Cowan Consultancy
STRUCTURAL, CIVIL AND BUILDING CONSULTANTS

BITTERNE PARISH CHURCH
WHITES ROAD, BITTERNE, SOUTHAMPTON
SO19 7NP

SuDS MAINTENANCE & MANAGEMENT PLAN

For:
IMPERIAL HOMES

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DOCUMENT CONTROL

Project: Bitterne Parish Church, Whites Road, Bitterne, Southampton, SO19 7NP

Proposed Development Site at Bitterne Parish Church

Document: SuDS Maintenance and Management Plan

Client: Imperial Homes

Reference: HS/456146/tb

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Document Checking:

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For and on behalf of
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Approved by:

TIMOTHY BUTTON

For and on behalf of
Cowan Consultancy Limited

Table of Contents

1. Introduction

1.1. This document has been prepared by Cowan Consultancy Limited (CCL) on behalf of Imperial Homes for the proposed Development Site at Bitterne Parish Church, Whites Road, Bitterne, Southampton, SO19 7NP.

1.2. This document sets out the proposals for the disposal of surface water runoff for the development, highlighting the principles for the long-term management and maintenance of the proposed surface water strategy through the provision and incorporation of Sustainable Urban Drainage Systems (SuDS) in an environmentally friendly manner, to prevent, control, and minimise, as reasonably practicable, the negative effects of runoff flows onsite.

1.3. The purpose of this document is to ensure that the Management Company and/or homeowner entrusted with the inspection and maintenance of the SuDS will adopt the measures and programme set in this document to ensure the optimum operation of the surface water drainage network. The SuDS are to be continuously maintained over the lifetime of the development to prevent the increased risk of flooding both on and off site.

1.4. The guidance notes hereby provided, have been comprised of and are directly referenced from the latest technical SuDS guidance within the CIRIA C753 Report *The SuDS Manual* (2015) and other applicable guidance. This document sets out specific sections applicable to the relevant SuDS type itemising:

1.4.1. A description of the SuDS component and its use;
1.4.2. The maintenance requirements and frequencies; and
1.4.3. The inspection requirements and frequencies.

1.5. The activities listed are generic to the relative SuDS types and represent the minimum maintenance and inspection requirements, however additional tasks or varied maintenance frequency may be instructed by the maintenance company as required. Rubbish and debris removal is also an integral part of SuDS maintenance, especially with regards to surface features and the reduction of the risks of inlet and outlet blockages.

1.6. Specific maintenance needs of the SuDS elements should be monitored and maintenance schedules adjusted to suit requirements.

1.7. All those responsible for maintenance should follow relevant health and safety legislation for all activities listed within this report (including lone working, if relevant) and risk assessments should always be undertaken.

1.8. This report is to read in conjunction with CCL drawings '*456146-201P1 (Drainage GA 1of 3)'*, '*456146-202P1 (Drainage GA 2 of 3)', '456146-203P1 (Drainage GA 3 of 3)'*which regards the overall Drainage Infrastructure Layout for the site, and '*456146-204P (Standard Details 1 of 2)' (Storm Drainage)*', '*456146-205P (Standard Details 2 of 2)'*, which regards the standard details for both surface and foul water drainage.

1.9. There are three categories of maintenance activities referred to in this report:

1.9.1. ***Regular maintenance*** (including inspections and monitoring) – consisting of basic tasks done on a frequent and predictable schedule, including inspections and monitoring, silt or oil removal if required more frequently than once per year, vegetation management, rubbish and debris removal, and sweeping of surfaces. Regular maintenance/inspections of SuDS will help to:

a) determine optimum future maintenance;
b) establish ongoing hydraulic, water quality, amenity performance of the system; and
c) allow for the identification of potential performance failures, such as blockage, reduced infiltration and poor water quality resulting from lack of maintenance.

1.9.2. ***Occasional maintenance*** – comprising tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the routine tasks such as sediment management/removal; and

1.9.3. ***Remedial maintenance*** – comprising of intermittent tasks that may be required to rectify faults associated with the system, although the likelihood of faults can be minimised by regular and adequate maintenance activities. Remedial maintenance is likely to comprise of activities such as:

a) erosion repairs which can include inlets and outlets;
b) reinstatement or realignment of edgings, barriers, rip-rap or other erosion control;

c) infiltration surface rehabilitation;

d) replacement of blocked filter materials/fabrics;

e) construction stage sediment removal (although this activity must be undertaken from early construction stages and during construction period); and

f) system rehabilitation (although unlikely) immediately following a pollution event.

1.9.4. Remedial activities are not expected to be required for all systems, however, for the purpose of estimating whole life maintenance costs, a contingency sum of 15–20% should be added to the annual regular and occasional maintenance costs to cover the risk of these activities being required. Where remedial work is found to be necessary, it is likely to be due to site-specific characteristics or unforeseen events, and as such timings are difficult to predict.

1.10. After construction, and during the first year of operation inspections should usually be carried out at least monthly to all types of SuDS, and after significant storm events, to ensure that the system is functioning as designed and that no damage is evident. Adherence to the guidance hereby provided will safeguard the SuDS scheme and ensure that suitable measures are incorporated within scheme for the submission and approval of the local planning authority.

1.11. Upon completion of the development, a management company will be formed, with residents of the development comprising the board of directors. The management company will appoint a manging company (Oyster Estates) who will be responsible for maintaining all communal aspects of the development, including SuDS. The obligations of the management company will be funded by an annual contribution from the residents of the development. This manual will form part of the brief provided to the management company, who will use it to calculate fees which will be paid by residents.

2. SuDS Layout and Design

SuDS are an environmentally friendly approach to managing rainfall through the use of landscape features to conceal the surface water and its surroundings. The use of SuDS aims to locally control flow volumes and the frequency of water leaving a development area. When associated with relevant

components to intercept silt and remove TSS, Metals and Hydrocarbons, their use helps to prevent pollution and cleanse the runoff, improving water quality.

SuDS are also responsible for providing attractive built environment surroundings that promote promotes biodiversity, create opportunities for wildlife and local habitats, enhancing the visual character of developments whilst providing resilience and adaptability for the future. Hence, the SuDS components at Bitterne Parish Church site were designed to cater for the surface runoff of the site, preventing flood onsite and adjacent areas, through the underground discharge of drainage systems.

There are four main SuDS components incorporated within the surface water drainage strategy:

- Soakaways
- Permeable Paving
- Rainwater Harvesting tank

2.1. The **Soakaways** – will be scattered onsite and only used to cater for the surface water of the roofs. Located at a minimum 5 metres away from foundations on rear gardens wherever possible and within the access road where this is not possible (plots 6-7 and 14), this SuDS system will incorporate a minimum 100mm thick bed and surround filter media to ensure that adequate treatment is provided to the surface water runoff, prior to infiltration. This SuDS component allows for the required design storage of 1 in 100 year storm event, including 45% climate change allowance (CCA) as required by current regulations.

2.1.1. Drainage will be carried via drain pipes connected to inspection chambers incorporating silt trap and subsequently to the soakaways;

2.1.2. Storage will be provided by Polypipe Permavoid PVPP15 for soakaways located within the access road, and Polypipe Polystorm PSM1 or AquaCell Core Stormwater units (or similar approved voided and specification units) on rear gardens, and discharge via infiltration to ground, by stormwater crate units with a minimum 95% void ratio;

2.1.3. To prevent sedimentation within the soakaways, silt traps will be incorporated to inspection chambers preceding the soakaway to collect suspended solids;

2.1.4. Overflow from storms in excess of 1 in 100 year, including 40% CCA, will be catered via overflow drainage pipes connecting the soakaways to the surface (gardens and road make-up).

2.2. **Permeable Paving** – (permeable tarmac and block paving) is to be installed with a tanked waterproof boundary due to the low permeability of the top soil strata and incorporation of the soakaways in the road. This drainage system will be utilised to drain the access roads on site and the permeable paving parking bays. The attenuation of this system including the calculated depth of voided storage will provide adequate surface water treatment levels as detailed within the drainage assessment report. Flows from the permeable pavement, including overflow from 1 in 100 year storm plus 45% CCA, will be directed to the and the incorporated cellular units allow regulated discharge.

2.2.1. Drainage will be carried via road and parking spaces surface directly to the underlying road and car park sub-base makeup;

2.2.2. Storage will be provided through the gravel makeup of the permeable paving filtration system, including the calculated depth of voided storage as detailed within the drainage assessment report, and directed to the localised infiltration/soakaway area systems;

2.2.3. Although up to 20mm of flood water displacement is expected in some rear gardens in the occasion of an exceptional rainfall, this SuDS system will be able to cater for approximately 38.93m^3 of additional surface water flows.

2.3. The **rainwater harvesting tank** will be a water butt tank and rainwater harvesting system. It will take the form of an above ground tank with a pumped system to collect the storm water and to pump to the harvested water usage positions.

2.4. The **Exceedance flow 'Channel' route** – this feature have been provided to cater for exceptional rainfall or the occasion of extreme weather / flash flood event. This is required to ensure that surface water from the development site are kept within the site boundaries and directed to a site specific location within the amenity area. This will allow the runoff flows to be stored within the landscaped rear gardens and permeable surface make-up. This system will follow the regraded profile of the site topography and will direct the overflows to the access road.

2.4.1. Drainage will be carried out via an excess water pathways and site topography, which will direct excess water to the designated area at the lowest point of the site minimising the possible effects of an exceptional flash flood.

2.4.2. Infiltration will occur along time via infiltration and evapotranspiration.

3. SuDS Maintenance and Management

3.1. Soakaway

3.1.1. Regular inspection and maintenance is required to ensure the effective long-term operation of belowground storage systems. Infiltration systems will require regular maintenance to ensure continuing operation to design performance standards.

3.1.2. Inspections Chambers preceding soakaway inlets are to be monitored, inspect and maintained frequently.

3.1.3. Treatment to remove coarse sediment should carried out quarterly at the beginning of each season and as necessary after long period of storms.

3.1.4. Regular inspection of silt traps, inspection chambers and pipework as well as removal of sediment and debris is required.

3.1.5. Table 3.1 provides guidance on the type of operational and maintenance requirements. The list of actions is not exhaustive and some actions may not always be required.

3.1.6. Maintenance responsibility for systems should be placed with either a responsible organisation such as a management company.

3.1.7. Management Company should be made aware of all SuDS systems that serve their property, the location of the device and the maintenance requirements and responsibilities.

Table 3.1 – ***Soakaways Key operation and Maintenance Requirements***

Maintenance schedule	*Required action*	*Typical frequency*
Regular maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside of manhole rings	Annually
	Cleaning of gutters and any filters on downpipes	Annually (or as required based on inspections)
	Inspect inspection chambers for silt accumulation, establish appropriate silt removal frequencies	Quarterly, or as required
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment or other matter; remove and/or replace surface infiltration medium as necessary.	Annually
	Trimming any roots that may be causing blockages	Annually (or as required)
Occasional maintenance	Remove sediment and debris from pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	As required, based on inspections

Remedial actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs	As required
	Replacement of clogged geotextile (will require reconstruction of soakaway)	As required
Monitoring	Inspect silt traps and note rate of sediment accumulation	Monthly in the first year and then annually
	Check soakaway to ensure emptying is occurring	Annually

3.2. Porous Tarmac Access Road & Permeable Block Paving Parking

3.2.1. Regular inspection and maintenance is required to maintain the effective operation permeable paving require and to ensure continuing operation to design performance standards.

3.2.2. After construction, before hand over to the client, the pavement should be inspected for clogging, litter, weeds and water ponding.

3.2.3. After the handover the pavement should be inspected on regular basis, particularly during and after heavy rainfall to ascertain the effective operation and to identify any performance issues.

3.2.4. Silt and sediments removal should be carried out regularly to preserve and maintain pavement infiltration capacity.

3.2.5. Brushing and suction cleaning should be used for regular sweeping. Care should be taken whilst vacuuming to avoid the removal of jointing material.

3.2.6. In case of any blockage or clogging of the paving surface a specialist sweeper with water jetting and oscillating and rotating brushes may be required.

3.2.7. Table 3.2 provides guidance on the type of operational and maintenance requirements that may be appropriate. The list of actions is not exhaustive and some actions may not always be required.

3.2.8. Specific maintenance needs for block permeable paving should be monitored, and maintenance schedules adjusted to suit site requirements.

3.2.9. Maintenance responsibility for systems should be placed with a responsible organisation such as a management company.

Table 3.2 – Permeable Paving Key operation and Maintenance Requirements

Maintenance Schedule	*Required action*	*Typical frequency*
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Annually, , after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial actions	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

3.3. Silt Traps & Catchpits

3.3.1. Silt traps and catchpits are circular or rectangular inspection chambers and /or chambers with a sump in them to collect suspended solids.

3.3.2. Some chambers have removable silt buckets to assist with the removal of accumulated silt deposits. Catchpits are usually concrete ring or segment structures and silt traps preformed plastic chambers.

3.3.3. Regular inspection and maintenance is required to ensure the effective long-term operation of below ground silt traps and catchpits systems.

3.3.4. Maintenance responsibility for systems should be placed with a responsible organization.

3.3.5. Table 3.3 provides guidance Maintenance requirements are described in the table below.

3.3.6. Specific maintenance needs of the gullies should be monitored, and maintenance schedules adjusted to best suit site requirements.

3.3.7. Maintenance responsibility for systems should be placed with a responsible organisation such as a management company.

Table 3.3 – Silt Traps & Catchpits Key operation and Maintenance Requirements

Maintenance Schedule	*Required action*	*Typical frequency*
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required take remedial action.	Monthly for 3 months then six monthly, or as required
	Remove debris from catchment surface (where it may cause risks to performance)	Monthly, or as required
	Remove sediment and oil deposits from all sumps	Annually, or as required
	Remove sediments structures upstream of the cellular storage tanks.	Annually, or as required
Occasional maintenance	Remove and dispose of oils or petrol residues using safe standard practices	As required
Remedial maintenance	Repair/rehabilitation of inlets, outlets, overflow and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually, and after large storms

3.4. Rainwater Harvesting Tank

3.5.1 Regular inspection and maintenance is required to ensure the effective long-term operation of the rain water harvesting and supplying / distribution pumping system to ensure continuing operation to design performance standards.

3.5.2 Inspection chambers preceding rainwater harvesting tank inlets to be monitored, inspect and maintained frequently.

3.5.3 Pumps should be regularly services to suppliers' requirements and any filters / systems maintained / replaced as required.

3.5.4 Treatment to remove coarse sediment should carried out quarterly at the beginning of each season and as necessary after long period of storms within supplying chambers and pipework.

3.5.5 Regular inspection of silt traps, inspection chambers and pipework as well as removal of sediment and debris is required.

3.5.6 Table 3.5 provides guidance on the type of operational and maintenance requirements. The list of actions is not exhaustive and some actions may not always be required.

3.5.7 Maintenance responsibility for systems should be placed with either a responsible organisation such as a management company.

3.5.8 Site users should be made aware of all SuDS systems that serve their property, the location of the device and the maintenance requirements and responsibilities.

Table 3.5 – Rainwater harvesting and pump system operation and Maintenance Requirements

Maintenance Schedule	*Required action*	*Typical frequency*
Regular maintenance	Remove rubbish and debris	Monthly, or as required
	Remove any vegetation growth	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours	Monthly, or when required
	Inspection of the tank for debris and sediment build-up, inlets/outlets/withdrawal devices, overflow areas, pumps, filters	Annually (and following poor performance)
	Cleaning of tank, inlets, outlets, gutters, withdrawal devices and roof drain filters of silts and other debris	Annually (and following poor performance)
Occasional maintenance	Cleaning and/or replacement of any filters	Three monthly or as required
Remedial actions	Repair of overflow erosion damage or damage to tank	As required
	Pump repairs	As required

3.5. Exceedance flow 'channel' route

3.5.1. Regular inspection and maintenance are required to ensure the effective and continuous long-term operation of all SuDS systems to design performance standards.

3.5.2. Rubbish and debris removal should be undertaken as part of general maintenance of the attenuation basin and surrounding amenity locations.

3.5.3. The proposed external ground level will provide the exceedance flow channel route and flow pathway/escape route on the occasion of extreme weather.

3.5.4. Regular site maintenance of landscape and pavements will allow the exceedance flow to follow its designated route and channel the water to an informal detention basin.

3.5.5. Table 3.5 provides guidance on the type of operational and maintenance requirements. The list of actions is not exhaustive and some actions may not always be required.

3.5.6. Maintenance will usually be carried out annually. If maintenance is not undertaken for long periods, deposits can become hard-packed and require considerable effort to remove.

Table 3.5 – Exceedance Flow 'Channel' route Key operation and Maintenance Requirements

Maintenance schedule	*Required action*	*Typical frequency*
Regular maintenance	Remove litter, debris and rubbish	Monthly
	Cut grass – for landscaped areas and access routes	Monthly (during growing season) or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
Occasional maintenance	Remove sediment and any vegetation	Annually, or as required
Remedial actions	Repair (as a result of damage or vandalism)	As required
Monitoring	Inspect/check all inlet to ensure that it is in good condition and operating as designed	Annually

4. References

- CIRIA C753 Report *The SuDS Manual* (2015)

In the event of concern over any matter with regards to the management and maintenance of the drainage systems please contact:

Oyster Estates UK Ltd.

Tel: **+44 (0) 1243 586939**

Who is responsible for the post development Maintenance and Management Regime of the Development.

Appendix A

- **456146/201P1 - INFRASTRUCTURE DAINAGE LAYOUT GENERAL ARRANGEMENT (1/3)**
- **456146/202P1 - INFRASTRUCTURE DAINAGE LAYOUT GENERAL ARRANGEMENT (2/3)**
- **456146/203P1 - INFRASTRUCTURE DAINAGE LAYOUT GENERAL ARRANGEMENT (3/3)**
- **456146/204P - INFRASTRUCTURE STORM & FOUL WATER DAINAGE STANDARD DETAILS (1/2)**
- **456146/205P - INFRASTRUCTURE STORM & FOUL WATER DAINAGE STANDARD DETAILS (2/2)**

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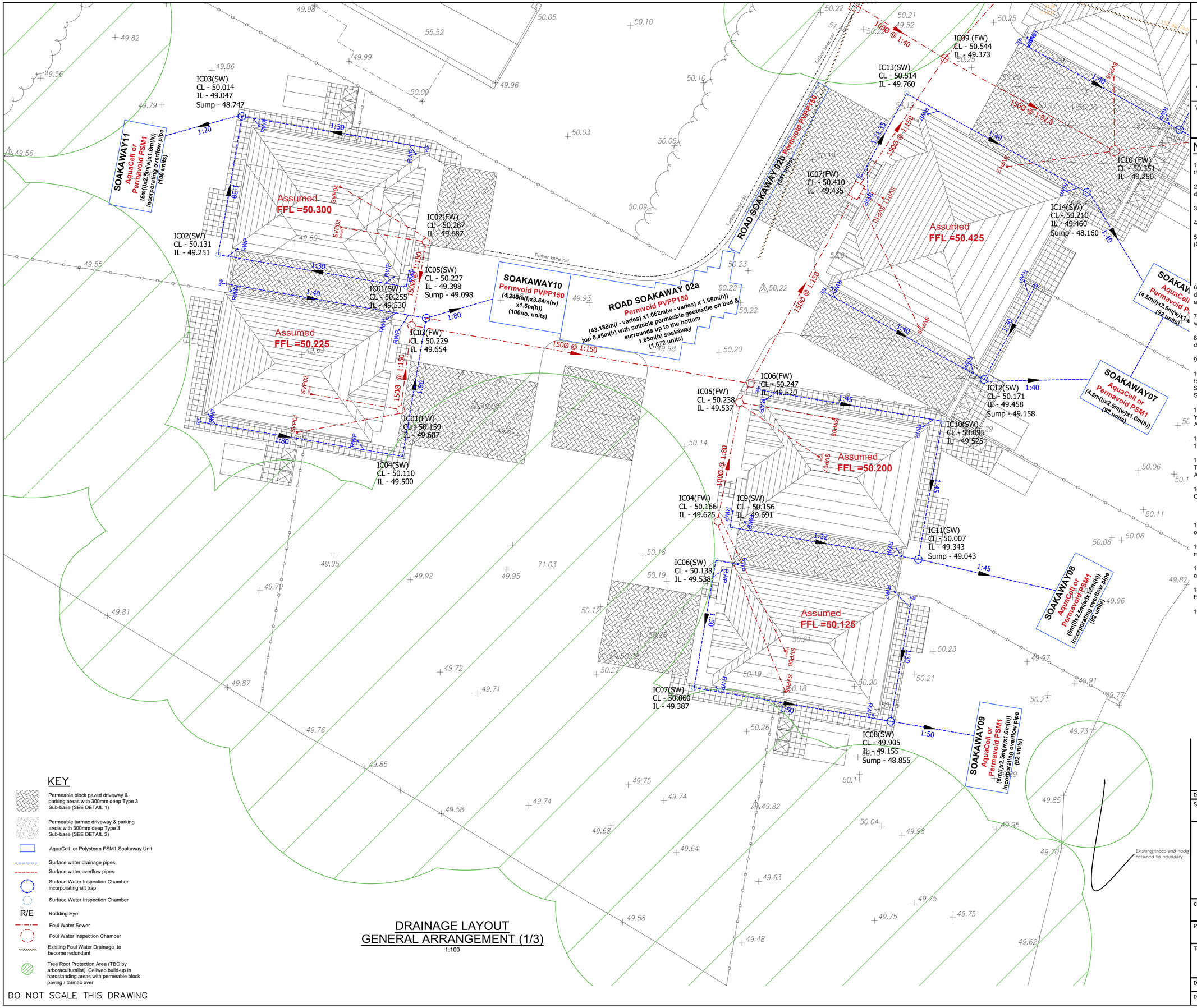


KEY

- Permeable block paved driveway & parking areas with 300mm deep Type 3 Sub-base (SEE DETAIL 1)
- Permeable tarmac driveway & parking areas with 300mm deep Type 3 Sub-base (SEE DETAIL 2)
- AquaCell or Polystorm PSM1 Soakaway Unit
- Surface water drainage pipes
- Surface water overflow pipes
- Surface Water Inspection Chamber incorporating silt trap
- Surface Water Inspection Chamber
- R/E — Rodding Eye
- Foul Water Sewer
- Foul Water Inspection Chamber
- Existing Foul Water Drainage to become redundant
- Tree Root Protection Area (TBC by arboraculturalist). Cellweb build-up in hardstanding areas with permeable block paving / tarmac over

DO NOT SCALE THIS DRAWING

DRAINAGE LAYOUT GENERAL ARRANGEMENT (1/3)

1:100

! CDM 2015 - RESIDUAL RISKS !

In preparing the designs illustrated by this drawing we have fulfilled our duties in the role of Designer as defined in the Construction Design and Management Regulations 2015. We have undertaken a full Hazard Identification and Risk Analysis and have designed out any special risks associated with the work, so that as far as possible there are no residual risks.

NOTE: Residual risks are defined as those risks arising from identified hazards which cannot be designed-out, and which a competent and experienced building contractor is unlikely to encounter during normal construction activities. Ordinary risks arising from normal construction operations have not been included.

Where hazards have been identified, the risks from which it has not been possible to eliminate during the design process, these are indicated on the drawing. It will be the responsibility of the Principal Contractor to develop Safe Systems of Work and/or Method Statements to minimise any risks associated with such hazards.

NOTES

1. This drawing has been prepared using a Topographical Survey Drawing supplied by the client in AutoCAD format.

2.This drawing is to be read in conjunction with all relevant Engineers' and Architects' drawings and specifications.

3. All dimensions are in millimetres unless noted otherwise. All levels are in metres.

4. The contractor is responsible for setting out and for checking dimensions.

5. In accordance with The Construction (Design and Management) Regulations 2015 (CDM 2015) the Principle Designer and Contractor are to:
   - Notify HSE of works.
   - Comply with the requirements of Health and Safety Plan (if applicable)
   - Provide risk assessments and method statements for all potential hazards relevant to this project.

6. The main contractor shall be responsible for the setting out and accuracy of all dimensions. The contractor shall be satisfied that the information given is correct and any discrepancies should be noted to the Engineer immediately.

7. Contractor to ensure that the existing sewers remain in service until the diversion works are completed.

8. The Contractor is responsible for specifying product and codes and ordering of drainage materials.

9. Contractor to ensure that new sewers are laid and installed in like for like basis.

10. New adoptable pipework to be vitrified clay type and to be constructed to the following specifications. Systems that are resistant to a jetting pressure of 4000psi. Systems that minimise the number of joints in the system, by using 3metre pipe length. Systems that do not have lip seal joints, hence preventing root ingress.

11. All non-uPVC (adoptable) pipe connection to manholes shall be provided with a 'rocker pipe' of 600mm effective length in accordance with Cl E6.6 of 'Sewers for Adoption'.

12.Precast concrete manhole units shall comply with the relevant provisions of BS EN 1917 and BS 5911-3.

13. The diameter of the pipes to be diverted are 300mm for storm and 150mm for foul. The new pipes are to of 300mm and 150mm for foul diameter respectively. Any abandoned pipes or manholes are to be grubbed out or sealed up.

14. Cover grades are in accordance with BS497 Pt 1
Cover Grades : D400 - carriageways.
B125 - carriageways for slow traffic.
A15 - inaccessible to vehicles

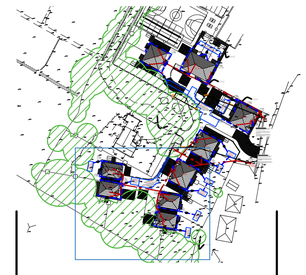
15. All drainage pipes within development site to be 100mm dia unless shown otherwise.

16. All uPVC drainage to be installed to BS5955 Pt6 and in strict accordance with the manufacturers instructions.

17. All uPVC drainage products to conform to BS EN1401 & Kite mark certified in accordance with specification.

18. All adoptable drainage and associated works to comply with the latest Part E - Civil Engineering Specification of 'Sewer for Adoption'.

19. DO NOT SCALE. If discrepancy or query arises on dimensions consult Engineer.



Date	By	Revision	QA'D	Chk'd	Ref

Status: PRELIMINARY

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Client: IMPERIAL HOMES SOUTH LTD.

Project: DEVELOPMENT AT BITTERNE PARISH CHURCH
WHITES LANE, BITTERNE, SOUTHAMPTON

Title: INFRASTRUCTURE
DRAINAGE LAYOUT
GENERAL ARRANGEMENT (1/3)

Date	Scale	Drg. No.
MAY 2023	AS SHOWN @ A1	456146/201P1

Drawn	Chk'd	QA'D
HS	TB	TB

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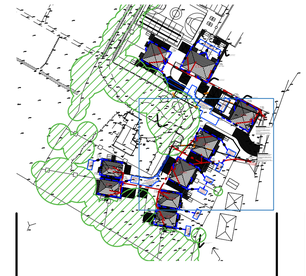

DRAINAGE LAYOUT
GENERAL ARRANGEMENT (2/3)
1:100

ROAD SOAKAWAY 01
Permvoid PVPP150
(81.42m(l - varies) x1.062m(w - varies) x 0.9m(h)) top 0.45m(h) with suitable permeable geotextile on bed & surrounds up to the bottom
0.9m(h) soakaway
(2,077 units)

SOAKAWAY01
AquaCell or Permavoid PSM1
(9m(l - 3no varies) x 2.5mw - 3no varies) x 1.6m(h))
(180 units)

ROAD SOAKAWAY 02a
Permvoid PVPP150
(43.188m(l - varies) x1.062m(w - varies) x 1.65m(h)) top 0.45m(h) with suitable permeable geotextile on bed & surrounds up to the bottom
1.65m(h) soakaway
(1,672 units)

ROAD SOAKAWAY 02b Permvoid PVPP150 (341 units)

SOAKAWAY04
AquaCell or Permavoid PSM1
(4.5m(l))x2.5m(w)x1.6m(h))
(92 units)

SOAKAWAY05
AquaCell or Permavoid PSM1
(4.5m(l))x2.5m(w)x1.6m(h))
(92 units)

SOAKAWAY06
AquaCell or Permavoid PSM1
(4.5m(l))x2.5m(w)x1.6m(h))
(92 units)

SOAKAWAY07
AquaCell or Permavoid PSM1
(4.5m(l))x2.5m(w)x1.6m(h))
(92 units)

IC15 (FW) CL - 50.757 IL - 49.542
IC17 (FW) CL - 50.827 IL - 49.402
Exist. MH (FW-B) CL - 50.820 IL - 49.340
IC16 (FW) CL - 50.837 IL - 49.565
IC19(SW) CL - 50.685 IL - 49.973 Sump - 49.673
IC16(SW) CL - 50.749 IL - 49.xxx
IC08 (FW) CL - 50.681 IL - 49.530
IC17(SW) CL - 50.599 IL - 49.xxx Sump - 48.xxx
IC18(SW) CL - 50.835 IL - 50.220
Exist. IC(FW) CL - 50.239 IL - 49.52
IC09 (FW) CL - 50.544 IL - 49.373
IC13(SW) CL - 50.514 IL - 49.760
IC15(SW) CL - 50.452 IL - 49.662 Sump - 48.362
IC11 (FW) CL - 50.400 IL - 49.058
Exist. IC (FW-A) CL - 50.440 IL - 48.990
IC10 (FW) CL - 50.351 IL - 49.250
IC07(FW) CL - 50.410 IL - 49.435
IC14(SW) CL - 50.210 IL - 49.460 Sump - 48.160
IC12(SW) CL - 50.171 IL - 49.458 Sump - 49.158
IC05(FW) CL - 50.238 IL - 49.537
IC06(FW) CL - 50.247 IL - 49.520
IC10(SW) CL - 50.095 IL - 49.525
IC04(FW) CL - 50.166 IL - 49.625
IC9(SW) CL - 50.156 IL - 49.691
IC11(SW) CL - 50.007 IL - 49.343 Sump - 49.043
IC06(SW)

Assumed FFL =51.000
Assumed FFL =50.725
Assumed FFL =50.425
Assumed FFL =50.200

Existing trees and hedges to be retained to boundary
Existing foul drain to be grubbed up once contractor has confirmed there are no live flows.
100 dia Foul Pipe
1500 @ 1:92.8
1000 @ 1:40
1500 @ 1:150
1000 @ 1:150
1000 @ 1:80
Existing Pipe Connection to So. Wa. MH3806
Existing 150Ø Vitrified Clay Pipe Connection to So. Wa. MH3702

S106 FOUL SEWER CONNECTION
CONNECTION INTO EXISTING IC WHICH CONNECTS VIA EXISTING PIPE INTO EXISTING SOUTHER WATER MANHOLE REF MH3806.

EXISTING FOUL RUN TO REMAIN. SUBJECT TO CCTV INSPECTION TO ASCERTAIN SUITABILITY DOWNSTREAM.

CONFIRMATION RECEIVED FROM SOUTHERN WATER THAT MH3806 HAS SUFFICIENT CAPACITY FOR THE ADDITIONAL FLOWS

S106 FOUL SEWER CONNECTION
CONNECTION INTO EXISTING IC WHICH CONNECTS VIA EXISTING PIPE INTO EXISTING SOUTHER WATER MANHOLE REF MH3702.

EXISTING FOUL RUN TO REMAIN. SUBJECT TO CCTV INSPECTION TO ASCERTAIN SUITABILITY DOWNSTREAM.

CONFIRMATION RECEIVED FROM SOUTHERN WATER THAT MH3702 HAS SUFFICIENT CAPACITY FOR THE ADDITIONAL FLOWS

KEY

- Permeable block paved driveway & parking areas with 300mm deep Type 3 Sub-base (SEE DETAIL 1)
- Permeable tarmac driveway & parking areas with 300mm deep Type 3 Sub-base (SEE DETAIL 2)
- AquaCell or Polystorm PSM1 Soakaway Unit
- Surface water drainage pipes
- Surface water overflow pipes
- Surface Water Inspection Chamber incorporating silt trap
- Surface Water Inspection Chamber
- R/E Rodding Eye
- Foul Water Sewer
- Foul Water Inspection Chamber
- Existing Foul Water Drainage to become redundant
- Tree Root Protection Area (TBC by arboraculturalist). Cellweb build-up in hardstanding areas with permeable block paving / tarmac over

DO NOT SCALE THIS DRAWING

Date	By	Revision	QA'D	Chk'd	Ref

Status: PRELIMINARY

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STRUCTURAL, CIVIL AND BUILDING CONSULTANTS
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Landguard Manor Road
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PO37 7JB

Client: IMPERIAL HOMES SOUTH LTD.

Project: DEVELOPMENT AT BITTERNE PARISH CHURCH
WHITES LANE, BITTERNE, SOUTHAMPTON

Title: INFRASTRUCTURE
DRAINAGE LAYOUT
GENERAL ARRANGEMENT (2/3)

Date	Scale	Drg. No.
MAY 2023	AS SHOWN @ A1	456146/202P1

Drawn	Chk'd	QA'D
HS	TB	TB

IC26(SW)
CL - 50.636
IL - 50.100

IC27(SW)
CL - 50.888
IL - 49.942

IC25(SW)
CL - 50.939
IL - 50.147
Sump - 49.847

IC23(SW)
CL - 50.939
IL - 50.139
Sump - 49.839

IC22(SW)
CL - 50.941
IL - 50.133
Sump - 49.833

IC12 (FW)
CL - 50.837
IL - 50.334

IC24(SW)
CL - 51.056
IL - 50.427

IC28(SW)
CL - 50.756
IL - 49.806
Sump - 49.506

IC13 (FW)
CL - 51.113
IL - 50.103

IC14 (FW)
CL - 51.053
IL - 49.933

IC21(SW)
CL - 51.052
IL - 50.394

IC20(SW)
CL - 50.728
IL - 49.996
Sump - 49.696

IC19(SW)
CL - 50.685
IL - 49.973
Sump - 49.673

Assumed
FFL =50.850

Assumed
FFL =51.150

Assume
FFL =51

SOAKAWAY02
AquaCell or Permavoid PSM1
(12m(l)x2.0m(w)x1.6m(h)) incorporating overflow pipe
(192 units)

SOAKAWAY03
Permvoid PVPP150
(12.036m(l) x 2.184m(w) x 0.9m(h))
(612 units)

ROAD SOAKAWAY 01
Permvoid PVPP150
(81.42m(l - varies) x1.062m(w - varies) x 0.9m(h))
top 0.45m(h) with suitable permeable geotextile on
bed & surrounds up to the bottom
0.9m(h) soakaway
(2,077 units)

SOAKAWAY01
AquaCell or Permavoid PSM1
(9m(l - but varies) x 2.5m(w - but varies)
x 1.6m(h))
(180 units)

100Ø @ 1:60

Existing 1.8m high timber close boarded fence to boundary to be retained

Existing foul drain to be grubbed up once contractor has confirmed there are no live flows.

Existing 1.8m high timber close boarded fence to boundary to be retained

Timber knee rail

DRAINAGE LAYOUT
GENERAL ARRANGEMENT (3/3)
1:100

DO NOT SCALE THIS DRAWING

KEY

- Permeable block paved driveway & parking areas with 300mm deep Type 3 Sub-base (SEE DETAIL 1)
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- Tree Root Protection Area (TBC by arboraculturalist). Cellweb build-up in hardstanding areas with permeable block paving / tarmac over

! CDM 2015 - RESIDUAL RISKS !

In preparing the designs illustrated by this drawing we have fulfilled our duties in the role of Designer as defined in the Construction Design and Management Regulations 2015. We have undertaken a full Hazard Identification and Risk Analysis and have designed out any special risks associated with the work, so that as far as possible there are no residual risks.

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NOTES

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2.This drawing is to be read in conjunction with all relevant Engineers' and Architects' drawings and specifications.

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7. Contractor to ensure that the existing sewers remain in service until the diversion works are completed.

8. The Contractor is responsible for specifying product and codes and ordering of drainage materials.

9. Contractor to ensure that new sewers are laid and installed in like for like basis.

10. New adoptable pipework to be vitrified clay type and to be constructed to the following specifications. Systems that are resistant to a jetting pressure of 4000psi. Systems that minimise the number of joints in the system, by using 3metre pipe length. Systems that do not have lip seal joints, hence preventing root ingress.

11. All non-uPVC (adoptable) pipe connection to manholes shall be provided with a 'rocker pipe' of 600mm effective length in accordance with Cl E6.6 of 'Sewers for Adoption'.

12.Precast concrete manhole units shall comply with the relevant provisions of BS EN 1917 and BS 5911-3.

13. The diameter of the pipes to be diverted are 300mm for storm and 150mm for foul. The new pipes are to of 300mm and 150mm for foul diameter respectively. Any abandoned pipes or manholes are to be grubbed out or sealed up.

14. Cover grades are in accordance with BS497 Pt 1
Cover Grades : D400 - carriageways.
B125 - carriageways for slow traffic.
A15 - inaccessible to vehicles

15. All drainage pipes within development site to be 100mm dia unless shown otherwise.

16. All uPVC drainage to be installed to BS5955 Pt6 and in strict accordance with the manufacturers instructions.

17. All uPVC drainage products to conform to BS EN1401 & Kite mark certified in accordance with specification.

18. All adoptable drainage and associated works to comply with the latest Part E - Civil Engineering Specification of 'Sewer for Adoption'.

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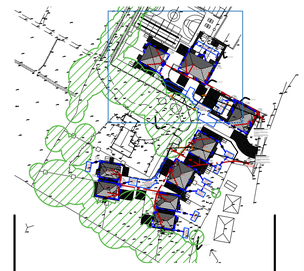

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Status: PRELIMINARY

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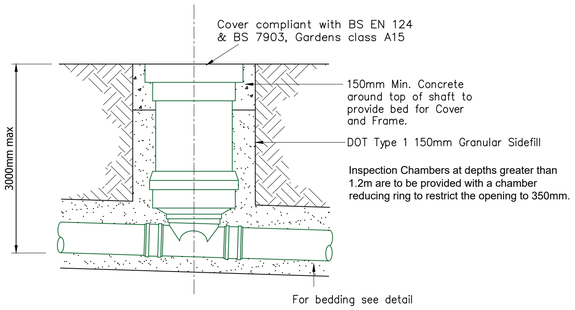
Client: IMPERIAL HOMES SOUTH LTD.

Project: DEVELOPMENT AT BITTERNE PARISH CHURCH
WHITES LANE, BITTERNE, SOUTHAMPTON

Title: INFRASTRUCTURE
DRAINAGE LAYOUT
GENERAL ARRANGEMENT (3/3)

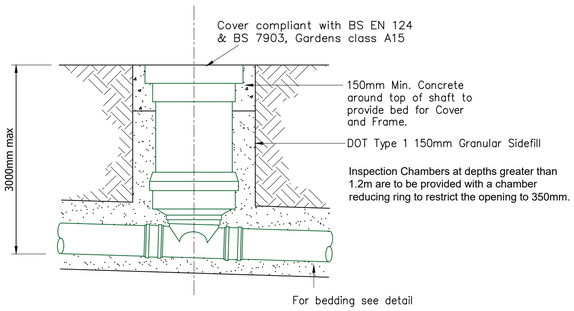
Date	Scale	Drg. No.
MAY 2023	AS SHOWN @ A1	456146/203P1

Drawn	Chk'd	QA'D
HS	TB	TB



450mmø INSPECTION CHAMBER GRADE 'A' NON-LOAD BEARING INSTALLATION

1:10

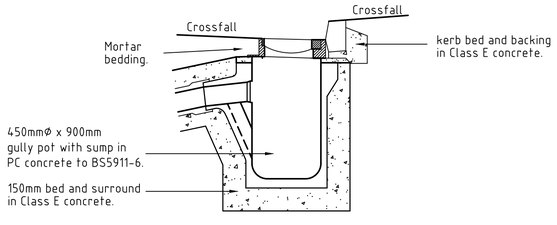


450mmø INSPECTION CHAMBER GRADE 'A' NON-LOAD BEARING INSTALLATION

1:10

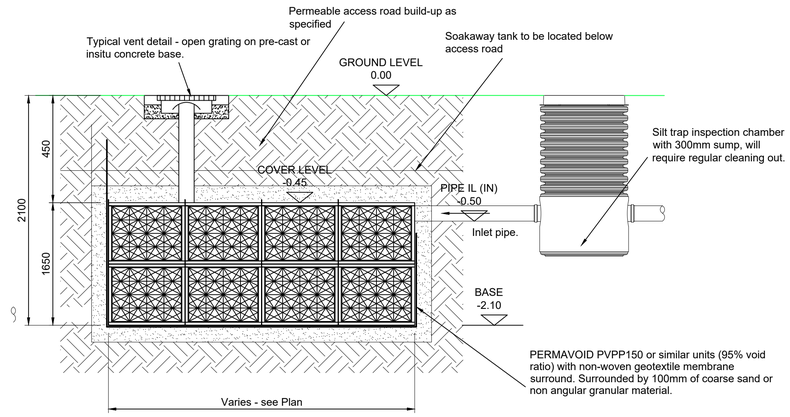
CONCRETE GULLY DETAIL

Scale 1:20



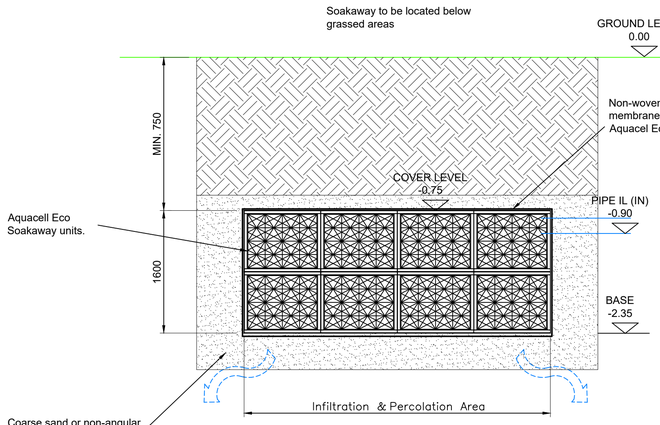
ACCESS ROAD CONCRETE GULLY DETAIL

Scale 1:20



TYPICAL SECTION STORM WATER SOAKAWAY DETAIL UNDER ACCESS ROAD

1:20

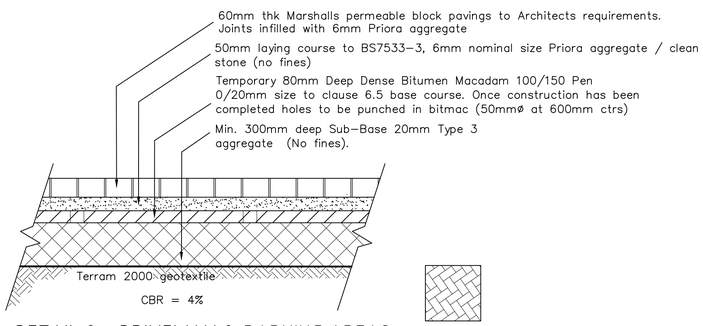


SECTION TRHOUGH SURFACE WATER SOAKAWAY DETAIL WITHIN GARDENS

1:20

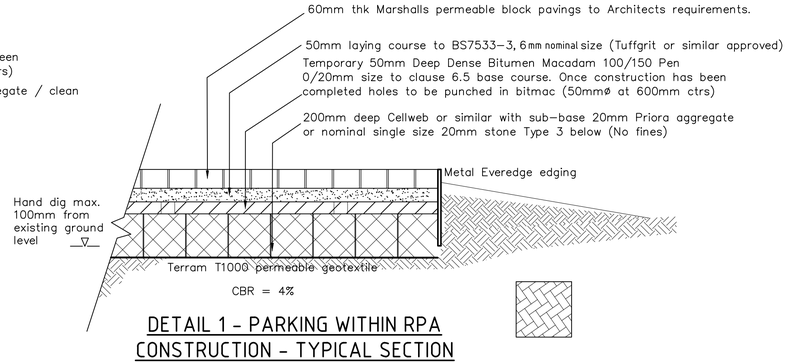
DETAIL 1 - NEW ACCESS ROAD - TYPICAL SECTION

SCALE 1: 20



DETAIL 2 - DRIVEWAY & PARKING AREAS CONSTRUCTION - TYPICAL SECTION

SCALE 1: 20



DETAIL 1 - PARKING WITHIN RPA CONSTRUCTION - TYPICAL SECTION

SCALE 1: 20

DO NOT SCALE THIS DRAWING

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B125 - carriageways for slow traffic.
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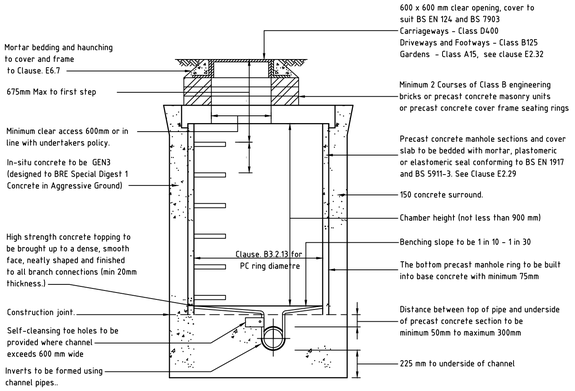
Client: IMPERIAL HOMES SOUTH LTD.

Project: DEVELOPMENT AT BITTERNE PARISH CHURCH
WHITES LANE, BITTERNE, SOUTHAMPTON

Title: INFRASTRUCTURE
STORM & FOUL WATER DRAINAGE
STANDARD DETAILS (1/2)

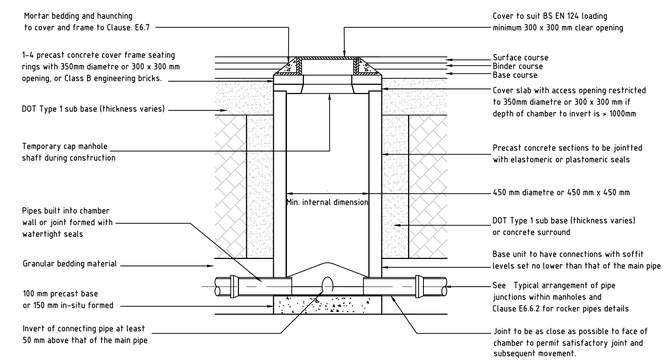
Date	Scale	Drg. No.
OCT 2023	AS SHOWN @ A1	456146/204P

Drawn	Chk'd	QA'D
HS	TB	TB



TYPICAL MANHOLE DETAIL-TYPE 2

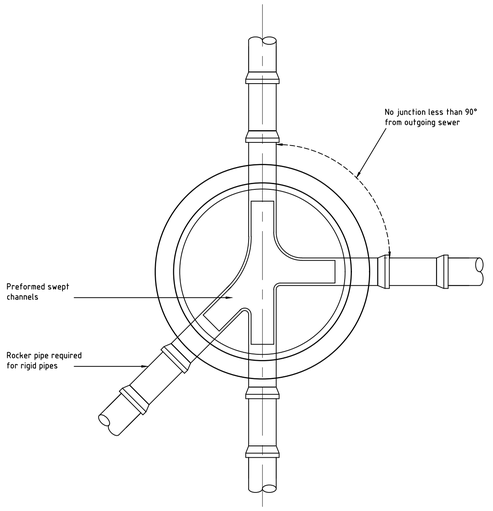
(MAX DEPTH FROM C.L. TO SOFFIT OF PIPE 3000MM)



TYPICAL INSPECTION CHAMBER DETAIL-TYPE 3

(MAX DEPTH FROM C.L. TO SOFFIT OF PIPE IN AREAS SUBJECT TO VEHICLE LOADING 3000MM, NON-ENTRY

NOTE: Where the access chamber is in the highway the Highway Authority can have specific requirements



TYPICAL ARRANGEMENT FOR PIPE JUNCTIONS WITHIN MANHOLES

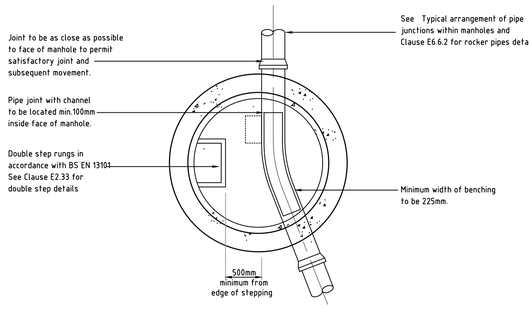
Alternative manhole base layouts to Figure B.20

Scale 1:25

Rigid pipes built into manhole should have a flexible joint as close as feasible to the external face of the structure and the length of the next rocker pipe should be as shown

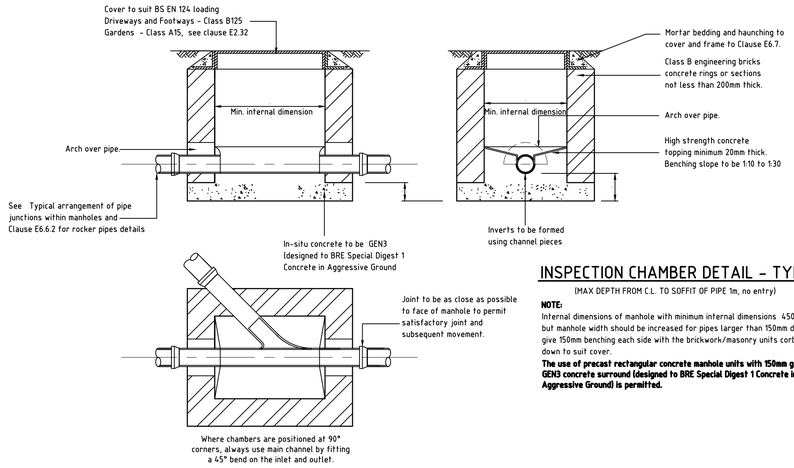
NOMINAL DIAmetre (MM)	MAXIMUM EFFECTIVE LENGTH (MM)
150 - 600	600
601 - 750	1000
over 750	1250

All pipes entering the bottom of the manhole to have soffits level.



ADOPTABLE DRAINAGE INSPECTION CHAMBERS / MANHOLES

1:25

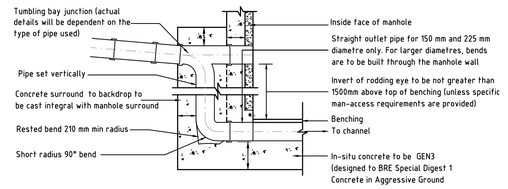


INSPECTION CHAMBER DETAIL - TYPE 4

(MAX DEPTH FROM C.L. TO SOFFIT OF PIPE 1m, no entry)

NOTE:
Internal dimensions of manhole with minimum internal dimensions 450x600mm but manhole width should be increased for pipes larger than 150mm dia. to give 150mm benching each side with the brickwork/masonry units corbelled down to suit cover.

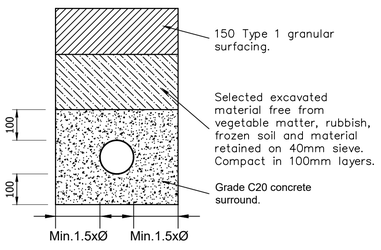
The use of precast rectangular concrete manhole units with 150mm grade GEN3 concrete surround (designed to BRE Special Digest 1 Concrete in Aggressive Ground) is permitted.



VERTICAL BACKDROP DETAIL

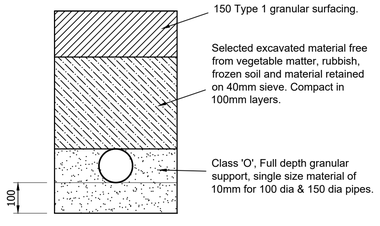
Scale 1:25

TYPICAL PRECAST CONCRETE CHAMBER SHOWN SIMILAR DETAIL FOR BRICK CONSTRUCTION.



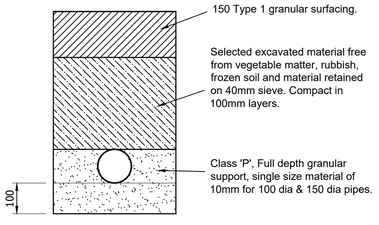
BEDDING FOR FLEXIBLE PIPES LESS THAN 900mm COVER UNDER ROADS

1:10



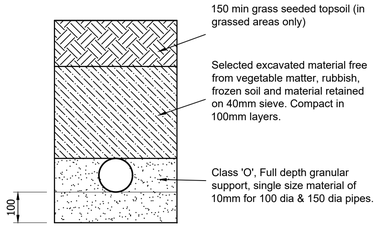
BEDDING FOR FLEXIBLE PIPES 900-1200mm COVER UNDER ROADS

1:10



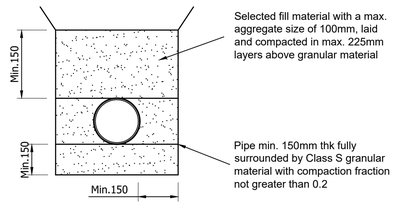
BEDDING FOR FLEXIBLE PIPES 1200-2000mm COVER UNDER ROADS

1:10



BEDDING FOR FLEXIBLE PIPES UP to 1500mm DEEP NOT UNDER ROADS

1:10



DETAIL FOR BEDDING OF VITRIFIED CLAY PIPES OF ADOPTABLE FOUL DRAINAGE & STORM CONNECTION TO MH9054

1:10

! CDM 2015 - RESIDUAL RISKS !

In preparing the designs illustrated by this drawing we have fulfilled our duties in the role of Designer as defined in the Construction Design and Management Regulations 2015. We have undertaken a full Hazard Identification and Risk Analysis and have designed out any special risks associated with the work, so that as far as possible there are no residual risks.

NOTE: Residual risks are defined as those risks arising from identified hazards which cannot be designed-out, and which a competent and experienced building contractor is unlikely to encounter during normal construction activities. Ordinary risks arising from normal construction operations have not been included.

Where hazards have been identified, the risks from which it has not been possible to eliminate during the design process, these are indicated on the drawing. It will be the responsibility of the Principal Contractor to develop Safe Systems of Work and/or Method Statements to minimise any risks associated with such hazards.

NOTES

1. This drawing has been prepared using a Topographical Survey Drawing supplied by the client in AutoCAD format.

2.This drawing is to be read in conjunction with all relevant Engineers' and Architects' drawings and specifications.

3. All dimensions are in millimetres unless noted otherwise. All levels are in metres.

4. The contractor is responsible for setting out and for checking dimensions.

5. In accordance with The Construction (Design and Management) Regulations 2015 (CDM 2015) the Principle Designer and Contractor are to:
   - Notify HSE of works.
   - Comply with the requirements of Health and Safety Plan (if applicable)
   - Provide risk assessments and method statements for all potential hazards relevant to this project.

6. The main contractor shall be responsible for the setting out and accuracy of all dimensions. The contractor shall be satisfied that the information given is correct and any discrepancies should be noted to the Engineer immediately.

7. Contractor to ensure that the existing sewers remain in service until the diversion works are completed.

8. The Contractor is responsible for specifying product and codes and ordering of drainage materials.

9. Contractor to ensure that new sewers are laid and installed in like to like basis.

10. New adoptable pipework to be vitrified clay type and to be constructed to the following specifications. Systems that are resistant to a jetting pressure of 4000psi. Systems that minimise the number of joints in the system, by using 3metre pipe length. Systems that do not have lip seal joints, hence preventing root ingress.

11. All non-uPVC (adoptable) pipe connection to manholes shall be provided with a 'rocker pipe' of 600mm effective length in accordance with Cl E6.6 of 'Sewers for Adoption'.

12.Precast concrete manhole units shall comply with the relevant provisions of BS EN 1917 and BS 5911-3.

13. The diameter of the pipes to be diverted are 300mm for storm and 150mm for foul. The new pipes are to of 300mm and 150mm for foul diameter respectively. Any abandoned pipes or manholes are to be grubbed out or sealed up.

14. Cover grades are in accordance with BS497 Pt 1
Cover Grades : D400 - carriageways.
B125 - carriageways for slow traffic.
A15 - inaccessible to vehicles

15. All drainage pipes within development site to be 100mm dia unless shown otherwise.

16. All uPVC drainage to be installed to BS5955 Pt6 and in strict accordance with the manufacturers instructions.

17. All uPVC drainage products to conform to BS EN1401 & Kite mark certified in accordance with specification.

18. All adoptable drainage and associated works to comply with the latest Part E - Civil Engineering Specification of 'Sewer for Adoption'.

19. DO NOT SCALE. If discrepancy or query arises on dimensions consult Engineer.

Date	By	Revision	QA'D	Chk'd	Ref

Status: **PRELIMINARY**

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Client: IMPERIAL HOMES SOUTH LTD.

Project: DEVELOPMENT AT BITTERNE PARISH CHURCH
WHITES LANE, BITTERNE, SOUTHAMPTON

Title: INFRASTRUCTURE
STORM & FOUL WATER DRAINAGE
STANDARD DETAILS (2/2)

Date	Scale	Drg. No.
MAY 2023	AS SHOWN @ A1	456146/205P
Drawn: HS	Chk'd: TB	QA'D: TB

DO NOT SCALE THIS DRAWING

Appendix B

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Job No.	456146	Sheet	21	Date	Sep-23
Job	Bitterne Parish Church	By	HS	Checked	

Soakaway Design (10 yrs)

Plots 12-15

Roofs =	74.04	m^2
Footpaths =	36.66	m^2
Parking Spaces =	75.15	m^2 (30% Incl. in calcs)
Road =		m^2
Amenity Paving =		m^2 (0% Incl. in calcs)
	133.245	**m^2**

Area	133.245	m^2	
Urban Creep	1.100		
	146.570	m^2	
10 year return period + 45%			Storm duration (Min.)
R5	0.013	m	5
R10	0.018	m	10
R15	0.022	m	15
R30	0.028	m	30
R60	0.036	m	60
R120	0.044	m	120
R240	0.053	m	240
R360	**0.059**	**m**	**360**
R600	0.068	m	600
R1440	0.084	m	1440
Inflow to soakaway system			
I5	1.85	m^3	
I10	2.64	m^3	
I15	3.25	m^3	
I30	4.17	m^3	
I60	5.27	m^3	
I120	6.44	m^3	
I240	7.71	m^3	
I360	8.69	m^3	
I600	9.90	m^3	
I1440	12.28	m^3	
Outflow from Tank			
f	6.46E-06	**m^3/s**	**SI Report**

Soakaway dims:			
Length	4.248	m	6No
Width	2.832	m	8No
Depth	1.2	m	(below invert depth of inlet pipe)

As50	8.496	
Void ratio	95	%
Outflow from Tank:		
O5	0.02	m^3
O10	0.03	m^3
O15	0.05	m^3
O30	0.10	m^3
O60	0.20	m^3
O120	0.40	m^3
O240	0.79	m^3
O360	1.19	m^3
O600	1.98	m^3
O1440	4.74	m^3

Allowance for extra rain during storage period (assume average rainfall)

Average daily rain	2.60	mm
Extra rain during storage	**0.41**	m^3

Storage required:			Time to drain:		
S5	1.83	m^3	ts50	4.64	hours
S10	2.60	m^3	ts50	6.59	hours
S15	3.20	m^3	ts50	8.10	hours
S30	4.07	m^3	ts50	10.29	hours
S60	5.07	m^3	ts50	12.84	hours
S120	6.04	m^3	ts50	15.30	hours
S240	6.92	m^3	ts50	17.52	hours
S360	7.51	m^3	ts50	19.00	hours
S600	7.93	m^3	ts50	20.06	hours
S1440	7.54	m^3	ts50	19.09	hours

Storage provided	**13.71**	m^3		
Critical storm =	**S600**			
Storage required =	**8.33**			
Time to discharge=	**20.06**	Hours	**0.84**	Days

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **Permavoid PVPP150** stormwater systems is **recommended.** Proposed **design includes 45% Climate Change Allowence**.

Soakaway size proposed is satisfactory

http://www.metoffice.gov.uk/climate/uk/regional-climates/so

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Job	Bitterne Parish Church	By	HS	Checked	

Soakaway Design (1 yr)

Plots 12-15

To reduce from 10 year storm to 1 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours
N = No. of storms in 10 years

Area	133.245	m^2	
Urban Creep	1.100		
	146.570	m^2	

1 year return period + 45%			Storm duration (Min.)
R5	0.006	m	5
R10	0.009	m	10
R15	0.010	m	15
R30	0.013	m	30
R60	0.017	m	60
R120	0.021	m	120
R240	0.027	m	240
R360	**0.030**	**m**	**360**
R600	0.036	m	600
R1440	0.047	m	1440

T	N	r	0.45	10 year return period	
0.083333	10	0.004482	0.00650	R5	0.0087 m
0.166667	10	0.005996	0.00869	R10	0.0124 m
0.25	10	0.007029	0.01019	R15	0.0153 m
0.5	10	0.009092	0.01318	R30	0.0196 m
1	10	0.011600	0.01682	R60	0.0248 m
2	10	0.014649	0.02124	R120	0.0303 m
4	10	0.018355	0.02661	R240	0.0363 m
6	**10**	**0.020883**	0.03028	R360	0.0409 m
10	10	0.024508	0.03554	R600	0.0466 m
24	10	0.032073	0.04651	R1440	0.0578 m

Inflow to soakaway system

I5	0.95	m^3
I10	1.27	m^3
I15	1.49	m^3
I30	1.93	m^3
I60	2.47	m^3
I120	3.11	m^3
I240	3.90	m^3
I360	4.44	m^3
I600	5.21	m^3
I1440	6.82	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

Soakaway dims:

L	2.832	m	4No
W	2.832	m	8No
Depth	0.9	m	6No

As50	5.0976	
Void ratio	95	%

Outflow from Tank:

O5	0.0099	m^3
O10	0.0198	m^3
O15	0.0296	m^3
O30	0.0593	m^3
O60	0.1185	m^3
O120	0.2371	m^3
O240	0.4742	m^3
O360	0.7112	m^3
O600	1.1854	m^3
O1440	2.8450	m^3

Storage required:			Time to half drain:		
S5	0.94	m^3	ts50	3.98	hours
S10	1.25	m^3	ts50	5.29	hours
S15	1.46	m^3	ts50	6.18	hours
S30	1.87	m^3	ts50	7.90	hours
S60	2.35	m^3	ts50	9.90	hours
S120	2.88	m^3	ts50	12.13	hours
S240	3.43	m^3	ts50	14.45	hours
S360	3.73	m^3	ts50	15.72	hours
S600	4.02	m^3	ts50	16.97	hours
S1440	3.97	m^3	ts50	16.75	hours

Storage Provided	**6.86**	m^3
Critical storm =	**S600**	
Storage required =	**4.02**	
Time to half discharge=	**16.97**	Hours (Acceptable time as 1/100 year storm)

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **Permavoid PVPP150** stormwater systems is **recommended.** Proposed **design includes 45% Climate Change Allowence**.

Soakaway size proposed is satisfactory

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Job No.	456146	Sheet	23	Date	Sep-23
Job	Bitterne Parish Church	By	HS	Checked	

Soakaway Design (30 yr)

Plots 12-15

Area	133.245	m^2
Urban Creep	1.100	
	146.570	m^2

30 year return period + 45%

			Storm duration (Min.)
R5	0.023	m	5
R10	0.029	m	10
R15	0.032	m	15
R30	0.040	m	30
R60	0.050	m	60
R120	0.061	m	120
R240	0.075	m	240
R360	**0.085**	**m**	**360**
R600	0.099	m	600
R1440	0.127	m	1440

Inflow to soakaway system

I5	3.35	m^3
I10	4.19	m^3
I15	4.76	m^3
I30	5.90	m^3
I60	7.29	m^3
I120	8.98	m^3
I240	11.04	m^3
I360	12.44	m^3
I600	14.44	m^3
I1440	18.64	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

For increase from 10 year storm to 30 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours
N = No. of storms in 10 years

T	N	r	0.45	10 year return period		
0.083333	0.333	0.015764	0.02286	R5	0.0087	m
0.166667	0.333	0.019710	0.02858	R10	0.0124	m
0.25	0.333	0.022402	0.03248	R15	0.0153	m
0.5	0.333	0.027780	0.04028	R30	0.0196	m
1	0.333	0.034318	0.04976	R60	0.0248	m
2	0.333	0.042265	0.06128	R120	0.0303	m
4	0.333	0.051926	0.07529	R240	0.0363	m
6	**0.333**	**0.058516**	0.08485	R360	0.0409	m
10	0.333	0.067965	0.09855	R600	0.0466	m
24	0.333	0.087685	0.12714	R1440	0.0578	m

Soakaway dims:

L	4.248	m	6No	L	12.036	m
W	3.54	m	10No	W	2.124	m
Depth	1.5	m	10No	Depth	0.45	m
As50	11.682			As50	1	
Void ratio	95	%		Void rati	30	%

Outflow from Tank:

O5	0.0226	m^3
O10	0.0453	m^3
O15	0.0679	m^3
O30	0.1358	m^3
O60	0.2717	m^3
O120	0.5433	m^3
O240	1.0866	m^3
O360	1.6299	m^3
O600	2.7166	m^3
O1440	6.5197	m^3

Storage required:			Time to half drain:		
S5	3.33	m^3	ts50	6.12	hours
S10	4.14	m^3	ts50	7.63	hours
S15	4.69	m^3	ts50	8.64	hours
S30	5.77	m^3	ts50	10.62	hours
S60	7.02	m^3	ts50	12.92	hours
S120	8.44	m^3	ts50	15.53	hours
S240	9.95	m^3	ts50	18.31	hours
S360	10.81	m^3	ts50	19.89	hours
S600	11.73	m^3	ts50	21.59	hours
S1440	12.12	m^3	ts50	22.30	hours

Storage Provided	**24.88**	m^3
Critical storm =	**S1440**	
Storage required =	**12.12**	
Time to half discharge=	**22.30**	Hours (Acceptable time as 1/30 year storm)

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **Permavoid PVPP150** stormwater systems is **recommended.** Proposed **design includes 45% Climate Change Allowence**.

Soakaway size proposed is satisfactory

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Job No.	456146	Sheet	24	Date	Sep-23
Job	Bitterne Parish Church	By	HS	Checked	

Soakaway Design (100 yr)

Plots 12-15

Area	133.245	m^2
Urban Creep	1.100	
	146.570	m^2

100 year return period + 40%

Storm duration (Min.)

R5	0.032	m	5
R10	0.040	m	10
R15	0.045	m	15
R30	0.056	m	30
R60	0.069	m	60
R120	0.084	m	120
R240	0.103	m	240
R360	**0.116**	**m**	**360**
R600	0.135	m	600
R1440	0.174	m	1440

Inflow to soakaway system

I5	4.75	m^3
I10	5.89	m^3
I15	6.66	m^3
I30	8.21	m^3
I60	10.10	m^3
I120	12.38	m^3
I240	15.17	m^3
I360	17.07	m^3
I600	19.79	m^3
I1440	25.47	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

Soakaway dims:

L	4.248	m	6No
W	3.54	m	10No
Depth	1.5	m	10No

As50	11.682
Void ratio	95 %

Outflow from Tank:

O5	0.0226	m^3
O10	0.0453	m^3
O15	0.0679	m^3
O30	0.1358	m^3
O60	0.2717	m^3
O120	0.5433	m^3
O240	1.0866	m^3
O360	1.6299	m^3
O600	2.7166	m^3
O1440	6.5197	m^3

Storage required:			Time to half drain:		
S5	4.73	m^3	ts50	8.70	hours
S10	5.84	m^3	ts50	10.75	hours
S15	6.60	m^3	ts50	12.14	hours
S30	8.08	m^3	ts50	14.87	hours
S60	9.82	m^3	ts50	18.08	hours
S120	11.84	m^3	ts50	21.80	hours
S240	14.08	m^3	ts50	25.92	hours
S360	15.44	m^3	ts50	28.41	hours
S600	17.07	m^3	ts50	31.42	hours
S1440	18.95	m^3	ts50	34.87	hours

Storage Provided	**21.43**	m^3
Critical storm =	**S1440**	
Storage required =	**18.95**	
Time to half discharge=	**34.87**	Hours (Acceptable time as 1/100 year storm)

Soakaway size proposed is satisfactory

For increase from 10 year storm to 100 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours

N = No. of storms in 10 years

T	N	r	0.4	10 year return period	
0.083333	0.1	0.023154	0.03241527	R5	0.0087 m
0.166667	0.1	0.028694	0.04017133	R10	0.0124 m
0.25	0.1	0.032473	0.04546206	R15	0.0153 m
0.5	0.1	0.040022	0.05603125	R30	0.0196 m
1	0.1	0.0492	0.06887934	R60	0.0248 m
2	0.1	0.060356	0.08449771	R120	0.0303 m
4	0.1	0.073917	0.10348369	R240	0.0363 m
6	**0.1**	**0.083168**	**0.11643482**	R360	0.0409 m
10	0.1	0.10	0.13500488	R600	0.0466 m
24	0.1	0.124113	0.17375774	R1440	0.0578 m

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **Permavoid PVPP150** stormwater systems is **recommended.** Proposed **design includes 40% Climate Change Allowence**.

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Job No.	456146	Sheet	25	Date	Sep-23
Job	Bitterne Parish Church	By	HS	Checked	

Soakaway Exceedance Flow Design (500 yr)

Plots 12-15

For increase from 10 year storm to 500 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours
N = No. of storms in 10 years

			Storm duration (Min.)	T	N	r	0	10 year return period		
Area	133.245	m^2								
Urban Creep	1.100									
	146.570	m^2								
500 year return period										
R5	0.038	m	5	0.083333	0.02	0.037892	0.03789158	R5	0.0087	m
R10	0.047	m	10	0.166667	0.02	0.046609	0.04660936	R10	0.0124	m
R15	0.053	m	15	0.25	0.02	0.052556	0.05255612	R15	0.0153	m
R30	0.064	m	30	0.5	0.02	0.064436	0.06443585	R30	0.0196	m
R60	0.079	m	60	1	0.02	0.078877	0.07887706	R60	0.0248	m
R120	0.096	m	120	2	0.02	0.096432	0.09643206	R120	0.0303	m
R240	0.118	m	240	4	0.02	0.117772	0.11777223	R240	0.0363	m
R360	**0.132**	**m**	**360**	**6**	0.02	**0.132329**	0.13232925	R360	0.0409	m
R600	0.153	m	600	10	0.02	0.15	0.15320193	R600	0.0466	m
R1440	0.197	m	1440	24	0.02	0.19676	0.19676001	R1440	0.0578	m

Inflow to soakaway system

I5	5.55	m^3
I10	6.83	m^3
I15	7.70	m^3
I30	9.44	m^3
I60	11.56	m^3
I120	14.13	m^3
I240	17.26	m^3
I360	19.40	m^3
I600	22.45	m^3
I1440	28.84	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

System Storage (1No IC & pipes)

Aver. Ø 450mm Aver. h = 450mm

Aver. Ø 100mm Aver. L =31000mm

$V = \pi r^2 h =$ 0.3410 m^3

@100 % = **0.341** m^3

Soakaway dims:

L	4.248	m	8No
W	3.54	m	10No
Depth	1.5	m	8No

As50	11.682	
Void ratio	95	%

Outflow from Tank:

O5	0.0226	m^3
O10	0.0453	m^3
O15	0.0679	m^3
O30	0.1358	m^3
O60	0.2717	m^3
O120	0.5433	m^3
O240	1.0866	m^3
O360	1.6299	m^3
O600	2.7166	m^3
O1440	6.5197	m^3

Storage required:			Time to half drain:		
S5	5.53	m^3	ts50	10.18	hours
S10	6.79	m^3	ts50	12.49	hours
S15	7.64	m^3	ts50	14.05	hours
S30	9.31	m^3	ts50	17.13	hours
S60	11.29	m^3	ts50	20.78	hours
S120	13.59	m^3	ts50	25.01	hours
S240	16.18	m^3	ts50	29.77	hours
S360	17.77	m^3	ts50	32.70	hours
S600	19.74	m^3	ts50	36.33	hours
S1440	22.32	m^3	ts50	41.08	hours

Storage Provided **21.77** m^3

Critical storm = **S1440**
Storage required = **22.32**
Time to half discharge= **41.08**

0.55 m^3 Overflow expected on the Access Road_Bottom

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **Permavoid PVPP150** stormwater systems is **recommended.** Proposed exceedance **design does not include Climate Change Allowence**.

Try larger Soakaway tank

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Soakaway Design (10 yrs)

Plots 6-7

Roofs =	99.9	m^2
Footpaths =	24.36	m^2
Parking Spaces =	63.36	m^2 (30% Incl. in calcs)
Road =		m^2
Amenity Paving =		m^2 (0% Incl. in calcs)
	143.268	**m^2**

Area	143.268	m^2	
Urban Creep	1.100		
	157.595	m^2	

10 year return period + 45%

			Storm duration (Min.)
R5	0.013	m	5
R10	0.018	m	10
R15	0.022	m	15
R30	0.028	m	30
R60	0.036	m	60
R120	0.044	m	120
R240	0.053	m	240
R360	**0.059**	**m**	**360**
R600	0.068	m	600
R1440	0.084	m	1440

Inflow to soakaway system

I5	1.99	m^3
I10	2.83	m^3
I15	3.50	m^3
I30	4.48	m^3
I60	5.67	m^3
I120	6.92	m^3
I240	8.30	m^3
I360	9.35	m^3
I600	10.65	m^3
I1440	13.21	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**	**SI Report**

Soakaway dims:

Length	7.08	m	
Width	2.124	m	
Depth	0.9	m	(below invert depth of inlet pipe)

Attenuation dims:

L	7.08	m
W	2.124	m
Depth	0.45	m

As50	8.2836		As50	1	
Void ratio	95	%	Void ratio	95	%

Allowance for extra rain during storage period (assume average rainfall)

Average daily rain	2.60	mm
Extra rain during storage	**0.49**	m^3

Outflow from Tank:

O5	0.02	m^3
O10	0.03	m^3
O15	0.05	m^3
O30	0.10	m^3
O60	0.19	m^3
O120	0.39	m^3
O240	0.77	m^3
O360	1.16	m^3
O600	1.93	m^3
O1440	4.62	m^3

Storage required:			Time to drain:		
S5	1.97	m^3	ts50	5.12	hours
S10	2.80	m^3	ts50	7.27	hours
S15	3.45	m^3	ts50	8.95	hours
S30	4.38	m^3	ts50	11.38	hours
S60	5.47	m^3	ts50	14.21	hours
S120	6.54	m^3	ts50	16.97	hours
S240	7.52	m^3	ts50	19.53	hours
S360	8.19	m^3	ts50	21.26	hours
S600	8.72	m^3	ts50	22.64	hours
S1440	8.58	m^3	ts50	22.28	hours

Storage provided	**19.29**	m^3		
Critical storm =	**S600**			
Storage required =	**9.21**			
Time to discharge=	**22.64**	Hours	**0.94**	Days

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **Permavoid PVPP150** stormwater systems is **recommended.** Proposed **design includes 45% Climate Change Allowence**.

Soakaway size proposed is satisfactory

http://www.metoffice.gov.uk/climate/uk/regional-climates/so

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Soakaway Design (1 yr)

Plots 6-7

Area	143.268	m^2
Urban Creep	1.100	
	157.595	m^2

1 year return period + 45%

			Storm duration (Min.)
R5	0.006	m	5
R10	0.009	m	10
R15	0.010	m	15
R30	0.013	m	30
R60	0.017	m	60
R120	0.021	m	120
R240	0.027	m	240
R360	**0.030**	**m**	**360**
R600	0.036	m	600
R1440	0.047	m	1440

Inflow to soakaway system

I5	1.02	m^3
I10	1.37	m^3
I15	1.61	m^3
I30	2.08	m^3
I60	2.65	m^3
I120	3.35	m^3
I240	4.19	m^3
I360	4.77	m^3
I600	5.60	m^3
I1440	7.33	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

To reduce from 10 year storm to 1 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours
N = No. of storms in 10 years

T	N	r	0.45	10 year return period	
0.083333	10	0.004482	0.00650	R5	0.0087 m
0.166667	10	0.005996	0.00869	R10	0.0124 m
0.25	10	0.007029	0.01019	R15	0.0153 m
0.5	10	0.009092	0.01318	R30	0.0196 m
1	10	0.011600	0.01682	R60	0.0248 m
2	10	0.014649	0.02124	R120	0.0303 m
4	10	0.018355	0.02661	R240	0.0363 m
6	**10**	**0.020883**	0.03028	R360	0.0409 m
10	10	0.024508	0.03554	R600	0.0466 m
24	10	0.032073	0.04651	R1440	0.0578 m

Soakaway dims:

L	5.664	m
W	2.124	m
Depth	0.9	m

Attenuation dims:

L	5.664	m
W	2.124	m
Depth	0.45	m

As50	7.0092		As50	1	
Void ratio	95	%	Void rati	95	%

Outflow from Tank:

O5	0.0136	m^3
O10	0.0272	m^3
O15	0.0407	m^3
O30	0.0815	m^3
O60	0.1630	m^3
O120	0.3260	m^3
O240	0.6520	m^3
O360	0.9780	m^3
O600	1.6299	m^3
O1440	3.9118	m^3

Storage required:			Time to half drain:		
S5	1.01	m^3	ts50	3.10	hours
S10	1.34	m^3	ts50	4.12	hours
S15	1.57	m^3	ts50	4.80	hours
S30	2.00	m^3	ts50	6.12	hours
S60	2.49	m^3	ts50	7.63	hours
S120	3.02	m^3	ts50	9.27	hours
S240	3.54	m^3	ts50	10.87	hours
S360	3.79	m^3	ts50	11.64	hours
S600	3.97	m^3	ts50	12.18	hours
S1440	3.42	m^3	ts50	10.48	hours

Storage Provided	**15.43**	m^3		
Critical storm =	**S600**			
Storage required =	**3.97**			
Time to half discharge=	**12.18**	Hours	**0.51**	Days

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **Permavoid PVPP150** stormwater systems is **recommended.** Proposed **design includes 45% Climate Change Allowence**.

Soakaway size proposed is satisfactory

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Soakaway Design (30 yr)

Plots 6-7

Area	143.268	m^2
Urban Creep	1.100	
	157.595	m^2

30 year return period + 45%

			Storm duration (Min.)
R5	0.023	m	5
R10	0.029	m	10
R15	0.032	m	15
R30	0.040	m	30
R60	0.050	m	60
R120	0.061	m	120
R240	0.075	m	240
R360	**0.085**	**m**	**360**
R600	0.099	m	600
R1440	0.127	m	1440

Inflow to soakaway system

I5	3.60	m^3
I10	4.50	m^3
I15	5.12	m^3
I30	6.35	m^3
I60	7.84	m^3
I120	9.66	m^3
I240	11.87	m^3
I360	13.37	m^3
I600	15.53	m^3
I1440	20.04	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

For increase from 10 year storm to 30 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours
N = No. of storms in 10 years

T	N	r	0.45	10 year return period		
0.083333	0.333	0.015764	0.02286	R5	0.0087	m
0.166667	0.333	0.019710	0.02858	R10	0.0124	m
0.25	0.333	0.022402	0.03248	R15	0.0153	m
0.5	0.333	0.027780	0.04028	R30	0.0196	m
1	0.333	0.034318	0.04976	R60	0.0248	m
2	0.333	0.042265	0.06128	R120	0.0303	m
4	0.333	0.051926	0.07529	R240	0.0363	m
6	**0.333**	**0.058516**	0.08485	R360	0.0409	m
10	0.333	0.067965	0.09855	R600	0.0466	m
24	0.333	0.087685	0.12714	R1440	0.0578	m

Soakaway dims:

L	12.036	m
W	2.124	m
Depth	0.9	m
As50	12.744	
Void ratio	95	%

Attenuation dims:

L	12.036	m
W	2.124	m
Depth	0	m
As50	1	
Void rati	30	%

Outflow from Tank:

O5	0.0247	m^3
O10	0.0494	m^3
O15	0.0741	m^3
O30	0.1482	m^3
O60	0.2964	m^3
O120	0.5927	m^3
O240	1.1854	m^3
O360	1.7781	m^3
O600	2.9635	m^3
O1440	7.1124	m^3

Storage required:			Time to half drain:		
S5	3.58	m^3	ts50	6.04	hours
S10	4.45	m^3	ts50	7.52	hours
S15	5.05	m^3	ts50	8.51	hours
S30	6.20	m^3	ts50	10.46	hours
S60	7.55	m^3	ts50	12.73	hours
S120	9.07	m^3	ts50	15.30	hours
S240	10.68	m^3	ts50	18.02	hours
S360	11.59	m^3	ts50	19.56	hours
S600	12.57	m^3	ts50	21.20	hours
S1440	12.92	m^3	ts50	21.81	hours

Storage Provided	**21.86**	m^3
Critical storm =	**S1440**	
Storage required =	**12.92**	
Time to half discharge=	**21.81**	Hours (Acceptable time as 1/30 year storm)

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **Permavoid PVPP150** stormwater systems is **recommended.** Proposed **design includes 45% Climate Change Allowence**.

Soakaway size proposed is satisfactory

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Soakaway Design (100 yr)

Plots 6-7

For increase from 10 year storm to 100 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours
N = No. of storms in 10 years

Area	143.268	m^2	
Urban Creep	1.100		
	157.595	m^2	

100 year return period + 40%			Storm duration (Min.)
R5	0.032	m	5
R10	0.040	m	10
R15	0.045	m	15
R30	0.056	m	30
R60	0.069	m	60
R120	0.084	m	120
R240	0.103	m	240
R360	**0.116**	**m**	**360**
R600	0.135	m	600
R1440	0.174	m	1440

T	N	r		0.4	10 year return period	
0.083333	0.1	0.023154	0.03241527	R5	0.0087	m
0.166667	0.1	0.028694	0.04017133	R10	0.0124	m
0.25	0.1	0.032473	0.04546206	R15	0.0153	m
0.5	0.1	0.040022	0.05603125	R30	0.0196	m
1	0.1	0.0492	0.06887934	R60	0.0248	m
2	0.1	0.060356	0.08449771	R120	0.0303	m
4	0.1	0.073917	0.10348369	R240	0.0363	m
6	**0.1**	**0.083168**	**0.11643482**	R360	0.0409	m
10	0.1	0.10	0.13500488	R600	0.0466	m
24	0.1	0.124113	0.17375774	R1440	0.0578	m

Inflow to soakaway system

I5	5.11	m^3
I10	6.33	m^3
I15	7.16	m^3
I30	8.83	m^3
I60	10.86	m^3
I120	13.32	m^3
I240	16.31	m^3
I360	18.35	m^3
I600	21.28	m^3
I1440	27.38	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

Soakaway dims:			Attenuation dims:		
L	12.036	m	L	12.036	m
W	2.124	m	W	2.124	m
Depth	0.9	m	Depth	0	m
As50	12.744		As50	1	
Void ratio	95	%	Void ratio	30	%

Outflow from Tank:

O5	0.0247	m^3
O10	0.0494	m^3
O15	0.0741	m^3
O30	0.1482	m^3
O60	0.2964	m^3
O120	0.5927	m^3
O240	1.1854	m^3
O360	1.7781	m^3
O600	2.9635	m^3
O1440	7.1124	m^3

Storage required:			Time to half drain:		
S5	5.08	m^3	ts50	8.58	hours
S10	6.28	m^3	ts50	10.60	hours
S15	7.09	m^3	ts50	11.96	hours
S30	8.68	m^3	ts50	14.65	hours
S60	10.56	m^3	ts50	17.81	hours
S120	12.72	m^3	ts50	21.47	hours
S240	15.12	m^3	ts50	25.52	hours
S360	16.57	m^3	ts50	27.96	hours
S600	18.31	m^3	ts50	30.90	hours
S1440	20.27	m^3	ts50	34.20	hours

Storage Provided	**21.86**	m^3
Critical storm =	**S1440**	
Storage required =	**20.27**	
Time to half discharge=	**34.20**	Hours (Acceptable time as 1/100 year storm)

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **Permavoid PVPP150** stormwater systems is **recommended.** Proposed **design includes 40% Climate Change Allowence**.

Soakaway size proposed is satisfactory

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Soakaway Exceedance Flow Design (500 yr)

Plots 6-7

For increase from 10 year storm to 500 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours
N = No. of storms in 10 years

Area	143.268	m^2
Urban Creep	1.100	
	157.595	m^2

500 year return period			Storm duration (Min.)	T	N	r	0	10 year return period		
R5	0.038	m	5	0.083333	0.02	0.037892	0.03789158	R5	0.0087	m
R10	0.047	m	10	0.166667	0.02	0.046609	0.04660936	R10	0.0124	m
R15	0.053	m	15	0.25	0.02	0.052556	0.05255612	R15	0.0153	m
R30	0.064	m	30	0.5	0.02	0.064436	0.06443585	R30	0.0196	m
R60	0.079	m	60	1	0.02	0.078877	0.07887706	R60	0.0248	m
R120	0.096	m	120	2	0.02	0.096432	0.09643206	R120	0.0303	m
R240	0.118	m	240	4	0.02	0.117772	0.11777223	R240	0.0363	m
R360	**0.132**	**m**	**360**	**6**	0.02	**0.132329**	0.13232925	R360	0.0409	m
R600	0.153	m	600	10	0.02	0.15	0.15320193	R600	0.0466	m
R1440	0.197	m	1440	24	0.02	0.19676	0.19676001	R1440	0.0578	m

Inflow to soakaway system

I5	5.97	m^3
I10	7.35	m^3
I15	8.28	m^3
I30	10.15	m^3
I60	12.43	m^3
I120	15.20	m^3
I240	18.56	m^3
I360	20.85	m^3
I600	24.14	m^3
I1440	31.01	m^3

System Storage (2No IC & pipes)

Aver. Ø 450mm Aver. h = 450mm

Aver. Ø 100mm Aver. L =40000mm

$V = \pi r^2 h =$ 0.4573 m^3

@100 % = **0.457** m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

Soakaway dims:

L	12.036	m
W	2.124	m
Depth	0.9	m
As50	12.744	
Void ratio	95	%

Attenuation dims:

L	12.036	m
W	2.124	m
Depth	0	m
As50	1	
Void ratio	30	%

Outflow from Tank:

O5	0.0247	m^3
O10	0.0494	m^3
O15	0.0741	m^3
O30	0.1482	m^3
O60	0.2964	m^3
O120	0.5927	m^3
O240	1.1854	m^3
O360	1.7781	m^3
O600	2.9635	m^3
O1440	7.1124	m^3

Storage required:			Time to half drain:		
S5	5.95	m^3	ts50	10.03	hours
S10	7.30	m^3	ts50	12.31	hours
S15	8.21	m^3	ts50	13.85	hours
S30	10.01	m^3	ts50	16.88	hours
S60	12.13	m^3	ts50	20.47	hours
S120	14.60	m^3	ts50	24.64	hours
S240	17.37	m^3	ts50	29.31	hours
S360	19.08	m^3	ts50	32.19	hours
S600	21.18	m^3	ts50	35.74	hours
S1440	23.90	m^3	ts50	40.32	hours

Storage Provided	**22.31**	m^3
Critical storm =	**S1440**	
Storage required =	**23.90**	
Time to half discharge=	**40.32**	Hours

1.58 m^3 Overflow expected on the Access Road_Top

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **Permavoid PVPP150** stormwater systems is **recommended.** Proposed exceedance **design does not include Climate Change Allowence**.

Try larger Soakaway tank

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Job No.	456146	Sheet	6	Date	May-23
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Soakaway Design (10 yrs)

Plots 3-5

Roofs =	147.74	m^2
Footpaths =	80.36	m^2
Parking Spaces =	69.12	m^2 (30% Incl. in calcs)
Road =		m^2
Amenity Paving =		m^2 (0% Incl. in calcs)
	248.836	**m^2**

Area	248.836	m^2	
Urban Creep	1.100		
	273.720	m^2	

10 year return period + 45%

			Storm duration (Min.)
R5	0.013	m	5
R10	0.018	m	10
R15	0.022	m	15
R30	0.028	m	30
R60	0.036	m	60
R120	0.044	m	120
R240	0.053	m	240
R360	**0.059**	**m**	**360**
R600	0.068	m	600
R1440	0.084	m	1440

Inflow to soakaway system

I5	3.45	m^3
I10	4.92	m^3
I15	6.07	m^3
I30	7.78	m^3
I60	9.84	m^3
I120	12.03	m^3
I240	14.41	m^3
I360	16.23	m^3
I600	18.50	m^3
I1440	22.94	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**	**SI Report**

Soakaway dims:

Length	10	m
Width	2	m
Depth	1.2	m (below invert depth of inlet pipe)

As50	14.4	
Void ratio	95	%

Outflow from Tank:

O5	0.03	m^3
O10	0.06	m^3
O15	0.08	m^3
O30	0.17	m^3
O60	0.33	m^3
O120	0.67	m^3
O240	1.34	m^3
O360	2.01	m^3
O600	3.35	m^3
O1440	8.04	m^3

Allowance for extra rain during storage period (assume average rainfall)

Average daily rain	2.60	mm
Extra rain during storage	**0.85**	m^3

Storage required: / Time to drain:

S5	3.43	m^3	ts50	5.11	hours
S10	4.87	m^3	ts50	7.27	hours
S15	5.99	m^3	ts50	8.94	hours
S30	7.61	m^3	ts50	11.37	hours
S60	9.51	m^3	ts50	14.20	hours
S120	11.36	m^3	ts50	16.96	hours
S240	13.07	m^3	ts50	19.51	hours
S360	14.22	m^3	ts50	21.24	hours
S600	15.15	m^3	ts50	22.62	hours
S1440	14.90	m^3	ts50	22.25	hours

Storage provided	**22.80**	m^3		
Critical storm =	**S600**			
Storage required =	**16.00**			
Time to discharge=	**22.62**	Hours	**0.94**	Days

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **AquaCell Core** or **Polystorm PSM1** stormwater systems is **recommended.** Proposed **design includes** for **45% Climate Change Allowence**.

Soakaway size proposed is satisfactory

http://www.metoffice.gov.uk/climate/uk/regional-climates/so

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Soakaway Design (1 yr)

Plots 3-5

Area	248.836	m^2
Urban Creep	1.100	
	273.720	m^2

1 year return period + 45%

			Storm duration (Min.)
R5	0.006	m	5
R10	0.009	m	10
R15	0.010	m	15
R30	0.013	m	30
R60	0.017	m	60
R120	0.021	m	120
R240	0.027	m	240
R360	**0.030**	**m**	**360**
R600	0.036	m	600
R1440	0.047	m	1440

Inflow to soakaway system

I5	1.78	m^3
I10	2.38	m^3
I15	2.79	m^3
I30	3.61	m^3
I60	4.60	m^3
I120	5.81	m^3
I240	7.28	m^3
I360	8.29	m^3
I600	9.73	m^3
I1440	12.73	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

Soakaway dims:

L	8	m
W	2	m
Depth	0.8	m

As50	8	
Void ratio	95	%

Outflow from Tank:

O5	0.0155	m^3
O10	0.0310	m^3
O15	0.0465	m^3
O30	0.0930	m^3
O60	0.1860	m^3
O120	0.3721	m^3
O240	0.7441	m^3
O360	1.1162	m^3
O600	1.8603	m^3
O1440	4.4648	m^3

Storage required: / Time to half drain:

S5	1.76	m^3	ts50	4.74	hours
S10	2.35	m^3	ts50	6.31	hours
S15	2.74	m^3	ts50	7.37	hours
S30	3.52	m^3	ts50	9.45	hours
S60	4.42	m^3	ts50	11.87	hours
S120	5.44	m^3	ts50	14.63	hours
S240	6.54	m^3	ts50	17.58	hours
S360	7.17	m^3	ts50	19.28	hours
S600	7.87	m^3	ts50	21.14	hours
S1440	8.26	m^3	ts50	22.21	hours

To reduce from 10 year storm to 1 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours
N = No. of storms in 10 years

T	N	r	0.45	10 year return period	
0.083333	10	0.004482	0.00650	R5	0.0087 m
0.166667	10	0.005996	0.00869	R10	0.0124 m
0.25	10	0.007029	0.01019	R15	0.0153 m
0.5	10	0.009092	0.01318	R30	0.0196 m
1	10	0.011600	0.01682	R60	0.0248 m
2	10	0.014649	0.02124	R120	0.0303 m
4	10	0.018355	0.02661	R240	0.0363 m
6	**10**	**0.020883**	0.03028	R360	0.0409 m
10	10	0.024508	0.03554	R600	0.0466 m
24	10	0.032073	0.04651	R1440	0.0578 m

Storage Provided	**12.16**	m^3
Critical storm =	**S1440**	
Storage required =	**8.26**	
Time to half discharge=	**22.21**	Hours (Acceptable time as 1/100 year storm)

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **AquaCell Core** or **Polystorm PSM1** stormwater systems is **recommended.** Proposed **design includes** for **45% Climate Change Allowence**.

Soakaway size proposed is satisfactory

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Soakaway Design (30 yr)

Plots 3-5

Area	248.836	m^2
Urban Creep	1.100	
	273.720	m^2

30 year return period + 45%			Storm duration (Min.)
R5	0.023	m	5
R10	0.029	m	10
R15	0.032	m	15
R30	0.040	m	30
R60	0.050	m	60
R120	0.061	m	120
R240	0.075	m	240
R360	**0.085**	**m**	**360**
R600	0.099	m	600
R1440	0.127	m	1440

Inflow to soakaway system

I5	6.26	m^3
I10	7.82	m^3
I15	8.89	m^3
I30	11.03	m^3
I60	13.62	m^3
I120	16.77	m^3
I240	20.61	m^3
I360	23.22	m^3
I600	26.98	m^3
I1440	34.80	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

Soakaway dims:

L	12	m
W	2	m
Depth	1.6	m

As50	22.4	
Void ratio	95	%

Outflow from Tank:

O5	0.0434	m^3
O10	0.0868	m^3
O15	0.1302	m^3
O30	0.2604	m^3
O60	0.5209	m^3
O120	1.0418	m^3
O240	2.0836	m^3
O360	3.1254	m^3
O600	5.2089	m^3
O1440	12.5015	m^3

Storage required:			Time to half drain:		
S5	6.21	m^3	ts50	5.96	hours
S10	7.74	m^3	ts50	7.43	hours
S15	8.76	m^3	ts50	8.41	hours
S30	10.77	m^3	ts50	10.33	hours
S60	13.10	m^3	ts50	12.57	hours
S120	15.73	m^3	ts50	15.10	hours
S240	18.53	m^3	ts50	17.78	hours
S360	20.10	m^3	ts50	19.29	hours
S600	21.77	m^3	ts50	20.89	hours
S1440	22.30	m^3	ts50	21.41	hours

Storage Provided	**36.48**	m^3
Critical storm =	**S1440**	
Storage required =	**22.30**	
Time to half discharge=	**21.41**	Hours (Acceptable time as 1/30 year storm)

Soakaway size proposed is satisfactory

For increase from 10 year storm to 30 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours
N = No. of storms in 10 years

T	N	r	0.45	10 year return period	
0.083333	0.333	0.015764	0.02286	R5	0.0087 m
0.166667	0.333	0.019710	0.02858	R10	0.0124 m
0.25	0.333	0.022402	0.03248	R15	0.0153 m
0.5	0.333	0.027780	0.04028	R30	0.0196 m
1	0.333	0.034318	0.04976	R60	0.0248 m
2	0.333	0.042265	0.06128	R120	0.0303 m
4	0.333	0.051926	0.07529	R240	0.0363 m
6	**0.333**	**0.058516**	0.08485	R360	0.0409 m
10	0.333	0.067965	0.09855	R600	0.0466 m
24	0.333	0.087685	0.12714	R1440	0.0578 m

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **AquaCell Core** or **Polystorm PSM1** stormwater systems is **recommended.** Proposed **design includes** for **45% Climate Change Allowence**.

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Soakaway Design (100 yr)

Plots 3-5

Area	248.836	m^2
Urban Creep	1.100	
	273.720	m^2

100 year return period + 40%

			Storm duration (Min.)
R5	0.032	m	5
R10	0.040	m	10
R15	0.045	m	15
R30	0.056	m	30
R60	0.069	m	60
R120	0.084	m	120
R240	0.103	m	240
R360	**0.116**	**m**	**360**
R600	0.135	m	600
R1440	0.174	m	1440

Inflow to soakaway system

I5	8.87	m^3
I10	11.00	m^3
I15	12.44	m^3
I30	15.34	m^3
I60	18.85	m^3
I120	23.13	m^3
I240	28.33	m^3
I360	31.87	m^3
I600	36.95	m^3
I1440	47.56	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

Soakaway dims:

L	12	m
W	2	m
Depth	1.6	m

As50	22.4	
Void ratio	95	%

Outflow from Tank:

O5	0.0434	m^3
O10	0.0868	m^3
O15	0.1302	m^3
O30	0.2604	m^3
O60	0.5209	m^3
O120	1.0418	m^3
O240	2.0836	m^3
O360	3.1254	m^3
O600	5.2089	m^3
O1440	12.5015	m^3

Storage required:			Time to half drain:		
S5	8.83	m^3	ts50	8.48	hours
S10	10.91	m^3	ts50	10.47	hours
S15	12.31	m^3	ts50	11.82	hours
S30	15.08	m^3	ts50	14.47	hours
S60	18.33	m^3	ts50	17.60	hours
S120	22.09	m^3	ts50	21.20	hours
S240	26.24	m^3	ts50	25.19	hours
S360	28.75	m^3	ts50	27.59	hours
S600	31.74	m^3	ts50	30.47	hours
S1440	35.06	m^3	ts50	33.65	hours

Storage Provided	**36.48**	m^3
Critical storm =	**S1440**	
Storage required =	**35.06**	
Time to half discharge=	**33.65**	Hours (Acceptable time as 1/100 year storm)

Soakaway size proposed is satisfactory

For increase from 10 year storm to 100 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours

N = No. of storms in 10 years

T	N	r		0.4 10 year return period		
0.083333	0.1	0.023154	0.03241527	R5	0.0087	m
0.166667	0.1	0.028694	0.04017133	R10	0.0124	m
0.25	0.1	0.032473	0.04546206	R15	0.0153	m
0.5	0.1	0.040022	0.05603125	R30	0.0196	m
1	0.1	0.0492	0.06887934	R60	0.0248	m
2	0.1	0.060356	0.08449771	R120	0.0303	m
4	0.1	0.073917	0.10348369	R240	0.0363	m
6	**0.1**	**0.083168**	**0.11643482**	R360	0.0409	m
10	0.1	0.10	0.13500488	R600	0.0466	m
24	0.1	0.124113	0.17375774	R1440	0.0578	m

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **AquaCell Core** or **Polystorm PSM1** stormwater systems is **recommended.** Proposed **design includes** for **40% Climate Change Allowence**.

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Soakaway Exceedance Flow Design (500 yr)

Plots 3-5

Area	248.836	m^2
Urban Creep	1.100	
	273.720	m^2

500 year return period

			Storm duration (Min.)
R5	0.038	m	5
R10	0.047	m	10
R15	0.053	m	15
R30	0.064	m	30
R60	0.079	m	60
R120	0.096	m	120
R240	0.118	m	240
R360	**0.132**	**m**	**360**
R600	0.153	m	600
R1440	0.197	m	1440

Inflow to soakaway system

I5	10.37	m^3
I10	12.76	m^3
I15	14.39	m^3
I30	17.64	m^3
I60	21.59	m^3
I120	26.40	m^3
I240	32.24	m^3
I360	36.22	m^3
I600	41.93	m^3
I1440	53.86	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

Soakaway dims:

L	12	m
W	2	m
Depth	1.6	m

As50	22.4	
Void ratio	95	%

Outflow from Tank:

O5	0.0434	m^3
O10	0.0868	m^3
O15	0.1302	m^3
O30	0.2604	m^3
O60	0.5209	m^3
O120	1.0418	m^3
O240	2.0836	m^3
O360	3.1254	m^3
O600	5.2089	m^3
O1440	12.5015	m^3

Storage required:

			Time to half drain:		
S5	10.33	m^3	ts50	9.91	hours
S10	12.67	m^3	ts50	12.16	hours
S15	14.26	m^3	ts50	13.68	hours
S30	17.38	m^3	ts50	16.68	hours
S60	21.07	m^3	ts50	20.22	hours
S120	25.35	m^3	ts50	24.34	hours
S240	30.15	m^3	ts50	28.94	hours
S360	33.10	m^3	ts50	31.77	hours
S600	36.73	m^3	ts50	35.25	hours
S1440	41.36	m^3	ts50	39.70	hours

Storage Provided	**37.06**	m^3
Critical storm =	**S1440**	
Storage required =	**41.36**	
Time to half discharge=	**39.70**	

For increase from 10 year storm to 500 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours

N = No. of storms in 10 years

T	N	r	0	10 year return period		
0.083333	0.02	0.037892	0.03789158	R5	0.0087	m
0.166667	0.02	0.046609	0.04660936	R10	0.0124	m
0.25	0.02	0.052556	0.05255612	R15	0.0153	m
0.5	0.02	0.064436	0.06443585	R30	0.0196	m
1	0.02	0.078877	0.07887706	R60	0.0248	m
2	0.02	0.096432	0.09643206	R120	0.0303	m
4	0.02	0.117772	0.11777223	R240	0.0363	m
6	0.02	**0.132329**	0.13232925	R360	0.0409	m
10	0.02	0.15	0.15320193	R600	0.0466	m
24	0.02	0.19676	0.19676001	R1440	0.0578	m

System Storage (3No IC & pipes)

Aver. Ø 450mm Aver. h = 450mm

Aver. Ø 100mm Aver. L =46320mm

$V = \pi r^2 h =$ 0.5785 m^3

@100 % = **0.579** m^3

46.32

4.30 m^3 Overflow expected, representing
33.3 mm garden flood @ Plots 3-5

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **AquaCell Core** or **Polystorm PSM1** stormwater systems is **recommended.** Proposed exceedance **design does not include Climate Change Allowence**.

Try larger Soakaway tank

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Job No.	456146	Sheet	1	Date	Sep-23
Job	Bitterne Parish Church	By	HS	Checked	

Soakaway Design (10 yrs)

Plots 1-2, 8-9, 10-11

Area	197.198	m^2			
Urban Creep	1.100				
	216.918	m^2			
10 year return period + 45%			Storm duration (Min.)		
R5	0.013	m	5		
R10	0.018	m	10		
R15	0.022	m	15		
R30	0.028	m	30		
R60	0.036	m	60		
R120	0.044	m	120		
R240	0.053	m	240		
R360	**0.059**	**m**	**360**		
R600	0.068	m	600		
R1440	0.084	m	1440		

Roofs =	118.37	m^2
Footpaths =	59.82	m^2
Parking Spaces =	63.36	m^2 (30% Incl. in calcs)
Road =		m^2
Amenity Paving =		m^2 (0% Incl. in calcs)
	197.198	**m^2**

Inflow to soakaway system

I5	2.74	m^3
I10	3.90	m^3
I15	4.81	m^3
I30	6.16	m^3
I60	7.80	m^3
I120	9.53	m^3
I240	11.42	m^3
I360	12.86	m^3
I600	14.66	m^3
I1440	18.18	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**	**SI Report**

Soakaway dims:

Length	7	m
Width	2.5	m
Depth	1.2	m (below invert depth of inlet pipe)

As50	11.4	
Void ratio	95	%

Outflow from Tank:

O5	0.02	m^3
O10	0.04	m^3
O15	0.07	m^3
O30	0.13	m^3
O60	0.27	m^3
O120	0.53	m^3
O240	1.06	m^3
O360	1.59	m^3
O600	2.65	m^3
O1440	6.36	m^3

Allowance for extra rain during storage period (assume average rainfall)

Average daily rain	2.60	mm
Extra rain during storage	**0.68**	m^3

Storage required:

			Time to drain:		
S5	2.71	m^3	ts50	5.12	hours
S10	3.86	m^3	ts50	7.27	hours
S15	4.75	m^3	ts50	8.95	hours
S30	6.03	m^3	ts50	11.38	hours
S60	7.54	m^3	ts50	14.21	hours
S120	9.00	m^3	ts50	16.98	hours
S240	10.36	m^3	ts50	19.53	hours
S360	11.27	m^3	ts50	21.26	hours
S600	12.01	m^3	ts50	22.64	hours
S1440	11.82	m^3	ts50	22.29	hours

Storage provided	**19.95**	m^3		
Critical storm =	**S600**			
Storage required =	**12.68**			
Time to discharge=	**22.64**	Hours	**0.94**	Days

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **AquaCell Core** or **Polystorm PSM1** stormwater systems is **recommended.** Proposed **design includes** for **45% Climate Change Allowence**.

Soakaway size proposed is satisfactory

http://www.metoffice.gov.uk/climate/uk/regional-climates/so

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Soakaway Design (1 yr)

Plots 1-2, 8-9, 10-11

Area	197.198	m^2
Urban Creep	1.100	
	216.918	m^2

1 year return period + 45%

			Storm duration (Min.)
R5	0.006	m	5
R10	0.009	m	10
R15	0.010	m	15
R30	0.013	m	30
R60	0.017	m	60
R120	0.021	m	120
R240	0.027	m	240
R360	**0.030**	**m**	**360**
R600	0.036	m	600
R1440	0.047	m	1440

Inflow to soakaway system

I5	1.41	m^3
I10	1.89	m^3
I15	2.21	m^3
I30	2.86	m^3
I60	3.65	m^3
I120	4.61	m^3
I240	5.77	m^3
I360	6.57	m^3
I600	7.71	m^3
I1440	10.09	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

Soakaway dims:

L	4	m
W	2.5	m
Depth	1.2	m

As50	7.8	
Void ratio	95	%

Outflow from Tank:

O5	0.0151	m^3
O10	0.0302	m^3
O15	0.0453	m^3
O30	0.0907	m^3
O60	0.1814	m^3
O120	0.3628	m^3
O240	0.7255	m^3
O360	1.0883	m^3
O600	1.8138	m^3
O1440	4.3532	m^3

Storage required:			Time to half drain:		
S5	1.39	m^3	ts50	3.84	hours
S10	1.86	m^3	ts50	5.12	hours
S15	2.17	m^3	ts50	5.97	hours
S30	2.77	m^3	ts50	7.63	hours
S60	3.47	m^3	ts50	9.56	hours
S120	4.24	m^3	ts50	11.70	hours
S240	5.05	m^3	ts50	13.91	hours
S360	5.48	m^3	ts50	15.11	hours
S600	5.89	m^3	ts50	16.25	hours
S1440	5.73	m^3	ts50	15.81	hours

Storage Provided	**11.40**	m^3		
Critical storm =	**S600**			
Storage required =	**5.89**			
Time to half discharge=	**16.25**	Hours	**0.68**	Days

Soakaway size proposed is satisfactory

To reduce from 10 year storm to 1 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours

N = No. of storms in 10 years

T	N	r	0.45	10 year return period	
0.083333	10	0.004482	0.00650	R5	0.0087 m
0.166667	10	0.005996	0.00869	R10	0.0124 m
0.25	10	0.007029	0.01019	R15	0.0153 m
0.5	10	0.009092	0.01318	R30	0.0196 m
1	10	0.011600	0.01682	R60	0.0248 m
2	10	0.014649	0.02124	R120	0.0303 m
4	10	0.018355	0.02661	R240	0.0363 m
6	**10**	**0.020883**	0.03028	R360	0.0409 m
10	10	0.024508	0.03554	R600	0.0466 m
24	10	0.032073	0.04651	R1440	0.0578 m

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **AquaCell Core** or **Polystorm PSM1** stormwater systems is **recommended.** Proposed **design includes** for **45% Climate Change Allowence**.

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Soakaway Design (30 yr)

Plots 1-2, 8-9, 10-11

Area	197.198	m^2
Urban Creep	1.100	
	216.918	m^2

For increase from 10 year storm to 30 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours
N = No. of storms in 10 years

30 year return period + 45%			Storm duration (Min.)
R5	0.023	m	5
R10	0.029	m	10
R15	0.032	m	15
R30	0.040	m	30
R60	0.050	m	60
R120	0.061	m	120
R240	0.075	m	240
R360	**0.085**	**m**	**360**
R600	0.099	m	600
R1440	0.127	m	1440

T	N	r	0.45	10 year return period	
0.083333	0.333	0.015764	0.02286	R5	0.0087 m
0.166667	0.333	0.019710	0.02858	R10	0.0124 m
0.25	0.333	0.022402	0.03248	R15	0.0153 m
0.5	0.333	0.027780	0.04028	R30	0.0196 m
1	0.333	0.034318	0.04976	R60	0.0248 m
2	0.333	0.042265	0.06128	R120	0.0303 m
4	0.333	0.051926	0.07529	R240	0.0363 m
6	**0.333**	**0.058516**	0.08485	R360	0.0409 m
10	0.333	0.067965	0.09855	R600	0.0466 m
24	0.333	0.087685	0.12714	R1440	0.0578 m

Inflow to soakaway system

I5	4.96	m^3
I10	6.20	m^3
I15	7.05	m^3
I30	8.74	m^3
I60	10.79	m^3
I120	13.29	m^3
I240	16.33	m^3
I360	18.41	m^3
I600	21.38	m^3
I1440	27.58	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

Soakaway dims:

L	9	m
W	2.5	m
Depth	1.6	m

As50	18.4	
Void ratio	95	%

Outflow from Tank:

O5	0.0357	m^3
O10	0.0713	m^3
O15	0.1070	m^3
O30	0.2139	m^3
O60	0.4279	m^3
O120	0.8558	m^3
O240	1.7115	m^3
O360	2.5673	m^3
O600	4.2788	m^3
O1440	10.2691	m^3

Storage required:			Time to half drain:		
S5	4.92	m^3	ts50	5.75	hours
S10	6.13	m^3	ts50	7.16	hours
S15	6.94	m^3	ts50	8.11	hours
S30	8.52	m^3	ts50	9.96	hours
S60	10.37	m^3	ts50	12.11	hours
S120	12.44	m^3	ts50	14.53	hours
S240	14.62	m^3	ts50	17.09	hours
S360	15.84	m^3	ts50	18.51	hours
S600	17.10	m^3	ts50	19.98	hours
S1440	17.31	m^3	ts50	20.23	hours

Storage Provided	**34.20**	m^3
Critical storm =	**S1440**	
Storage required =	**17.31**	
Time to half discharge=	**20.23**	Hours (Acceptable time as 1/30 year storm)

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **AquaCell Core** or **Polystorm PSM1** stormwater systems is **recommended.** Proposed **design includes** for **45% Climate Change Allowence**.

Soakaway size proposed is satisfactory

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Soakaway Design (100 yr)

Plots 1-2, 8-9, 10-11

Area	197.198	m^2
Urban Creep	1.100	
	216.918	m^2

100 year return period + 40%

			Storm duration (Min.)
R5	0.032	m	5
R10	0.040	m	10
R15	0.045	m	15
R30	0.056	m	30
R60	0.069	m	60
R120	0.084	m	120
R240	0.103	m	240
R360	**0.116**	**m**	**360**
R600	0.135	m	600
R1440	0.174	m	1440

Inflow to soakaway system

I5	7.03	m^3
I10	8.71	m^3
I15	9.86	m^3
I30	12.15	m^3
I60	14.94	m^3
I120	18.33	m^3
I240	22.45	m^3
I360	25.26	m^3
I600	29.28	m^3
I1440	37.69	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

Soakaway dims:

L	9	m
W	2.5	m
Depth	1.6	m

As50	18.4	
Void ratio	95	%

Outflow from Tank:

O5	0.0357	m^3
O10	0.0713	m^3
O15	0.1070	m^3
O30	0.2139	m^3
O60	0.4279	m^3
O120	0.8558	m^3
O240	1.7115	m^3
O360	2.5673	m^3
O600	4.2788	m^3
O1440	10.2691	m^3

Storage required:			Time to half drain:		
S5	7.00	m^3	ts50	8.17	hours
S10	8.64	m^3	ts50	10.10	hours
S15	9.75	m^3	ts50	11.40	hours
S30	11.94	m^3	ts50	13.95	hours
S60	14.51	m^3	ts50	16.96	hours
S120	17.47	m^3	ts50	20.42	hours
S240	20.74	m^3	ts50	24.23	hours
S360	22.69	m^3	ts50	26.51	hours
S600	25.01	m^3	ts50	29.22	hours
S1440	27.42	m^3	ts50	32.04	hours

Storage Provided	**34.20**	m^3
Critical storm =	**S1440**	
Storage required =	**27.42**	
Time to half discharge=	**32.04**	Hours (Acceptable time as 1/100 year storm)

Soakaway size proposed is satisfactory

For increase from 10 year storm to 100 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours

N = No. of storms in 10 years

T	N	r		0.4 10 year return period		
0.083333	0.1	0.023154	0.03241527	R5	0.0087	m
0.166667	0.1	0.028694	0.04017133	R10	0.0124	m
0.25	0.1	0.032473	0.04546206	R15	0.0153	m
0.5	0.1	0.040022	0.05603125	R30	0.0196	m
1	0.1	0.0492	0.06887934	R60	0.0248	m
2	0.1	0.060356	0.08449771	R120	0.0303	m
4	0.1	0.073917	0.10348369	R240	0.0363	m
6	**0.1**	**0.083168**	**0.11643482**	R360	0.0409	m
10	0.1	0.10	0.13500488	R600	0.0466	m
24	0.1	0.124113	0.17375774	R1440	0.0578	m

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **AquaCell Core** or **Polystorm PSM1** stormwater systems is **recommended.** Proposed **design includes** for **40% Climate Change Allowence**.

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Soakaway Exceedance Flow Design (500 yr)

Plots 1-2, 8-9, 10-11

Area	197.198	m^2
Urban Creep	1.100	
	216.918	m^2

500 year return period

R5	0.038	m
R10	0.047	m
R15	0.053	m
R30	0.064	m
R60	0.079	m
R120	0.096	m
R240	0.118	m
R360	**0.132**	**m**
R600	0.153	m
R1440	0.197	m

Inflow to soakaway system

I5	8.22	m^3
I10	10.11	m^3
I15	11.40	m^3
I30	13.98	m^3
I60	17.11	m^3
I120	20.92	m^3
I240	25.55	m^3
I360	28.70	m^3
I600	33.23	m^3
I1440	42.68	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

Soakaway dims:

L	9	m
W	2.5	m
Depth	1.6	m

As50	18.4	
Void ratio	95	%

Outflow from Tank:

O5	0.0357	m^3
O10	0.0713	m^3
O15	0.1070	m^3
O30	0.2139	m^3
O60	0.4279	m^3
O120	0.8558	m^3
O240	1.7115	m^3
O360	2.5673	m^3
O600	4.2788	m^3
O1440	10.2691	m^3

Storage required:

S5	8.18	m^3	ts50	9.56	hours
S10	10.04	m^3	ts50	11.73	hours
S15	11.29	m^3	ts50	13.20	hours
S30	13.76	m^3	ts50	16.08	hours
S60	16.68	m^3	ts50	19.49	hours
S120	20.06	m^3	ts50	23.44	hours
S240	23.84	m^3	ts50	27.85	hours
S360	26.14	m^3	ts50	30.54	hours
S600	28.95	m^3	ts50	33.83	hours
S1440	32.41	m^3	ts50	37.87	hours

Storage Provided	**34.66**	m^3
Critical storm =	**S1440**	
Storage required =	**32.41**	
Time to half discharge=	**37.87**	Hours

For increase from 10 year storm to 500 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours

N = No. of storms in 10 years

Storm duration (Min.)	T	N	r	0	10 year return period	
5	0.083333	0.02	0.037892	0.03789158	R5	0.0087 m
10	0.166667	0.02	0.046609	0.04660936	R10	0.0124 m
15	0.25	0.02	0.052556	0.05255612	R15	0.0153 m
30	0.5	0.02	0.064436	0.06443585	R30	0.0196 m
60	1	0.02	0.078877	0.07887706	R60	0.0248 m
120	2	0.02	0.096432	0.09643206	R120	0.0303 m
240	4	0.02	0.117772	0.11777223	R240	0.0363 m
360	**6**	0.02	**0.132329**	0.13232925	R360	0.0409 m
600	10	0.02	0.15	0.15320193	R600	0.0466 m
1440	24	0.02	0.19676	0.19676001	R1440	0.0578 m

System Storage (2No IC & pipes)

Aver. Ø 450mm Aver. h = 450mm

Aver. Ø 100mm Aver. L =40000mm

$V = \pi r^2 h =$ 0.4573 m^3

@100% = **0.457** m^3

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **AquaCell Core** or **Polystorm PSM1** stormwater systems is **recommended.** Proposed exceedance **design does not include Climate Change Allowence**.

Soakaway size proposed is satisfactory

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Soakaway Design (10 yrs)

Plots 12, 13, 15

Roofs =	74.04	m^2
Footpaths =	36.66	m^2
Parking Spaces =	75.15	m^2 (30% Incl. in calcs)
Road =		m^2
Amenity Paving =		m^2 (0% Incl. in calcs)
	133.245	**m^2**

Area	133.245	m^2	
Urban Creep	1.100		
	146.570	m^2	
10 year return period + 45%			Storm duration (Min.)
R5	0.013	m	5
R10	0.018	m	10
R15	0.022	m	15
R30	0.028	m	30
R60	0.036	m	60
R120	0.044	m	120
R240	0.053	m	240
R360	**0.059**	**m**	**360**
R600	0.068	m	600
R1440	0.084	m	1440
Inflow to soakaway system			
I5	1.85	m^3	
I10	2.64	m^3	
I15	3.25	m^3	
I30	4.17	m^3	
I60	5.27	m^3	
I120	6.44	m^3	
I240	7.71	m^3	
I360	8.69	m^3	
I600	9.90	m^3	
I1440	12.28	m^3	
Outflow from Tank			
f	6.46E-06	**m^3/s**	**SI Report**

Soakaway dims:

Length	5	m
Width	2	m
Depth	1.2	m (below invert depth of inlet pipe)

As50	8.4		
Void ratio	95	%	
Outflow from Tank:			
O5	0.02	m^3	
O10	0.03	m^3	
O15	0.05	m^3	
O30	0.10	m^3	
O60	0.20	m^3	
O120	0.39	m^3	
O240	0.78	m^3	
O360	1.17	m^3	
O600	1.95	m^3	
O1440	4.69	m^3	
Storage required:			Time to drain:
S5	1.83	m^3	ts50 4.69 hours
S10	2.60	m^3	ts50 6.66 hours
S15	3.20	m^3	ts50 8.20 hours
S30	4.07	m^3	ts50 10.41 hours
S60	5.08	m^3	ts50 12.99 hours
S120	6.05	m^3	ts50 15.48 hours
S240	6.93	m^3	ts50 17.75 hours
S360	7.52	m^3	ts50 19.25 hours
S600	7.95	m^3	ts50 20.35 hours
S1440	7.60	m^3	ts50 19.44 hours

Allowance for extra rain during storage period (assume average rainfall)

Average daily rain	2.60	mm
Extra rain during storage	**0.41**	m^3

Storage provided	**11.40**	m^3		
Critical storm =	**S600**			
Storage required =	**8.36**			
Time to discharge=	**20.35**	Hours	**0.85**	Days

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **AquaCell Core** or **Polystorm PSM1** stormwater systems is **recommended.** Proposed **design includes** for **45% Climate Change Allowence**.

Soakaway size proposed is satisfactory

http://www.metoffice.gov.uk/climate/uk/regional-climates/so

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Job No.	456146	Sheet	17	Date	May-23
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Soakaway Design (1 yr)

Plots 12-15

Area	133.245	m^2
Urban Creep	1.100	
	146.570	m^2

1 year return period + 45%

			Storm duration (Min.)
R5	0.006	m	5
R10	0.009	m	10
R15	0.010	m	15
R30	0.013	m	30
R60	0.017	m	60
R120	0.021	m	120
R240	0.027	m	240
R360	**0.030**	**m**	**360**
R600	0.036	m	600
R1440	0.047	m	1440

Inflow to soakaway system

I5	0.95	m^3
I10	1.27	m^3
I15	1.49	m^3
I30	1.93	m^3
I60	2.47	m^3
I120	3.11	m^3
I240	3.90	m^3
I360	4.44	m^3
I600	5.21	m^3
I1440	6.82	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

Soakaway dims:

L	4	m
W	2	m
Depth	0.8	m

As50	4.8	
Void ratio	95	%

Outflow from Tank:

O5	0.0093	m^3
O10	0.0186	m^3
O15	0.0279	m^3
O30	0.0558	m^3
O60	0.1116	m^3
O120	0.2232	m^3
O240	0.4465	m^3
O360	0.6697	m^3
O600	1.1162	m^3
O1440	2.6789	m^3

Storage required:			Time to half drain:		
S5	0.94	m^3	ts50	4.23	hours
S10	1.26	m^3	ts50	5.62	hours
S15	1.47	m^3	ts50	6.57	hours
S30	1.88	m^3	ts50	8.41	hours
S60	2.35	m^3	ts50	10.54	hours
S120	2.89	m^3	ts50	12.95	hours
S240	3.45	m^3	ts50	15.47	hours
S360	3.77	m^3	ts50	16.88	hours
S600	4.09	m^3	ts50	18.33	hours
S1440	4.14	m^3	ts50	18.53	hours

Storage Provided	**6.08**	m^3		
Critical storm =	**S1440**			
Storage required =	**4.14**			
Time to half discharge=	**18.53**	Hours	**0.77**	Days

To reduce from 10 year storm to 1 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours
N = No. of storms in 10 years

T	N	r	0.45	10 year return period	
0.083333	10	0.004482	0.00650	R5	0.0087 m
0.166667	10	0.005996	0.00869	R10	0.0124 m
0.25	10	0.007029	0.01019	R15	0.0153 m
0.5	10	0.009092	0.01318	R30	0.0196 m
1	10	0.011600	0.01682	R60	0.0248 m
2	10	0.014649	0.02124	R120	0.0303 m
4	10	0.018355	0.02661	R240	0.0363 m
6	**10**	**0.020883**	0.03028	R360	0.0409 m
10	10	0.024508	0.03554	R600	0.0466 m
24	10	0.032073	0.04651	R1440	0.0578 m

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **AquaCell Core** or **Polystorm PSM1** stormwater systems is **recommended.** Proposed **design includes** for **45% Climate Change Allowence**.

Soakaway size proposed is satisfactory

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Job No.	456146	Sheet	18	Date	May-23
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Soakaway Design (30 yr)

Plots 12-15

Area	133.245	m^2
Urban Creep	1.100	
	146.570	m^2

For increase from 10 year storm to 30 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours
N = No. of storms in 10 years

30 year return period + 45%			Storm duration (Min.)
R5	0.023	m	5
R10	0.029	m	10
R15	0.032	m	15
R30	0.040	m	30
R60	0.050	m	60
R120	0.061	m	120
R240	0.075	m	240
R360	**0.085**	**m**	**360**
R600	0.099	m	600
R1440	0.127	m	1440

T	N	r	0.45	10 year return period	
0.083333	0.333	0.015764	0.02286	R5	0.0087 m
0.166667	0.333	0.019710	0.02858	R10	0.0124 m
0.25	0.333	0.022402	0.03248	R15	0.0153 m
0.5	0.333	0.027780	0.04028	R30	0.0196 m
1	0.333	0.034318	0.04976	R60	0.0248 m
2	0.333	0.042265	0.06128	R120	0.0303 m
4	0.333	0.051926	0.07529	R240	0.0363 m
6	**0.333**	**0.058516**	0.08485	R360	0.0409 m
10	0.333	0.067965	0.09855	R600	0.0466 m
24	0.333	0.087685	0.12714	R1440	0.0578 m

Inflow to soakaway system

I5	3.35	m^3
I10	4.19	m^3
I15	4.76	m^3
I30	5.90	m^3
I60	7.29	m^3
I120	8.98	m^3
I240	11.04	m^3
I360	12.44	m^3
I600	14.44	m^3
I1440	18.64	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

Soakaway dims:

L	5	m
W	2.5	m
Depth	1.6	m

As50	12	
Void ratio	95	%

Outflow from Tank:

O5	0.0233	m^3
O10	0.0465	m^3
O15	0.0698	m^3
O30	0.1395	m^3
O60	0.2791	m^3
O120	0.5581	m^3
O240	1.1162	m^3
O360	1.6743	m^3
O600	2.7905	m^3
O1440	6.6972	m^3

Storage required:			Time to half drain:		
S5	3.33	m^3	ts50	5.96	hours
S10	4.14	m^3	ts50	7.42	hours
S15	4.69	m^3	ts50	8.41	hours
S30	5.76	m^3	ts50	10.33	hours
S60	7.01	m^3	ts50	12.57	hours
S120	8.42	m^3	ts50	15.09	hours
S240	9.92	m^3	ts50	17.77	hours
S360	10.76	m^3	ts50	19.28	hours
S600	11.65	m^3	ts50	20.88	hours
S1440	11.94	m^3	ts50	21.39	hours

Storage Provided	**19.00**	m^3
Critical storm =	**S1440**	
Storage required =	**11.94**	
Time to half discharge=	**21.39**	Hours (Acceptable time as 1/30 year storm)

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **AquaCell Core** or **Polystorm PSM1** stormwater systems is **recommended.** Proposed **design includes** for **45% Climate Change Allowence**.

Soakaway size proposed is satisfactory

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Job No.	456146	Sheet	19	Date	May-23
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Soakaway Design (100 yr)

Plots 12-15

Area	133.245	m^2
Urban Creep	1.100	
	146.570	m^2

100 year return period + 40%

			Storm duration (Min.)
R5	0.032	m	5
R10	0.040	m	10
R15	0.045	m	15
R30	0.056	m	30
R60	0.069	m	60
R120	0.084	m	120
R240	0.103	m	240
R360	**0.116**	**m**	**360**
R600	0.135	m	600
R1440	0.174	m	1440

Inflow to soakaway system

I5	4.75	m^3
I10	5.89	m^3
I15	6.66	m^3
I30	8.21	m^3
I60	10.10	m^3
I120	12.38	m^3
I240	15.17	m^3
I360	17.07	m^3
I600	19.79	m^3
I1440	25.47	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

Soakaway dims:

L	5	m
W	2.5	m
Depth	1.6	m

As50	12	
Void ratio	95	%

Outflow from Tank:

O5	0.0233	m^3
O10	0.0465	m^3
O15	0.0698	m^3
O30	0.1395	m^3
O60	0.2791	m^3
O120	0.5581	m^3
O240	1.1162	m^3
O360	1.6743	m^3
O600	2.7905	m^3
O1440	6.6972	m^3

Storage required:			Time to half drain:		
S5	4.73	m^3	ts50	8.47	hours
S10	5.84	m^3	ts50	10.47	hours
S15	6.59	m^3	ts50	11.81	hours
S30	8.07	m^3	ts50	14.47	hours
S60	9.82	m^3	ts50	17.59	hours
S120	11.83	m^3	ts50	21.19	hours
S240	14.05	m^3	ts50	25.18	hours
S360	15.39	m^3	ts50	27.58	hours
S600	17.00	m^3	ts50	30.46	hours
S1440	18.77	m^3	ts50	33.63	hours

Storage Provided	**19.00**	m^3
Critical storm =	**S1440**	
Storage required =	**18.77**	
Time to half discharge=	**33.63**	Hours (Acceptable time as 1/100 year storm)

For increase from 10 year storm to 100 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours

N = No. of storms in 10 years

T	N	r		0.4 10 year return period		
0.083333	0.1	0.023154	0.03241527	R5	0.0087	m
0.166667	0.1	0.028694	0.04017133	R10	0.0124	m
0.25	0.1	0.032473	0.04546206	R15	0.0153	m
0.5	0.1	0.040022	0.05603125	R30	0.0196	m
1	0.1	0.0492	0.06887934	R60	0.0248	m
2	0.1	0.060356	0.08449771	R120	0.0303	m
4	0.1	0.073917	0.10348369	R240	0.0363	m
6	**0.1**	**0.083168**	**0.11643482**	R360	0.0409	m
10	0.1	0.10	0.13500488	R600	0.0466	m
24	0.1	0.124113	0.17375774	R1440	0.0578	m

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **AquaCell Core** or **Polystorm PSM1** stormwater systems is **recommended.** Proposed **design includes** for **40% Climate Change Allowence**.

Soakaway size proposed is satisfactory

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Soakaway Exceedance Flow Design (500 yr)

Plots 12-15

Area	133.245	m^2
Urban Creep	1.100	
	146.570	m^2

500 year return period

			Storm duration (Min.)
R5	0.038	m	5
R10	0.047	m	10
R15	0.053	m	15
R30	0.064	m	30
R60	0.079	m	60
R120	0.096	m	120
R240	0.118	m	240
R360	**0.132**	**m**	**360**
R600	0.153	m	600
R1440	0.197	m	1440

Inflow to soakaway system

I5	5.55	m^3
I10	6.83	m^3
I15	7.70	m^3
I30	9.44	m^3
I60	11.56	m^3
I120	14.13	m^3
I240	17.26	m^3
I360	19.40	m^3
I600	22.45	m^3
I1440	28.84	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

Soakaway dims:

L	5	m
W	2.5	m
Depth	1.6	m

As50	12	
Void ratio	95	%

Outflow from Tank:

O5	0.0233	m^3
O10	0.0465	m^3
O15	0.0698	m^3
O30	0.1395	m^3
O60	0.2791	m^3
O120	0.5581	m^3
O240	1.1162	m^3
O360	1.6743	m^3
O600	2.7905	m^3
O1440	6.6972	m^3

Storage required:

			Time to half drain:		
S5	5.53	m^3	ts50	9.91	hours
S10	6.79	m^3	ts50	12.16	hours
S15	7.63	m^3	ts50	13.68	hours
S30	9.30	m^3	ts50	16.67	hours
S60	11.28	m^3	ts50	20.21	hours
S120	13.58	m^3	ts50	24.33	hours
S240	16.15	m^3	ts50	28.93	hours
S360	17.72	m^3	ts50	31.75	hours
S600	19.66	m^3	ts50	35.23	hours
S1440	22.14	m^3	ts50	39.67	hours

Storage Provided	**19.34**	m^3
Critical storm =	**S1440**	
Storage required =	**22.14**	
Time to half discharge=	**39.67**	

2.80 m^3 Overflow expected, representing
19.1 mm garden flood @ Plots 12
7.1 mm garden flood @ Plots 13
5.5 mm garden flood @ Plots 15

Try larger Soakaway tank

For increase from 10 year storm to 500 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours
N = No. of storms in 10 years

T	N	r	0	10 year return period		
0.083333	0.02	0.037892	0.03789158	R5	0.0087	m
0.166667	0.02	0.046609	0.04660936	R10	0.0124	m
0.25	0.02	0.052556	0.05255612	R15	0.0153	m
0.5	0.02	0.064436	0.06443585	R30	0.0196	m
1	0.02	0.078877	0.07887706	R60	0.0248	m
2	0.02	0.096432	0.09643206	R120	0.0303	m
4	0.02	0.117772	0.11777223	R240	0.0363	m
6	0.02	**0.132329**	0.13232925	R360	0.0409	m
10	0.02	0.15	0.15320193	R600	0.0466	m
24	0.02	0.19676	0.19676001	R1440	0.0578	m

System Storage (1No IC & pipes)

Aver. Ø 450mm Aver. h = 450mm

Aver. Ø 100mm Aver. L =31000mm

$V = \pi r^2 h =$ 0.3410 m^3

@100 % = **0.341** m^3

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **AquaCell Core** or **Polystorm PSM1** stormwater systems is **recommended.** Proposed exceedance **design does not include Climate Change Allowence**.

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Job No.	456146	Sheet	21	Date	May-23
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Soakaway Design (10 yrs)

Access Road & Parking (RdTop)

Access Road & Parking (Top Section)=	691.6	m^2	
Access Road & Parking (Bottom Section) =	688.11	m^2	
Paved Spaces (Top Section) =	158.81	m^2	(30% Incl. in calcs)
Paved Spaces (Bottom Section) =	152.44	m^2	(30% Incl. in calcs)
Footpaths (Top Section) =	243.7	m^2	(50% Incl. in calcs)
Footpaths (Bottom Section) =	75.178	m^2	(50% Incl. in calcs)
	808.52	**m^2**	

Saokaway 03 =	28.07	m^2	
Saokaway 10 =	20.05	m^2	

Area	808.520	m^2	
Urban Creep	1.100		
	889.372	m^2	

10 year return period + 45%

			Storm duration (Min.)
R5	0.013	m	5
R10	0.018	m	10
R15	0.022	m	15
R30	0.028	m	30
R60	0.036	m	60
R120	0.044	m	120
R240	0.053	m	240
R360	**0.059**	**m**	**360**
R600	0.068	m	600
R1440	0.084	m	1440

Inflow to soakaway system

I5	11.22	m^3
I10	15.99	m^3
I15	19.73	m^3
I30	25.28	m^3
I60	31.98	m^3
I120	39.07	m^3
I240	46.81	m^3
I360	52.74	m^3
I600	60.09	m^3
I1440	74.54	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

SI Report

Tanked Permeable Paving dims:

Area	688.11	m
Gravel area (90%pp)	0.9	
D	0.15	m
As50	1.0	
Void ratio	30	%

Infiltration Area dims:

L	43.188	m
W	1.062	m
Depth	1.05	m
As50	46.4625	
Void ratio	95	%

Gravel Layer above Soakaway dims:

Area	65.916	m
Gravel area (90%pp)	0.9	
Depth	0	m
As50	1.0	
Void ratio	30	%

Allowance for extra rain during storage period (assume average rainfall)

Average daily rain	2.60	mm
Extra rain during storage	**2.80**	m^3

Outflow from Tank:

O5	0.09	m^3
O10	0.18	m^3
O15	0.27	m^3
O30	0.54	m^3
O60	1.08	m^3
O120	2.16	m^3
O240	4.32	m^3
O360	6.48	m^3
O600	10.80	m^3
O1440	25.93	m^3

Storage required:

S5	11.13	m^3
S10	15.81	m^3
S15	19.46	m^3
S30	24.74	m^3
S60	30.90	m^3
S120	36.91	m^3
S240	42.49	m^3
S360	46.26	m^3
S600	49.29	m^3
S1440	48.61	m^3

Time to drain:

ts50	5.15	hours
ts50	7.32	hours
ts50	9.01	hours
ts50	11.45	hours
ts50	14.30	hours
ts50	17.08	hours
ts50	19.66	hours
ts50	21.41	hours
ts50	22.81	hours
ts50	22.49	hours

Storage provided	**73.62**	m^3		
Critical storm =	**S600**			
Storage required =	**52.09**			
Time to discharge=	**22.81**	Hours	**0.95**	Days

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **Permavoid PVPP150** stormwater systems is **recommended.** Proposed **design includes 45% Climate Change Allowence**.

Soakaway size proposed is satisfactory

http://www.metoffice.gov.uk/climate/uk/regional-climates/so

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Job No.	456146	Sheet	22	Date	May-23
Job	Bitterne Parish Church	By	HS	Checked	

Soakaway Design (1 yr)

Access Road & Parking (RdTop)

To reduce from 10 year storm to 1 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours
N = No. of storms in 10 years

			Storm duration (Min.)	T	N	r	0.45	10 year return period	
Area	808.520	m^2							
Urban Creep	1.100								
	889.372	m^2							
1 year return period + 45%									
R5	0.006	m	5	0.083333	10	0.004482	0.00650	R5	0.0087 m
R10	0.009	m	10	0.166667	10	0.005996	0.00869	R10	0.0124 m
R15	0.010	m	15	0.25	10	0.007029	0.01019	R15	0.0153 m
R30	0.013	m	30	0.5	10	0.009092	0.01318	R30	0.0196 m
R60	0.017	m	60	1	10	0.011600	0.01682	R60	0.0248 m
R120	0.021	m	120	2	10	0.014649	0.02124	R120	0.0303 m
R240	0.027	m	240	4	10	0.018355	0.02661	R240	0.0363 m
R360	**0.030**	**m**	**360**	**6**	**10**	**0.020883**	0.03028	R360	0.0409 m
R600	0.036	m	600	10	10	0.024508	0.03554	R600	0.0466 m
R1440	0.047	m	1440	24	10	0.032073	0.04651	R1440	0.0578 m

Inflow to soakaway system

I5	5.78	m^3
I10	7.73	m^3
I15	9.06	m^3
I30	11.72	m^3
I60	14.96	m^3
I120	18.89	m^3
I240	23.67	m^3
I360	26.93	m^3
I600	31.61	m^3
I1440	41.36	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

Tanked Permeable Paving dims:

Area	688.11	m
Gravel area (90%pp)	0.9	
D	0.15	m
As50	1	
Void ratio	30	%

Infiltration Area dims:

L	43.188	m
W	1.062	m
Depth	0.9	m
As50	39.825	
Void rati	95	%

Gravel Layer above Soakaway dims:

Area	65.916	m
Gravel area (90%pp)	0.9	
Depth	0	m
As50	1.0	
Void ratio	30	%

Outflow from Tank:

O5	0.0772	m^3
O10	0.1543	m^3
O15	0.2315	m^3
O30	0.4630	m^3
O60	0.9261	m^3
O120	1.8522	m^3
O240	3.7044	m^3
O360	5.5566	m^3
O600	9.2610	m^3
O1440	22.2264	m^3

Storage required:			Time to half drain:		
S5	5.70	m^3	ts50	3.08	hours
S10	7.58	m^3	ts50	4.09	hours
S15	8.83	m^3	ts50	4.77	hours
S30	11.26	m^3	ts50	6.08	hours
S60	14.03	m^3	ts50	7.58	hours
S120	17.04	m^3	ts50	9.20	hours
S240	19.97	m^3	ts50	10.78	hours
S360	21.37	m^3	ts50	11.54	hours
S600	22.34	m^3	ts50	12.06	hours
S1440	19.13	m^3	ts50	10.33	hours

Storage Provided	**67.08**	m^3		
Critical storm =	**S600**			
Storage required =	**22.34**			
Time to half discharge=	**12.06**	Hours	**0.50**	Days

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **Permavoid PVPP150** stormwater systems is **recommended.** Proposed **design includes 45% Climate Change Allowence**.

Soakaway size proposed is satisfactory

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Job No.	456146	Sheet	23	Date	May-23
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Soakaway Design (30 yr)

Access Road & Parking (RdTop)

Area	808.520	m^2
Urban Creep	1.100	
	889.372	m^2

30 year return period + 45%

			Storm duration (Min.)
R5	0.023	m	5
R10	0.029	m	10
R15	0.032	m	15
R30	0.040	m	30
R60	0.050	m	60
R120	0.061	m	120
R240	0.075	m	240
R360	**0.085**	**m**	**360**
R600	0.099	m	600
R1440	0.127	m	1440

Inflow to soakaway system

I5	20.33	m^3
I10	25.42	m^3
I15	28.89	m^3
I30	35.83	m^3
I60	44.26	m^3
I120	54.50	m^3
I240	66.96	m^3
I360	75.46	m^3
I600	87.65	m^3
I1440	113.08	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

For increase from 10 year storm to 30 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours
N = No. of storms in 10 years

T	N	r	0.45	10 year return pe	
0.083333	0.333	0.015764	0.02286	R5	0.0087
0.166667	0.333	0.019710	0.02858	R10	0.0124
0.25	0.333	0.022402	0.03248	R15	0.0153
0.5	0.333	0.027780	0.04028	R30	0.0196
1	0.333	0.034318	0.04976	R60	0.0248
2	0.333	0.042265	0.06128	R120	0.0303
4	0.333	0.051926	0.07529	R240	0.0363
6	**0.333**	**0.058516**	0.08485	R360	0.0409
10	0.333	0.067965	0.09855	R600	0.0466
24	0.333	0.087685	0.12714	R1440	0.0578

Tanked Permeable Paving dims:

Area	688.11	m
Gravel area (90%pp)	0.9	
D	0.45	m
As50	1.0	
Void ratio	30	%

Infiltration Area dims:

L	43.188	m
W	1.062	m
Depth	1.65	m
As50	73.0125	
Void ratio	95	%

Gravel Layer above Soakaway dims:

Area	65.916	m
Gravel area (90%pp)	0.9	
Depth	0	m
As50	1.0	
Void ratio	30	%

Outflow from Tank:

O5	0.1415	m^3
O10	0.2830	m^3
O15	0.4245	m^3
O30	0.8489	m^3
O60	1.6978	m^3
O120	3.3957	m^3
O240	6.7914	m^3
O360	10.1871	m^3
O600	16.9785	m^3
O1440	40.7483	m^3

Storage required:

			Time to half drain:		
S5	20.19	m^3	ts50	5.94	hours
S10	25.14	m^3	ts50	7.40	hours
S15	28.47	m^3	ts50	8.38	hours
S30	34.98	m^3	ts50	10.30	hours
S60	42.56	m^3	ts50	12.53	hours
S120	51.11	m^3	ts50	15.05	hours
S240	60.17	m^3	ts50	17.72	hours
S360	65.27	m^3	ts50	19.22	hours
S600	70.67	m^3	ts50	20.81	hours
S1440	72.33	m^3	ts50	21.30	hours

Storage Provided	**155.50**	m^3
Critical storm =	**S1440**	
Storage required =	**72.33**	
Time to half discharge=	**21.30**	Hours (Acceptable time as 1/30 year storm)

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **Permavoid PVPP150** stormwater systems is **recommended.** Proposed **design includes 45% Climate Change Allowence**.

Soakaway size proposed is satisfactory

riod
m
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Job No.	456146	Sheet	24	Date	May-23
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Soakaway Design (100 yr)

Access Road & Parking (RdTop)

Area	808.520	m^2
Urban Creep	1.100	
	889.372	m^2

100 year return period + 40%

			Storm duration (Min.)
R5	0.032	m	5
R10	0.040	m	10
R15	0.045	m	15
R30	0.056	m	30
R60	0.069	m	60
R120	0.084	m	120
R240	0.103	m	240
R360	**0.116**	**m**	**360**
R600	0.135	m	600
R1440	0.174	m	1440

Inflow to soakaway system

I5	28.83	m^3
I10	35.73	m^3
I15	40.43	m^3
I30	49.83	m^3
I60	61.26	m^3
I120	75.15	m^3
I240	92.04	m^3
I360	103.55	m^3
I600	120.07	m^3
I1440	154.54	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

For increase from 10 year storm to 100 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours

N = No. of storms in 10 years

T	N	r		0.4	10 year return period	
0.083333	0.1	0.023154	0.03241527	R5	0.0087	m
0.166667	0.1	0.028694	0.04017133	R10	0.0124	m
0.25	0.1	0.032473	0.04546206	R15	0.0153	m
0.5	0.1	0.040022	0.05603125	R30	0.0196	m
1	0.1	0.0492	0.06887934	R60	0.0248	m
2	0.1	0.060356	0.08449771	R120	0.0303	m
4	0.1	0.073917	0.10348369	R240	0.0363	m
6	**0.1**	**0.083168**	**0.11643482**	R360	0.0409	m
10	0.1	0.10	0.13500488	R600	0.0466	m
24	0.1	0.124113	0.17375774	R1440	0.0578	m

Tanked Permeable Paving dims:

Area	688.11	m
Gravel area (90%pp)	0.9	
D	0.45	m
As50	1.0	
Void ratio	30	%

Infiltration Area dims:

L	43.188	m
W	1.062	m
Depth	1.65	m
As50	73.0125	
Void ratio	95	%

Gravel Layer above Soakaway dims:

Area	65.916	m
Gravel area (90%pp)	0.9	
Depth	0	m
As50	1.0	
Void ratio	30	%

Outflow from Tank:

O5	0.1415	m^3
O10	0.2830	m^3
O15	0.4245	m^3
O30	0.8489	m^3
O60	1.6978	m^3
O120	3.3957	m^3
O240	6.7914	m^3
O360	10.1871	m^3
O600	16.9785	m^3
O1440	40.7483	m^3

Storage required:			Time to half drain:		
S5	28.69	m^3	ts50	8.45	hours
S10	35.44	m^3	ts50	10.44	hours
S15	40.01	m^3	ts50	11.78	hours
S30	48.98	m^3	ts50	14.43	hours
S60	59.56	m^3	ts50	17.54	hours
S120	71.75	m^3	ts50	21.13	hours
S240	85.24	m^3	ts50	25.10	hours
S360	93.37	m^3	ts50	27.50	hours
S600	103.09	m^3	ts50	30.36	hours
S1440	113.79	m^3	ts50	33.51	hours

Storage Provided	**155.50**	m^3
Critical storm =	**S1440**	
Storage required =	**113.79**	
Time to half discharge=	**33.51**	Hours (Acceptable time as 1/100 year storm)

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **Permavoid PVPP150** stormwater systems is **recommended.** Proposed **design includes 40% Climate Change Allowence**.

Soakaway size proposed is satisfactory

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Job No.	456146	Sheet	25	Date	May-23
Job	Bitterne Parish Church	By	HS	Checked	

Soakaway Exceedance Flow Design (500 yr)

Access Road & Parking (RdTop)

Area	808.520	m^2
Urban Creep	1.100	
	889.372	m^2

500 year return period

			Storm duration (Min.)
R5	0.038	m	5
R10	0.047	m	10
R15	0.053	m	15
R30	0.064	m	30
R60	0.079	m	60
R120	0.096	m	120
R240	0.118	m	240
R360	**0.132**	**m**	**360**
R600	0.153	m	600
R1440	0.197	m	1440

Inflow to soakaway system

I5	33.70	m^3
I10	41.45	m^3
I15	46.74	m^3
I30	57.31	m^3
I60	70.15	m^3
I120	85.76	m^3
I240	104.74	m^3
I360	117.69	m^3
I600	136.25	m^3
I1440	174.99	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

For increase from 10 year storm to 500 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours

N = No. of storms in 10 years

T	N	r	0	10 year return period		
0.083333	0.02	0.037892	0.03789158	R5	0.0087	m
0.166667	0.02	0.046609	0.04660936	R10	0.0124	m
0.25	0.02	0.052556	0.05255612	R15	0.0153	m
0.5	0.02	0.064436	0.06443585	R30	0.0196	m
1	0.02	0.078877	0.07887706	R60	0.0248	m
2	0.02	0.096432	0.09643206	R120	0.0303	m
4	0.02	0.117772	0.11777223	R240	0.0363	m
6	0.02	**0.132329**	0.13232925	R360	0.0409	m
10	0.02	0.15	0.15320193	R600	0.0466	m
24	0.02	0.19676	0.19676001	R1440	0.0578	m

Tanked Permeable Paving dims:

Area	688.11	m
Gravel area (90%pp)	0.9	
D	0.45	m
As50	1.0	
Void ratio	30	%

Infiltration Area dims:

L	43.188	m
W	1.062	m
Depth	1.65	m
As50	73.0125	
Void ratio	95	%

Gravel Layer above Soakaway dims:

Area	65.916	m
Gravel area (90%pp)	0.9	
Depth	0	m
As50	1.0	
Void ratio	30	%

Outflow from Tank:

O5	0.1415	m^3
O10	0.2830	m^3
O15	0.4245	m^3
O30	0.8489	m^3
O60	1.6978	m^3
O120	3.3957	m^3
O240	6.7914	m^3
O360	10.1871	m^3
O600	16.9785	m^3
O1440	40.7483	m^3

Storage required:

			Time to half drain:		
S5	33.56	m^3	ts50	9.88	hours
S10	41.17	m^3	ts50	12.12	hours
S15	46.32	m^3	ts50	13.64	hours
S30	56.46	m^3	ts50	16.63	hours
S60	68.45	m^3	ts50	20.16	hours
S120	82.37	m^3	ts50	24.26	hours
S240	97.95	m^3	ts50	28.85	hours
S360	107.50	m^3	ts50	31.66	hours
S600	119.28	m^3	ts50	35.13	hours
S1440	134.24	m^3	ts50	39.53	hours

Storage Provided	**155.50**	m^3
Critical storm =	**S1440**	
Storage required =	**134.79**	
Time to half discharge=	**39.53**	Hours

0.55 m^3 Soakaway10 Overflow

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **Permavoid PVPP150** stormwater systems is **recommended.** Proposed exceedance **design does not include Climate Change Allowence**.

Soakaway size proposed is satisfactory

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Job No.	456146	Sheet	21	Date	May-23
Job	Bitterne Parish Church	By	HS	Checked	

Soakaway Design (10 yrs)

Area	861.093	m^2
Urban Creep	1.100	
	947.202	m^2

10 year return period + 45%

			Storm duration (Min.)
R5	0.013	m	5
R10	0.018	m	10
R15	0.022	m	15
R30	0.028	m	30
R60	0.036	m	60
R120	0.044	m	120
R240	0.053	m	240
R360	**0.059**	**m**	**360**
R600	0.068	m	600
R1440	0.084	m	1440

Inflow to soakaway system

I5	11.95	m^3
I10	17.03	m^3
I15	21.01	m^3
I30	26.92	m^3
I60	34.06	m^3
I120	41.62	m^3
I240	49.86	m^3
I360	56.17	m^3
I600	64.00	m^3
I1440	79.39	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

SI Report

Access Road & Parking (RdTop)

Access Road & Parking (Top Section)=	691.6	m^2
Access Road & Parking (Bottom Section) =	688.11	m^2
Paved Spaces (Top Section) =	158.81	m^2 (30% Incl. in calcs)
Paved Spaces (Bottom Section) =	152.44	m^2 (30% Incl. in calcs)
Footpaths (Top Section) =	243.7	m^2 (50% Incl. in calcs)
Footpaths (Bottom Section) =	75.178	m^2 (50% Incl. in calcs)
	861.093	**m^2**

Saokaway 03 =	28.07	m^2
Saokaway 10 =	20.05	m^2

Tanked Permeable Paving dims:

Area	691.6	m
Gravel area (90%pp)	0.9	
D	0.15	m
As50	1.0	
Void ratio	30	%

Infiltration Area dims:

L	81.42	m
W	1.062	m
Depth	0.9	m
As50	74.2338	
Void ratio	95	%

Gravel Layer above Soakaway dims:

Area	114.53804	m
Gravel area (90%pp)	0.9	
Depth	0	m
As50	1.0	
Void ratio	30	%

Allowance for extra rain during storage period (assume average rainfall)

Average daily rain	2.60	mm
Extra rain during storage	**1.77**	m^3

Outflow from Tank:

O5	0.14	m^3
O10	0.29	m^3
O15	0.43	m^3
O30	0.86	m^3
O60	1.73	m^3
O120	3.45	m^3
O240	6.90	m^3
O360	10.36	m^3
O600	17.26	m^3
O1440	41.43	m^3

0.00

Storage required:

Time to drain:

S5	11.81	m^3	ts50	3.42 hours
S10	16.74	m^3	ts50	4.85 hours
S15	20.58	m^3	ts50	5.96 hours
S30	26.06	m^3	ts50	7.55 hours
S60	32.34	m^3	ts50	9.37 hours
S120	38.16	m^3	ts50	11.05 hours
S240	42.95	m^3	ts50	12.44 hours
S360	45.82	m^3	ts50	13.27 hours
S600	46.74	m^3	ts50	13.54 hours
S1440	37.96	m^3	ts50	10.99 hours

Storage provided	**101.94**	m^3		
Critical storm =	**S600**			
Storage required =	**48.51**			
Time to discharge=	**13.54**	Hours	**0.56**	Days

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **Permavoid PVPP150** stormwater systems is **recommended.** Proposed **design includes 45% Climate Change Allowence**.

Soakaway size proposed is satisfactory

http://www.metoffice.gov.uk/climate/uk/regional-climates/so

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Job No.	456146	Sheet	22	Date	May-23
Job	Bitterne Parish Church	By	HS	Checked	

Soakaway Design (1 yr)

Access Road & Parking (RdTop)

Area	861.093	m^2
Urban Creep	1.100	
	947.202	m^2

1 year return period + 45%

			Storm duration (Min.)
R5	0.006	m	5
R10	0.009	m	10
R15	0.010	m	15
R30	0.013	m	30
R60	0.017	m	60
R120	0.021	m	120
R240	0.027	m	240
R360	**0.030**	**m**	**360**
R600	0.036	m	600
R1440	0.047	m	1440

To reduce from 10 year storm to 1 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours
N = No. of storms in 10 years

T	N	r	0.45	10 year return period		
0.083333	10	0.004482	0.00650	R5	0.0087	m
0.166667	10	0.005996	0.00869	R10	0.0124	m
0.25	10	0.007029	0.01019	R15	0.0153	m
0.5	10	0.009092	0.01318	R30	0.0196	m
1	10	0.011600	0.01682	R60	0.0248	m
2	10	0.014649	0.02124	R120	0.0303	m
4	10	0.018355	0.02661	R240	0.0363	m
6	**10**	**0.020883**	0.03028	R360	0.0409	m
10	10	0.024508	0.03554	R600	0.0466	m
24	10	0.032073	0.04651	R1440	0.0578	m

Inflow to soakaway system

I5	6.16	m^3
I10	8.23	m^3
I15	9.65	m^3
I30	12.49	m^3
I60	15.93	m^3
I120	20.12	m^3
I240	25.21	m^3
I360	28.68	m^3
I600	33.66	m^3
I1440	44.05	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

Tanked Permeable Paving dims:

Area	691.6	m
Gravel area (90%pp)	0.9	
D	0.15	m
As50	1.0	
Void ratio	30	%

Infiltration Area dims:

L	81.42	m
W	1.062	m
Depth	0.9	m
As50	74.2338	
Void rati	95	%

Gravel Layer above Soakaway dims:

Area	114.538	m
Gravel area (90%pp)	0.9	
Depth	0	m
As50	1.0	
Void ratio	30	%

Outflow from Tank:

O5	0.1439	m^3
O10	0.2877	m^3
O15	0.4316	m^3
O30	0.8631	m^3
O60	1.7262	m^3
O120	3.4525	m^3
O240	6.9050	m^3
O360	10.3575	m^3
O600	17.2625	m^3
O1440	41.4299	m^3

Storage required:			Time to half drain:		
S5	6.01	m^3	ts50	1.74	hours
S10	7.95	m^3	ts50	2.30	hours
S15	9.22	m^3	ts50	2.67	hours
S30	11.62	m^3	ts50	3.37	hours
S60	14.21	m^3	ts50	4.11	hours
S120	16.67	m^3	ts50	4.83	hours
S240	18.30	m^3	ts50	5.30	hours
S360	18.32	m^3	ts50	5.31	hours
S600	16.40	m^3	ts50	4.75	hours
S1440	2.62	m^3	ts50	0.76	hours

Storage Provided	**101.94**	m^3		
Critical storm =	**S360**			
Storage required =	**18.32**			
Time to half discharge=	**5.31**	Hours	**0.22**	Days

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **Permavoid PVPP150** stormwater systems is **recommended.** Proposed **design includes 45% Climate Change Allowence**.

Soakaway size proposed is satisfactory

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Job No.	456146	Sheet	23	Date	May-23
Job	Bitterne Parish Church	By	HS	Checked	

Soakaway Design (30 yr)

Access Road & Parking (RdTop)

Area	861.093	m^2
Urban Creep	1.100	
	947.202	m^2

30 year return period + 45%

			Storm duration (Min.)
R5	0.023	m	5
R10	0.029	m	10
R15	0.032	m	15
R30	0.040	m	30
R60	0.050	m	60
R120	0.061	m	120
R240	0.075	m	240
R360	**0.085**	**m**	**360**
R600	0.099	m	600
R1440	0.127	m	1440

For increase from 10 year storm to 30 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours
N = No. of storms in 10 years

T	N	r	0.45	10 year return pe	
0.083333	0.333	0.015764	0.02286	R5	0.0087
0.166667	0.333	0.019710	0.02858	R10	0.0124
0.25	0.333	0.022402	0.03248	R15	0.0153
0.5	0.333	0.027780	0.04028	R30	0.0196
1	0.333	0.034318	0.04976	R60	0.0248
2	0.333	0.042265	0.06128	R120	0.0303
4	0.333	0.051926	0.07529	R240	0.0363
6	**0.333**	**0.058516**	0.08485	R360	0.0409
10	0.333	0.067965	0.09855	R600	0.0466
24	0.333	0.087685	0.12714	R1440	0.0578

Inflow to soakaway system

I5	21.65	m^3
I10	27.07	m^3
I15	30.77	m^3
I30	38.15	m^3
I60	47.13	m^3
I120	58.05	m^3
I240	71.32	m^3
I360	80.37	m^3
I600	93.35	m^3
I1440	120.43	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

Tanked Permeable Paving dims:

Area	691.6	m
Gravel area (90%pp)	0.9	
D	0.45	m
As50	1.0	
Void ratio	30	%

Infiltration Area dims:

L	81.42	m
W	1.062	m
Depth	0.9	m
As50	74.2338	
Void ratio	95	%

Gravel Layer above Soakaway dims:

Area	114.538	m
	0.9	m
Depth	0	m
As50	1.0	
Void ratio	30	%

Outflow from Tank:

O5	0.1439	m^3
O10	0.2877	m^3
O15	0.4316	m^3
O30	0.8631	m^3
O60	1.7262	m^3
O120	3.4525	m^3
O240	6.9050	m^3
O360	10.3575	m^3
O600	17.2625	m^3
O1440	41.4299	m^3

Storage required:			Time to half drain:		
S5	21.51	m^3	ts50	6.23	hours
S10	26.78	m^3	ts50	7.76	hours
S15	30.34	m^3	ts50	8.79	hours
S30	37.29	m^3	ts50	10.80	hours
S60	45.41	m^3	ts50	13.15	hours
S120	54.60	m^3	ts50	15.81	hours
S240	64.41	m^3	ts50	18.66	hours
S360	70.01	m^3	ts50	20.28	hours
S600	76.08	m^3	ts50	22.04	hours
S1440	79.00	m^3	ts50	22.88	hours

Storage Provided	**157.96**	m^3
Critical storm =	**S1440**	
Storage required =	**79.00**	
Time to half discharge=	**22.88**	Hours (Acceptable time as 1/30 year storm)

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **Permavoid PVPP150** stormwater systems is **recommended.** Proposed **design includes 45% Climate Change Allowence**.

Soakaway size proposed is satisfactory

riod
m
m
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m
m
m
m

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Job No.	456146	Sheet	24	Date	May-23
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Soakaway Design (100 yr)

Access Road & Parking (RdTop)

For increase from 10 year storm to 100 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours
N = No. of storms in 10 years

			Storm duration (Min.)	T	N	r	0.4	10 year return period		
Area	861.093	m^2								
Urban Creep	1.100									
	947.202	m^2								
100 year return period + 40%										
R5	0.032	m	5	0.083333	0.1	0.023154	0.03241527	R5	0.0087	m
R10	0.040	m	10	0.166667	0.1	0.028694	0.04017133	R10	0.0124	m
R15	0.045	m	15	0.25	0.1	0.032473	0.04546206	R15	0.0153	m
R30	0.056	m	30	0.5	0.1	0.040022	0.05603125	R30	0.0196	m
R60	0.069	m	60	1	0.1	0.0492	0.06887934	R60	0.0248	m
R120	0.084	m	120	2	0.1	0.060356	0.08449771	R120	0.0303	m
R240	0.103	m	240	4	0.1	0.073917	0.10348369	R240	0.0363	m
R360	**0.116**	**m**	**360**	**6**	**0.1**	**0.083168**	**0.11643482**	R360	0.0409	m
R600	0.135	m	600	10	0.1	0.10	0.13500488	R600	0.0466	m
R1440	0.174	m	1440	24	0.1	0.124113	0.17375774	R1440	0.0578	m

Inflow to soakaway system

I5	30.70	m^3
I10	38.05	m^3
I15	43.06	m^3
I30	53.07	m^3
I60	65.24	m^3
I120	80.04	m^3
I240	98.02	m^3
I360	110.29	m^3
I600	127.88	m^3
I1440	164.58	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

Tanked Permeable Paving dims:			Infiltration Area dims:			Gravel Layer above Soakaway dims:		
Area	691.6	m	L	81.42	m	Area	114.53804	m
Gravel area (90%pp)	0.9		W	1.062	m		0.9	m
D	0.45	m	Depth	0.9	m	Depth	0	m
As50	1.0		As50	74.2338		As50	1.0	
Void ratio	30	%	Void ratio	95	%	Void ratio	30	%

Outflow from Tank:

O5	0.1439	m^3
O10	0.2877	m^3
O15	0.4316	m^3
O30	0.8631	m^3
O60	1.7262	m^3
O120	3.4525	m^3
O240	6.9050	m^3
O360	10.3575	m^3
O600	17.2625	m^3
O1440	41.4299	m^3

Storage required:			Time to half drain:		
S5	30.56	m^3	ts50	8.85	hours
S10	37.76	m^3	ts50	10.94	hours
S15	42.63	m^3	ts50	12.35	hours
S30	52.21	m^3	ts50	15.12	hours
S60	63.52	m^3	ts50	18.40	hours
S120	76.58	m^3	ts50	22.18	hours
S240	91.12	m^3	ts50	26.39	hours
S360	99.93	m^3	ts50	28.94	hours
S600	110.61	m^3	ts50	32.04	hours
S1440	123.15	m^3	ts50	35.67	hours

Storage Provided	**157.96**	m^3
Critical storm =	**S1440**	
Storage required =	**123.15**	
Time to half discharge=	**35.67**	Hours (Acceptable time as 1/100 year storm)

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **Permavoid PVPP150** stormwater systems is **recommended.** Proposed **design includes 40% Climate Change Allowence**.

Soakaway size proposed is satisfactory

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Job No.	456146	Sheet	25	Date	May-23
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Soakaway Exceedance Flow Design (500 yr)

Access Road & Parking (RdTop)

Area	861.093	m^2
Urban Creep	1.100	
	947.202	m^2

500 year return period

			Storm duration (Min.)
R5	0.038	m	5
R10	0.047	m	10
R15	0.053	m	15
R30	0.064	m	30
R60	0.079	m	60
R120	0.096	m	120
R240	0.118	m	240
R360	**0.132**	**m**	**360**
R600	0.153	m	600
R1440	0.197	m	1440

Inflow to soakaway system

I5	35.89	m^3
I10	44.15	m^3
I15	49.78	m^3
I30	61.03	m^3
I60	74.71	m^3
I120	91.34	m^3
I240	111.55	m^3
I360	125.34	m^3
I600	145.11	m^3
I1440	186.37	m^3

Outflow from Tank

f	6.46E-06	**m^3/s**

For increase from 10 year storm to 500 year storm use,
Bilhams formula r (mm) = (((1.25T)/N)^(1/3.55)) x25.4
T = storm duration in hours

N = No. of storms in 10 years

T	N	r	0	10 year return period		
0.083333	0.02	0.037892	0.03789158	R5	0.0087	m
0.166667	0.02	0.046609	0.04660936	R10	0.0124	m
0.25	0.02	0.052556	0.05255612	R15	0.0153	m
0.5	0.02	0.064436	0.06443585	R30	0.0196	m
1	0.02	0.078877	0.07887706	R60	0.0248	m
2	0.02	0.096432	0.09643206	R120	0.0303	m
4	0.02	0.117772	0.11777223	R240	0.0363	m
6	0.02	**0.132329**	0.13232925	R360	0.0409	m
10	0.02	0.15	0.15320193	R600	0.0466	m
24	0.02	0.19676	0.19676001	R1440	0.0578	m

Tanked Permeable Paving dims:

Area	691.6	m
Gravel area (90%pp)	0.9	
D	0.45	m
As50	1.0	
Void ratio	30	%

Infiltration Area dims:

L	81.42	m
W	1.062	m
Depth	0.9	m
As50	74.2338	
Void ratio	95	%

Gravel Layer above Soakaway dims:

Area	114.53804	m
Gravel area (90%pp)	0.9	
Depth	0	m
As50	1.0	
Void ratio	30	%

Outflow from Tank:

O5	0.1439	m^3
O10	0.2877	m^3
O15	0.4316	m^3
O30	0.8631	m^3
O60	1.7262	m^3
O120	3.4525	m^3
O240	6.9050	m^3
O360	10.3575	m^3
O600	17.2625	m^3
O1440	41.4299	m^3

Storage required:			Time to half drain:		
S5	35.75	m^3	ts50	10.35	hours
S10	43.86	m^3	ts50	12.70	hours
S15	49.35	m^3	ts50	14.29	hours
S30	60.17	m^3	ts50	17.43	hours
S60	72.99	m^3	ts50	21.14	hours
S120	87.89	m^3	ts50	25.46	hours
S240	104.65	m^3	ts50	30.31	hours
S360	114.99	m^3	ts50	33.30	hours
S600	127.85	m^3	ts50	37.03	hours
S1440	144.94	m^3	ts50	41.98	hours

Storage Provided	**157.96**	m^3
Critical storm =	**S1440**	
Storage required =	**146.52**	
Time to half discharge=	**41.98**	Hours

1.58 m^3 Soakaway 3 Overflow

Proposed Attenuation Tank **material** requires a **void ratio ≥95%.** The **use** of **Permavoid PVPP150** stormwater systems is **recommended.** Proposed exceedance **design does not include Climate Change Allowence**.

Soakaway size proposed is satisfactory