUDS cannot be connected directly to the sewer because of risk of surcharging foul water contaminating the SUDS storage; cellular storage however can be jetwashed. Granular storage at rear has a non return valve. TW will not allow direct / unprotected connection of Source Control SUDS at ground level to the combined sewer

Surface Water Drainage				
Manhole No.	**Invert (Metres bgl)**	**Type**	**Cover Size**	**Internal**
SW01 (new)	0.3	B	450	450
SW02 (new)	0.5	B	450	450
SW03 (new)	0.8	A	600x600	1200
SW04 (existing sewer)	1.2	n/a	n/a	n/a

Maximised Permeable & Porous areas new and retained

Red Dashed Box

Cellular Storage (Wavin or similar) with restriction device under permeable car space/ access area; store then discharge restricted rated to inspection chamber and then to sewer

See report for dimensions

Purple Dashed Line

Aco Drainage for permeable access area to communicate to SW02 and thence to cellular

Exact connections to be confirmed as part of construction site set out.

There are existing connections adjacent given the existing fully functioning site adjacent with foul and surface water connections to the sewers adjacent to the site.

RWP with Connection to granular storage

SW04

As per Building Regs connection to existing sewer

If required: Thames Water Developer Inquiry and contractor on site to confirm

MANHOLE TYPES

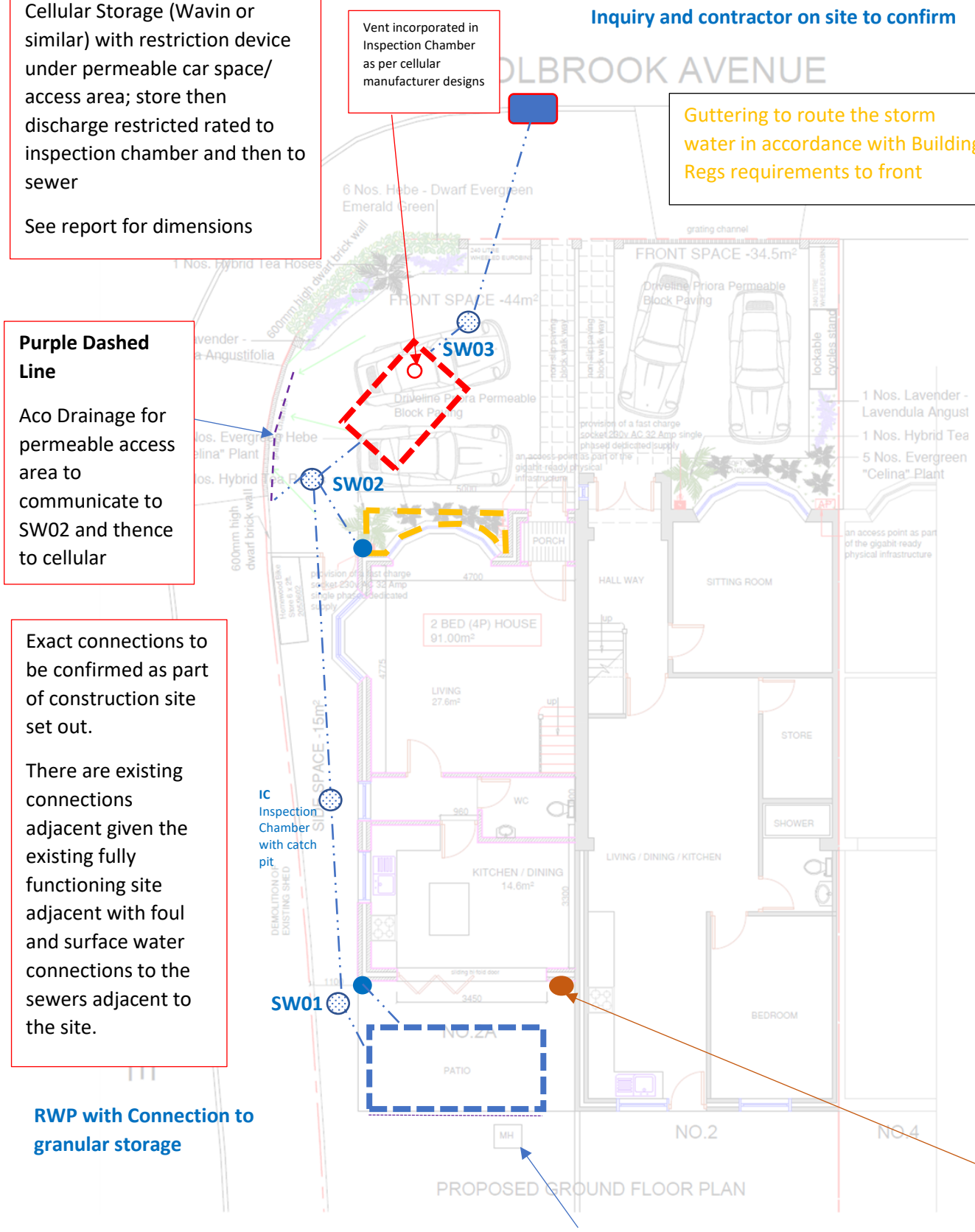
A: PC MANHOLE UNITS TO BS 5911 PART 200 KITE MARKED

B: POLYPROPYLENE INSPECTION CHAMBER-450 dia

POLYPROPYLENE INSPECTION CHAMBERS TO BE MANUFACTURED BY HEPWORTH OR SIMILAR APPROVED

All downpipes and gulleys to be roddable

Note: surface and foul water combined manhole existing connection inverts to be confirmed so levels can be finalised



Online lined granular storage to EA specification and installation, bedded, surrounded and backfilled as recommend by contractor:

Use EA specification guidance (see Appendix B) and as per the additional specification in Appendix B also

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/7728/pavingfrontgardens.pdf

Refer to the SUDS report for the dimensions

RWP with Diverter to Rain Garden and Direct Connection to Granular Storage

Existing foul manhole and pipe connections not compromised by surface water infrastructure

Rainwater Butt (off the shelf decision of client) with overflow discharge to the permeable patio / granular storage

Blue Dashed Box (additional Source Control)

Lined granular storage under patio; store then discharge to SW01 and to cellular (due to combined final connection) and thence sewer

See report for dimensions

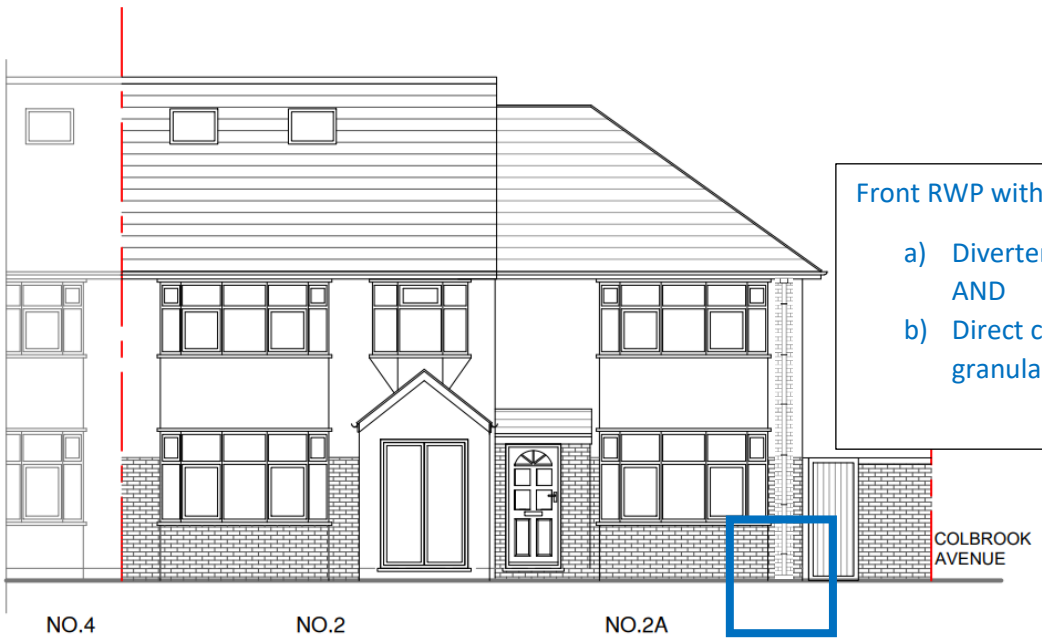
Surface Water pipes: 100mm diameter
Main communication pipes: 1in 100 fall (Building regs and contractor to conform on site)
Minor branches of RWP to storage adjacent = can be 1 in 50 fall
Pipes: choice of exact specification to be by contractor / Building Regs and British Standards requirements

2 Colbrook SUDS Layout

Must be read in conjunction with SUDS report for condition discharge

Formal SUDS Type	Source Control	Dimensions	Storage Volume
Rain Garden in Front Planted Area with raised perimeter Front Rainwater Downpipe with diverter	YES	2.4m by 0.8m = 1.6m2 Use a 0.2m raised perimeter / kerb edged = 0.384m3	0.384m3
Permeable Paving in front garden Large exclusion zone for excavated SUDS due to Root Protection Zone	YES	n/a	n/a
Cellular Storage Front Rainwater pipe to connect via rain garden / permeable paving then to cellular storage	YES	2.0m by 2.0m by 0.4m depth = 1.6m3 Assume 95% void ratio = 1.52m3	1.52m3
Granular Storage Rear Patio with non return valve on IC Lined under the rear permeable paving	YES	3.5m by 1.8m with 0.2m depth = 1.26m3 Use 30% void space 0.378m3	0.378m3
		Total	2.282m3 Greater than the 2.0m3 requirements including for 40% climate change and storing for the 1in100year for 100% of the site

2 Colbrook SUDS Layout



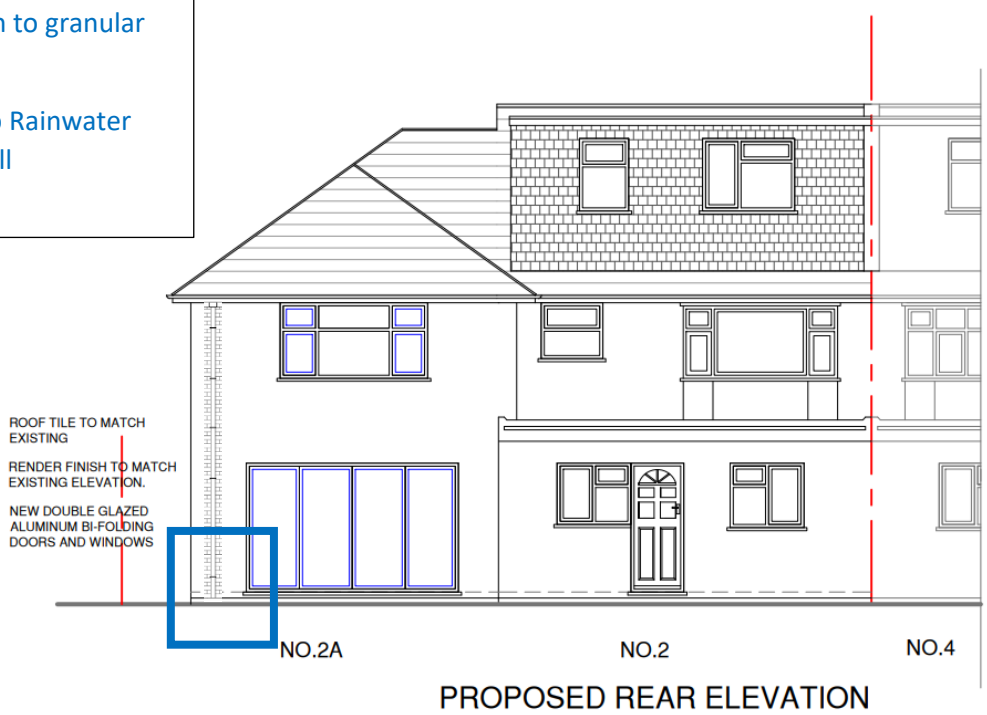
PROPOSED FRONT ELEVATION

Front RWP with:

a) Diverter to rain garden AND
b) Direct connection to granular storage

Rear RWP with direct connection to granular storage

Diverter to Rainwater Butt as well

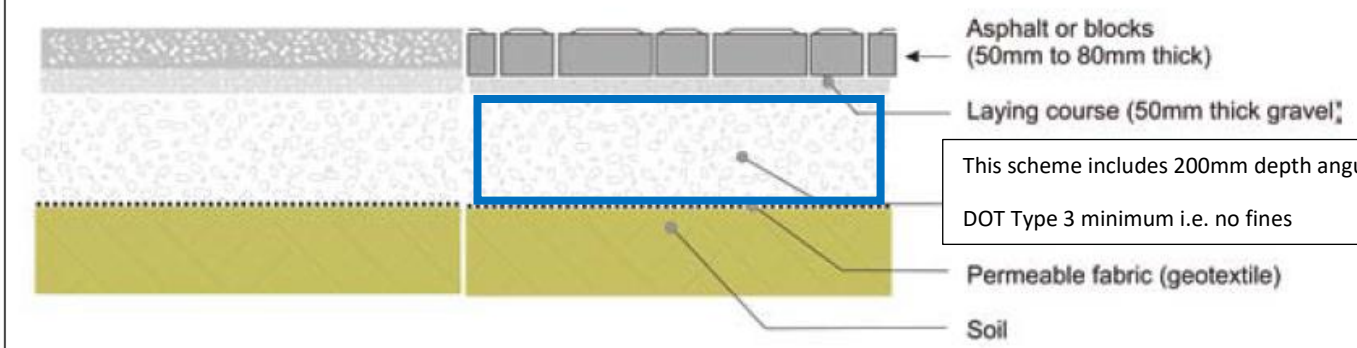


PROPOSED REAR ELEVATION

Specification to be chosen by client / contractor to integrate with cycle storage area

Hard permeable and porous surfaces

Hard surfacing which allows water to soak into it can be built with porous asphalt, porous concrete blocks, concrete or clay block permeable paving. The material has open voids across the surface of the material or around the edges of blocks that allow water to soak in. The surface is constructed over a permeable sub-base. Systems are available from a variety of manufacturers. Sources of further information are provided in Section 6.



This scheme includes 200mm depth angular granular storage

DOT Type 3 minimum i.e. no fines

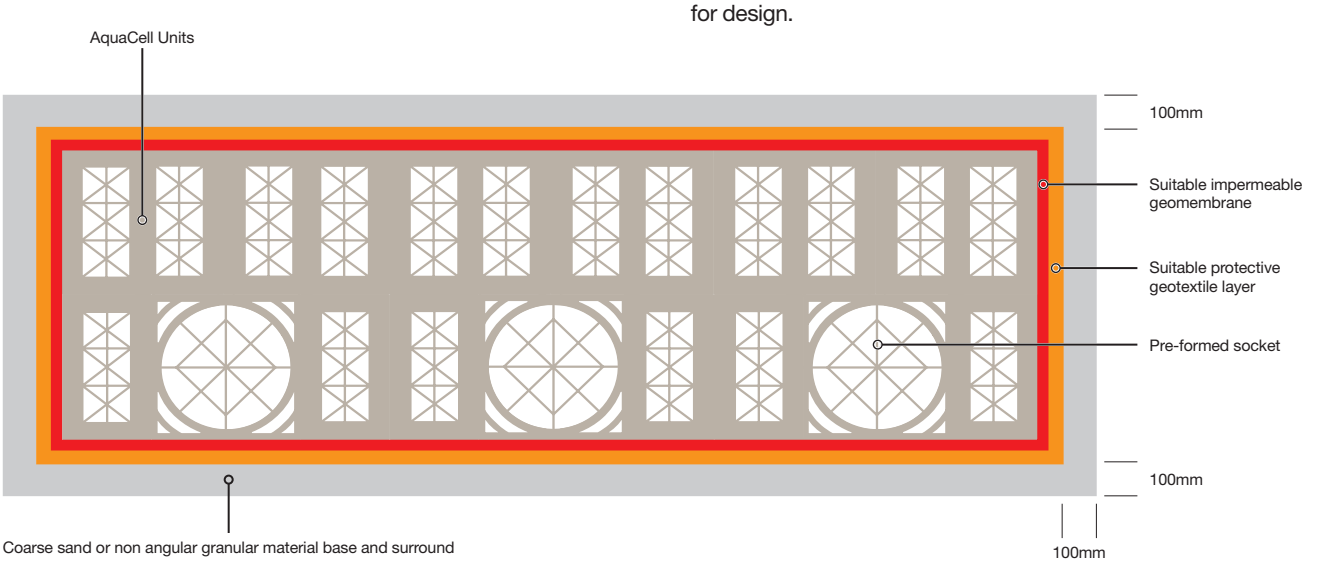
Pros	Cons
Hard and durable with a very long service life if correctly constructed	Can be more expensive than other options
Require the least amount of maintenance	Require knowledgeable contractor to construct correctly (especially porous asphalt which should be provided and laid by a specialist company)
Wide variety of shapes and colours available for concrete blocks	

Typical Storage Tank Installation Method

Typical installation procedure

1. Excavate the trench to the required depth ensuring that the plan area is slightly greater than that of the AquaCell units.
2. Lay 100mm bed of coarse sand, level and compact.
3. Lay the geotextile over the base and up the sides of the trench.
4. Lay the geomembrane on top of the geotextile over the base and up the sides of the trench.
5. Lay the AquaCell units parallel with each other. In multiple layer applications, wherever possible, continuous vertical joints should be avoided. AquaCell units can be laid in a 'brick bonded' formation (i.e. to overlap the joints below) – see page 18. For single layer applications use the AquaCell Clips and for multi layers use the AquaCell Clips and the AquaCell Shear Connectors (vertical rods).
6. Wrap the geomembrane around the AquaCell structure and seal to manufacturers recommendations.*
7. If side connections into the AquaCell units is required, (other than the preformed socket), use the appropriate Flange Adaptor (6LB104 or 6LB106). Fix the flange adaptor to the unit using self-tapping screws. Drill a hole through the Flange Adaptor and connect the pipework. (6LB106 should not be used with AquaCell Eco).
8. In order to prevent silt from entering the tank, clogging inlet pipework and reducing storage capacity, it is recommended that the Domestic Silt Trap (6LB300) or the standard Silt Trap (6LB600) is installed prior to the inlet pipework – see page 22 for installation guidelines.
9. Wrap and overlap the geotextile covering the entire AquaCell structure, to protect the geomembrane.
10. Lay 100mm of coarse sand between the trench walls and the AquaCell units and compact.
11. Lay 100mm bed of coarse sand over the geotextile and compact. Backfill with suitable material. .

NB: A storage tank must be vented, and it is recommended that one vent pipe, 110mm in diameter is provided per 7,500 square metres of impermeable catchment area on a site, see page 22 for design.



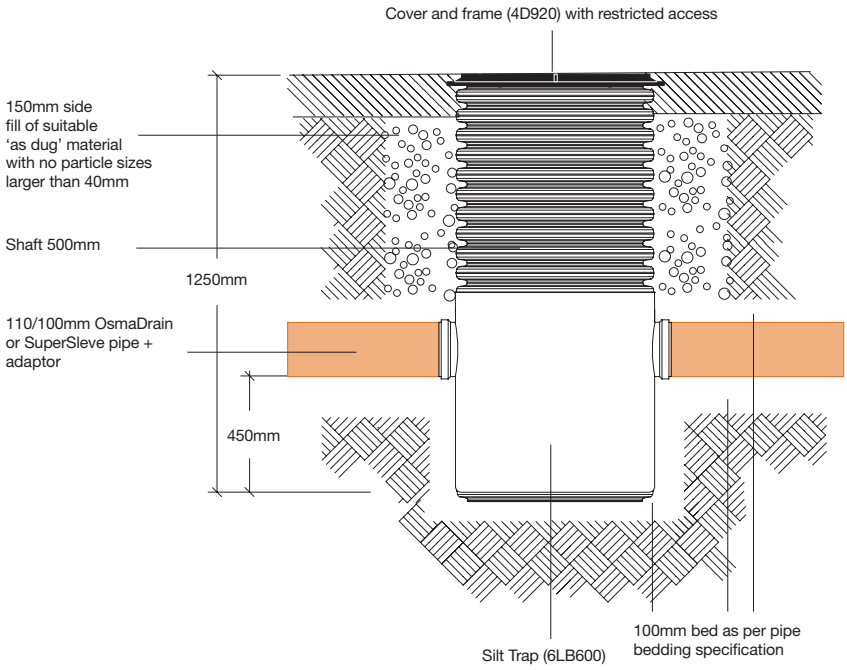
Example shows the use of AquaCell Prime. However, a storage tank can also be installed as shown using any of the other versions of AquaCell units (Eco, Core or Plus) as appropriate.

**For large scale, deep installations a 1mm thick geomembrane is recommended and joints should be sealed using proprietary welding techniques. For further details contact Wavin Technical Design.*

Installation
AquaCell Units

Silt Trap and Air Vent Termination

Silt Trap

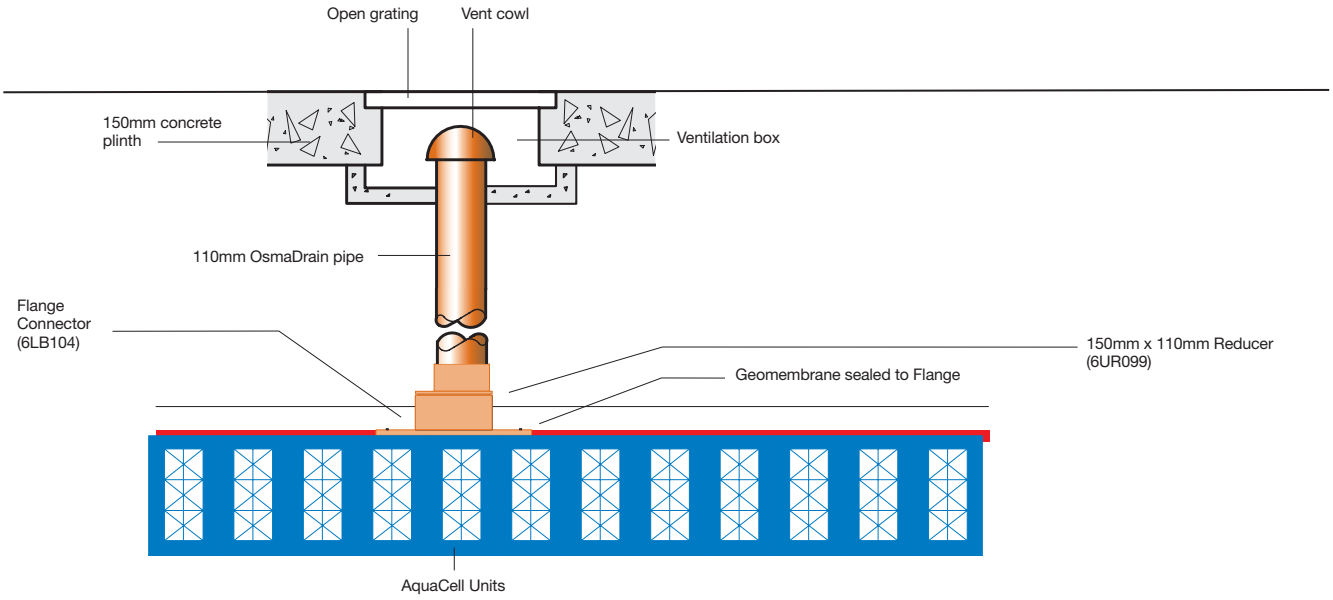


Typical installation procedure

1. Place the Silt Trap (6LB600) on a minimum of 100mm bed as per pipe bedding specification. Ensure that the trap is as close to the AquaCell unit as possible and in a suitable position to allow pipework connection.
2. Connect the relevant pipework in accordance with standard pipe installation guidelines.
3. Surround the sides of the Silt Trap with 150mm of 'as dug' material, with no particle sizes larger than 40mm.
4. Fit relevant cover and frame.

NOTE: When surrounded by a concrete plinth (150mm x 150mm) the 4D920 Cover and Frame can be used in situations with a loading of up to 50kN (5 tonne).

Typical Air Vent design



NOTE: It is recommended that all connections and air vent installations in storage applications (using geomembrane) are made using a Flange Adaptor.

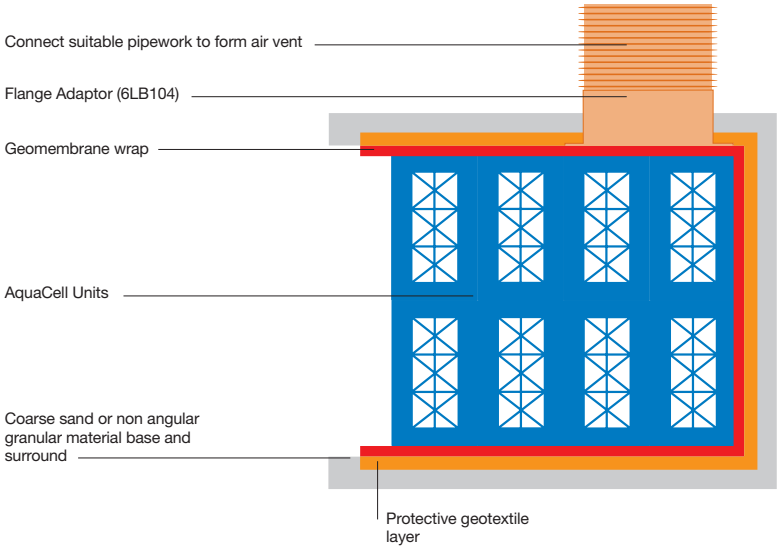
Adhesive or double sided tape should be used between the geomembrane and the flange plate to ensure a watertight seal.

NOTE: It is recommended that one vent pipe, 110mm in diameter, is provided per 7,500 square meters of impermeable catchment area on a site. Please contact Wavin Technical Design for further details.

Typical Details
AquaCell Units

Top Connection for Air Vent

Connect into the top of the AquaCell unit, using Flange Adaptor.

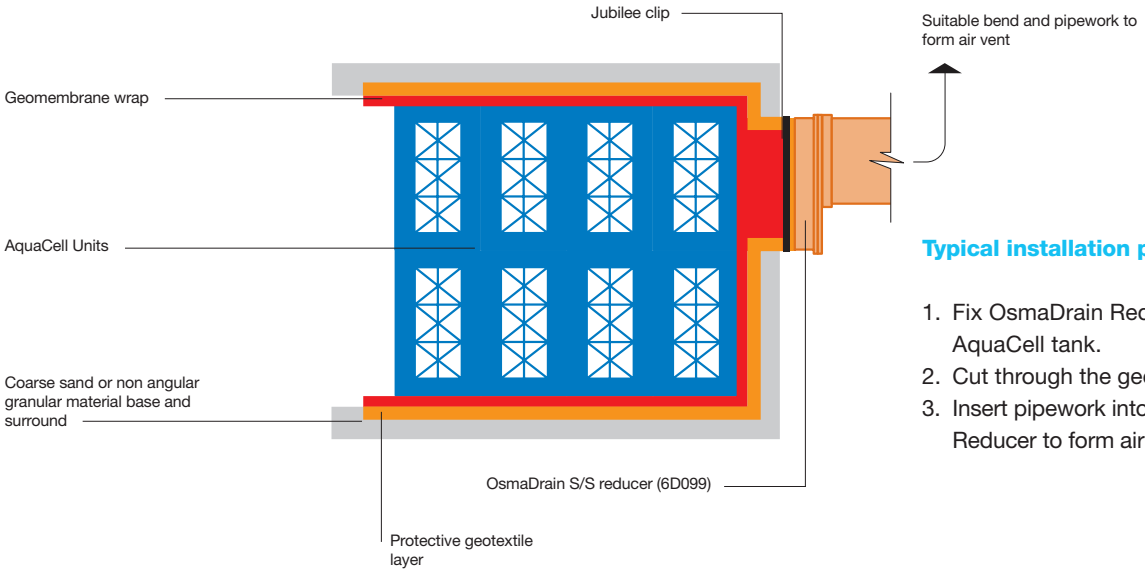


Typical installation procedure

1. Fix Flange Adaptor to the AquaCell unit with self tapping screws.
2. Cut through the geomembrane.
3. Insert pipework into Flange Adaptor to form air vent.

Side Connection for Air Vent

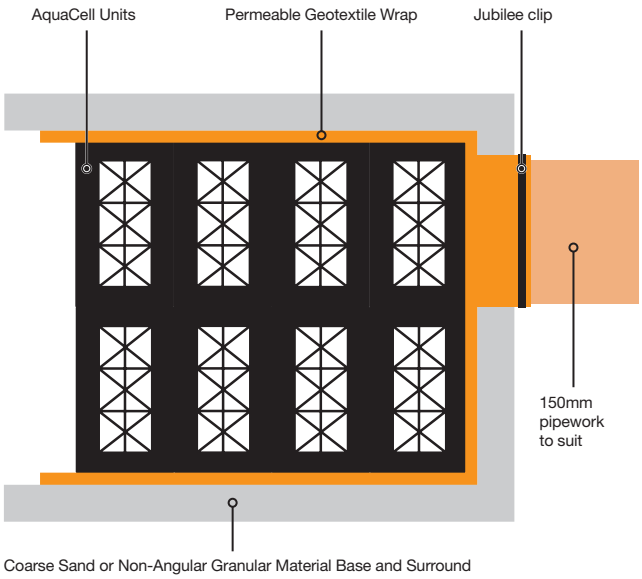
Connect into the side of the AquaCell tank unit using standard Reducer.



Typical installation procedure

1. Fix OsmaDrain Reducer to the AquaCell tank.
2. Cut through the geomembrane.
3. Insert pipework into OsmaDrain Reducer to form air vent.

Typical Details
AquaCell Units

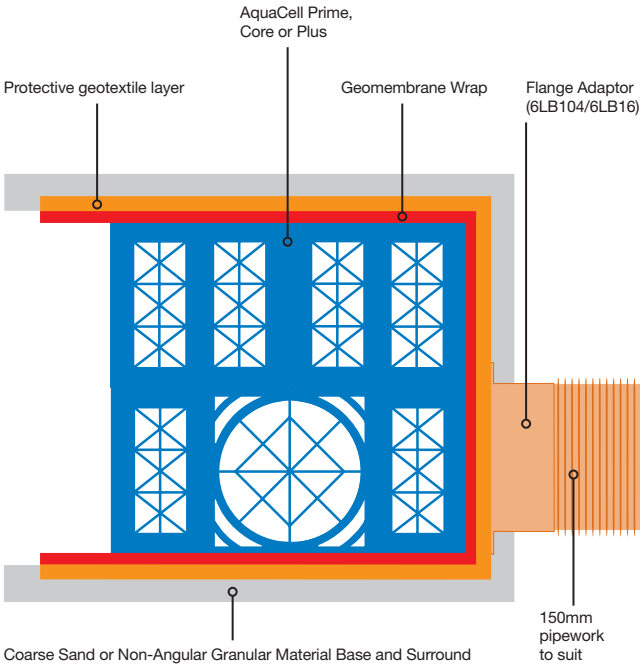


Connections to AquaCell Units

Connection for soakaway application using either the pre-formed socket (as shown below) or standard adaptors into pre-formed socket*.

*NOTE: For pipework other than 160mm OsmaDrain, these adaptors can be used to connect to the following:

- 6TW141: TwinWall S/S Adaptor connects to 150mm TwinWall
- 6D099: OsmaDrain Adaptor connects to 110mm OsmaDrain
- 4D916: OsmaDrain PE Adaptor connects to 160mm OsmaDrain
- 6UR141: UltraRib S/S Adaptor connects to 150mm UltraRib
- 6D129: OsmaDrain S/S Adaptor connects to 150mm SuperSleve clay. (Use an appropriate reducer, as required, e.g. 6D099)



Connection for storage application using Flange Adaptor at points other than pre-formed socket, (for AquaCell Prime, Core or Plus).

Installation procedure

1. Fix Flange Adaptor to the AquaCell unit with self tapping screws.
2. Cut through the geomembrane.
3. Insert pipework into Flange Adaptor.

*NOTE: AquaCell Eco is not suitable for side connection using a Flange Adaptor.

APPENDIX E

SUDS Maintenance Schedule

Installation	Maintenance Required	Frequency	Responsibility
Granular Attenuation: rear pation	No maintenance required	No maintenance required	No maintenance required
Permeable Paving / Rain Garden / Diverter (incl. associated distribution pipework and inspection chambers) Non return valve on granular storage IC	Inspection, debris removal and jetting Diverter to be maintained as per Manufacturer Guidance	Typically, inspection is recommended annually or after a severe or significant storm event, with any jetting/cleaning being carried out as necessary.	Estate/Building Management Company
Cellular storage under front parking Wavin specification (or similar) Restriction device as required	Inspection, debris removal and jetting Cellular to be maintained as per Manufacturer Guidance	Typically, inspection is recommended annually or after a severe or significant storm event, with any jetting/cleaning being carried out as necessary.	Typically, inspection is recommended annually or after a severe or significant storm event, with any jetting/cleaning being carried out as necessary.