

Land North of Goldring Close, Mengham, Hayling Island

Flood risk assessment and outline drainage strategies

Tolcarne Drive Developments
Ltd.

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Contents

1	Introduction.....	1
2	Site Description	4
3	Policy Appraisal.....	7
4	Flood Risk Assessment.....	12
5	Outline Surface Water Drainage Strategy.....	18
6	Outline Foul Drainage Strategy.....	24
7	Conclusions.....	25

Appendix A – background data

Appendix B - calculations

Appendix C - drawings

1 Introduction

1.1 Background

- 1.1.1 Tolcarne Drive Developments Ltd (the Client) is seeking planning permission to develop a site on land north of Goldring Close, Mengham, South Hayling, Hampshire for residential purposes. Figure 1.1 indicates the site location in relation to Hayling Island.



Figure 1.1 – site location plan

- 1.1.2 In accordance with the National Planning Policy Framework (NPPF) and associated technical guidance when considering planning applications Local Planning Authorities should take into account the flood risk posed to particular land uses and ensure that development is appropriately located. Paragraph 100 of the NPPF states:

“ Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere.”

- 1.1.3 To comply with technical guidance to the NPPF, planning applications for development sites either exceeding 1 hectare in area or located within an area susceptible to flood risk are to be accompanied by a site specific Flood Risk Assessment (FRA). The site extends to approximately 4.5 hectares thus a FRA is required.
- 1.1.4 Capita Symonds Ltd (CSL) has been appointed by the Client to prepare this FRA to demonstrate that the site is deemed suitable for the land use proposed.
- 1.1.5 During the course of producing this FRA, information has been obtained/discussions held with the Environment Agency (EA) and Havant Borough Council (HBC).

1.2 The Development Proposal

- 1.2.1 It is proposed to develop the site for 131 residential properties. Additional development details are provided in the Design and Access statement which supports the planning application. The site is centred at Ordnance Survey grid reference 472543, 99515 (see figure 1.2).

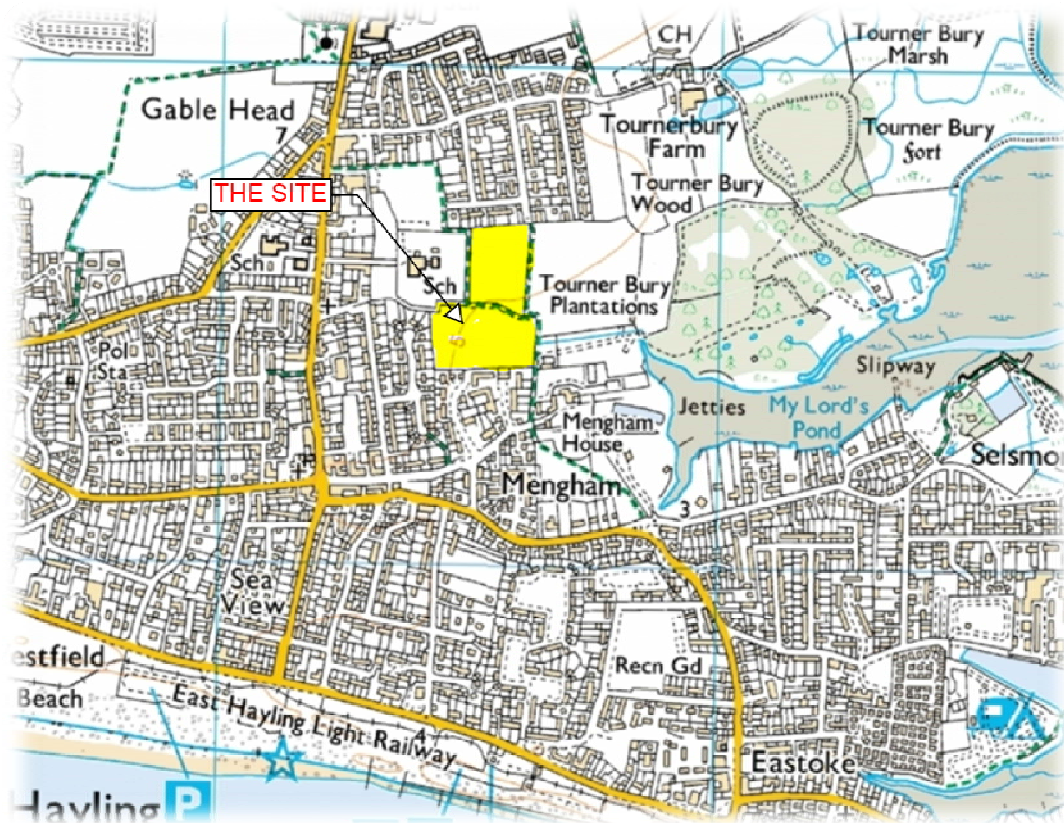


Figure 1.2 – site extent

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- 1.2.2 Boundaries to the site are formed by: Hawthorne Grove to the north; Mengham junior school and St. Margaret's Road to the west; open land to the east; and My Lord's Lane, Mengham Court and Goldring Close to the south.

1.3 Report structure

- 1.3.1 The following sections of this FRA consider:

Section 2 describes the general topographical features and ground conditions within the site extent. It also discusses drainage that exists in and around the development proposal.

Section 3 discusses key national and local planning policy with respect to flood risk and surface water management.

Section 4 assesses the likely flood risk posed to the developed parts of the site with reference to NPPF. In particular the proximity of 1 in 200 year and 1 in 1000 year costal floodplains to the site.

Section 5 proposes an outline surface water drainage strategy to serve the site with emphasis to the deployment of a sustainable drainage system.

Section 6 concludes the report.

2 Site Description

2.1 Topography

- 2.1.1 The Application Site comprises two fields (north and south) enclosed by hedgerows with trees interspersed irregularly along the field boundaries.
- 2.1.2 Each field is presently subdivided by fencing into paddock areas with associated stables (four stable blocks each to the north and south). Separation between the fields is defined by dense brambles and bushes up to 5 metres in width.
- 2.1.3 A topographical survey of the site was conducted by Total Survey Solutions in January 2011 and can be seen in Appendix A (drawing CS/056739/SE/001).

Northern field

- 2.1.4 The northern field is broadly rectangular in shape and measures approximately 120m x 160m (east-west / north-south). Ground levels within this field fall from north (5.8mAOD) to south (5.0mAOD) at an approximate gradient of 0.5%.
- 2.1.5 A ditch enters the northern field from the northwest corner of the site and flows south towards the southern field. This ditch and indeed others within the site do not appear to be regularly maintained and are heavily vegetated and poorly defined. The width and depth varies as a consequence and are nominally 2m wide and 600mm deep.
- 2.1.6 Approximately 8m south of the northeast corner of the site a second ditch is formed within the site. This ditch flows south along the length of eastern boundary of the northern field and subsequently joins with the central ditch separating the two fields.

Central ditch

- 2.1.7 During a site visit conducted in June 2012 it was observed that the central ditch consists of east and west reaches separated by a brick built structure adjacent to the southeast corner of Mengham Junior School. The topographical survey suggests that the western section (approximately 70m in length) flows west beyond the site towards St. Margaret's Road.
- 2.1.8 Alternatively, the bridge could act as a culvert between the central ditch sections although this connectivity has been lost over time due to silt deposits. As a consequence of this infill the bed levels within the western section may now direct runoff from a small part of the southern field to the west.
- 2.1.9 The eastern section of this ditch flows eastwards 110m towards the southeast corner of the northern field where it is bridged by a gated access track between the two fields. At the time when the site visit was conducted vegetation visually obscured the culvert.

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- 2.1.10 To the east of the access track the ditch recommences and joins with the eastern ditch to the northern field. It then flows east for a further 25m, appears to break for 1m and then turns south along the eastern boundary of the southern field for a distance of 37m where it terminates. The topographical survey confirms that this is the lowest point on the site with base level to the ditch 3.5mAOD.

Southern Field

- 2.1.11 The southern field is also rectangular area and measures approximately 210m x 125m (east-west / north-south). Ground levels along the southern boundary vary between 5.7mAOD in the southwest corner and 4.6mAOD in the southeast corner. To the northern boundary levels vary between 5.5mAOD in the northwest corner to 4.3mAOD in the north east corner.
- 2.1.12 Although ground levels generally fall from the southwest to northeast towards the central boundary ditch there is a section of land adjacent to the eastern boundary that slopes east.

2.2 Geology / hydrogeology

- 2.2.1 Based on British Geological Survey data the bedrock at the site is London Clay Formation - clay, silt and sand - and superficial deposits are River Terrace Deposits (Undifferentiated) - sand, silt and clay.
- 2.2.2 Trial pit investigations were undertaken at the site in May 2012 during wet conditions (refer to Soils Ltd report in Appendix A). The ground was exposed to depths of between 0.8m and 2.0m below ground levels. With exception to trail pit number 1 groundwater was observed within each excavation at depths of between 0.7m and 1.9m.

2.3 Hydrology

- 2.3.1 As described above there are three ditches within the site. For the most part these ditches are dry and become inundated at times of rainfall, although standing water was observed at localised low spots within these channels.
- 2.3.2 A drainage channel located directly to the east of the boundary to the southern field conveys flows into tidal reaches of My Lord's Pond (250m east of the site). Ultimately runoff from the site discharges into Chichester Harbour.

2.4 Public sewerage

- 2.4.1 Records obtained from the local drainage company, Southern Water, confirm that there are no sewers within the site boundary. There are, however, a number of foul and surface water sewers on land surrounding the site (refer to Appendix A for record plans).

Foul sewers

- 2.4.2 A 225mm foul sewer runs parallel to the eastern site boundary within an open field.
- 2.4.3 To the west of the site St. Margaret's Road contains a 225mm foul sewer.
- 2.4.4 Both Goldring Close and My Lord's Lane to the south of the site contain 150mm foul sewers.
- 2.4.5 All of the above foul sewers flow from north to south and eventually drain into the Fishery Lane pumping station. A rising main then pumps flows onwards to Stoke pumping station and eventually to the Budds Farm Sewage Treatment Works at Brockhampton (mainland).

Surface water sewers

- 2.4.6 Beyond Hawthorne Road to the north of the site, Poplar Grove and Beech Grove contain 225mm surface water sewers. Both these sewers flow north away from the site.
- 2.4.7 St. Margaret's Road to the west of the southern field contains a 225mm surface water sewer which flows south.
- 2.4.8 A 300mm surface water sewer is located in Goldring Close just to the south of the site boundary. This pipework flows away from the site towards the south.
- 2.4.9 My Lords Lane to the south of the site contains a 225mm surface water sewer. This pipework also flows south away from the site.

3 Policy Appraisal

3.1 The following section discusses the relevant planning policies which may influence the development of the site.

3.2 Flood and Water Management Act, 2010

3.2.1 In addition to the Flood Risk Regulations 2009 (which enacts the EU Floods Directive in the England and Wales) the FWMA Act places significantly greater responsibility on Local Authorities to manage and lead on local flooding issues. The Act and The Regulations together identify the requirements and targets that Local Authorities will need to meet, including:

- Playing an active role leading Flood Risk Management;
- Development of Local Flood Risk Management Strategies (LFRMS);
- Implementing requirements of Flood and Water Management legislation;
- Preparation of preliminary flood risk assessments and flood risk management plans;
- Development and implementation of drainage and flooding management strategies; and
- Responsibility for first approval, then adopting, management and maintenance of Sustainable Urban Drainage System (SUDS) where they service more than one property.

3.2.2 The Flood and Water Management Act also clarifies three key areas that influence development:

- Sustainable drainage (SUDs) - the Act makes provision for a national standard to be prepared on SUDS, it requires developers to obtain local authority approval for SUDS in accordance with the standards, and relevant planning conditions. Supporting this, the Act requires local authorities to adopt and maintain SUDS, thereby removing any ongoing responsibility for developers to maintain SUDS if they are designed and constructed robustly.
- Flood risk management structures - the Act enables the Environment Agency and local authorities to designate structures such as flood defences or embankments owned by third parties for protection if they affect flooding or coastal erosion. A developer or landowner will not be able to alter, remove or replace a designated structure or feature without first obtaining consent.
- Permitted flooding of third party land - The Environment Agency and local authorities have the power to carry out work which may cause flooding to third party land where the works are deemed to be in the interest of nature conservation, the preservation of cultural heritage or people's enjoyment of the environment or of cultural heritage.

3.3 National Planning Policy Framework (NPPF) March 2012

- 3.3.1 The methodology for assessing flood risk at the site has been determined based on planning policy context. Government Guidance requires that consideration be given to flood risk in the planning process. The National Planning Policy Framework was issued in March 2012 and outlines the national policy on development and flood risk assessment. This replaces with immediate effect Planning Policy Statement 25.
- 3.3.2 The Framework states that the in appropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere.
- 3.3.3 Key aims of the NPPF are as follows:
- Local Plans should be supported by Strategic Flood Risk Assessment and develop policies to manage flood risk from all sources, taking advice from the Environment Agency and other relevant flood risk management bodies, such as lead local flood authorities and internal drainage boards.
 - Policies in development plans should outline the consideration, which will be given to flood issues, recognising the uncertainties that are inherent in the prediction of flooding and that flood risk is expected to increase as a result of climate change.
 - Planning authorities should apply the precautionary principle to the issue of flood risk, using a risk based search sequence to avoid such risk where possible and managing it elsewhere;
 - The vulnerability of a proposed land use should be considered when assessing flood risk;
 - Use opportunities offered by new developments to reduce the causes and impacts of flooding;
 - Planning authorities should recognise the importance of functional floodplains, where water flows or is held at times of flood, and avoid inappropriate development on undeveloped and undefended floodplains;
 - The concept of Flood Risk Reduction is applied, particularly in circumstances where development has been sanctioned on the basis of the “Exception Test”.

3.4 Technical Guidance to the National Planning Policy Framework March 2012.

- 3.4.1 The Technical Guidance to the National Planning Policy Framework provides additional guidance to local planning authorities to ensure the effective implementation of the planning policy set out in the National Planning Policy Framework on development in areas at risk of flooding. The guidance retains key elements of the now superseded PPS 25. The document provides supporting information on:
- The application of the sequential approach and Sequential and Exception Tests;
 - Measures to reduce flood risk to acceptable levels;
 - How to manage residual risks; and
 - Guidance on how to take climate change into account.

Sequential Tests

- 3.4.2 The risk-based Sequential Test should be applied at all stages of the planning process. Its aim is to steer new development to areas at the lowest probability of flooding. The Sequential Test is applied on the basis of the EA Flood Zone Map and Tables 1 and 2 in NPPF guidance.

Exception Test

- 3.4.3 Where it is not possible to plan development within an appropriate flood zone the 'Exception Test' will need to be passed based on the following requirements:
- a) it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared.
 - b) a site specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.
 - c) Supporting information submitted with the planning application will need to demonstrate how the site passes part (a) Exception Test. The Flood Risk Assessment will need to demonstrate how the site passes part (b) of the Exception Test.

3.5 National Standards for Sustainable drainage systems

- 3.5.1 In accordance with Schedule 3 of the FWMA 2010 the Government published its consultation draft for National Standards for Sustainable Drainage Systems (NSFSDS) in December 2011. The implementation date was originally 1st October 2012 however this will now take place at a later date, perhaps 2013. Whilst the NSFSDS is not yet agreed Local Authorities are taking steps to ensure that when it is implemented the SUDS Approval Body (SAB) mechanism can be put in place.
- 3.5.2 Drainage systems that are submitted for approval to the SAB must be designed to comply with the National Standard in accordance with the following principles:
- a) Surface runoff is managed at its source where it is reasonably practicable to do so;
 - b) Surface runoff is managed on the surface where it is reasonably practicable to do so;
 - c) Public space is used and integrated with the drainage system, where it serves more than one property and it is reasonably practicable to do so;
 - d) Design is cost-effective to operate and maintain over the design life of the development, in order to reduce the risk of the drainage system not functioning;
 - e) Design of the drainage system accounts for the likely impacts of:
 - climate change; and
 - changes in impermeable area;over the design life of the development, where it is reasonably practicable to do so.

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- 3.5.3 Section A of the NSFSDS provides a hierarchy of destinations for surface water runoff from development sites which must be considered:
1. Discharge into the ground
 2. Discharge to a surface water body
 3. Discharge to a surface water sewer
 4. Discharge to a combined sewer
- 3.5.4 Section B prescribes the approach to be taken to drain surface water collected at development sites. It outlines the requirements for determining peak rainfall rates and volumes of water that need to be considered as part of the SUDS proposals for development sites.
- 3.5.5 Section C states criteria by which the provision of effective treatment of surface water prior to discharge will be measured against.

3.6 Partnership for Urban South Hampshire sub-regional Strategic Flood Risk Assessment (SFRA) - 2007

- 3.6.1 Subsequent to producing the SFRA the current Government published its National Planning Policy Framework (NPPF) in March 2012. The NPPF recommends that SFRAs are completed in two consecutive stages. The Level 1 SFRA enables application of the Sequential Test, and the Level 2 SFRA increases the scope of an SFRA for development sites where the Exception Test is required. The Sequential Test is a simple decision-making tool designed to ensure that sites at little or no risk of flooding are developed in preference to areas at higher risk. Where it is not possible, due to wider sustainable development issues, to locate the development in a low flood risk area, a sequential approach within the Flood Zone is required and the Exception Test should be applied where necessary.
- 3.6.2 The SFRA consisted of two parts. Stage 1 provided an appraisal across the PUSH sub-region and informed the South East Plan. A detailed Stage 2 assessment focused on flood risks within each of the Local Planning Authority areas that constitute PUSH and was used in to inform decisions when allocating development sites. For the purposes of this FRA the PUSH SFRA is broadly consistent with NPPF and outputs are considered valid reference points.

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- 3.6.3 Guidance provided within the SFRA pertaining to Havant, and in particular Hayling Island, is contained in Appendix A. The guidance includes the following:

Vulnerability to Climate Change

In Havant Borough, Hayling Island is the most sensitive area to sea level rise, particularly the southern half of the island. With much of the island low-lying, predicted sea-level rise could result in extreme tidal events inundating more of the island.

Wave Overtopping

Recommends that all applications for development within the vicinity of the southern frontage of Hayling Island include an assessment of extreme wave overtopping, regardless of which Flood Zone the site is in.

3.7 The SUDS Manual, CIRIA (2007)

- 3.7.1 This guidance provides best practice on planning, design, construction, operation and maintenance of Sustainable Drainage Systems (SUDS) to facilitate their effective implementation within developments.
- 3.7.2 The guidance supersedes previous general guidance on SUDS and addresses landscaping, biodiversity issues, public perception and community integration as well as water quality treatment and sustainable flood risk management. The output is based on results contained in the Environment Agency R&D Report SCO20114/2.
- 3.7.3 The SUDS Manual aims to provide comprehensive advice on the implementation of sustainable drainage techniques in the UK. It provides guidance on:
- Initial planning;
 - Design through to construction;
 - The management of SUDS in the context of the current regulatory framework; and
 - Advice on landscaping, waste management, cost, and community engagement.
- 3.7.4 The SUDS Manual has been used to provide the necessary design guidance for the surface water drainage strategy incorporated into the masterplan.

4 Flood risk assessment

4.1 National Planning Policy Framework

- 4.1.1 In developing any site, consideration should be given to flood risks associated with such proposals by following a sequential approach. This will ensure that development is located in an area that is not prone to flooding and is considered compatible with the intended land use.
- 4.1.2 Technical guidance concerning flood risk has been produced by the Government to support the NPPF. Table 1 classifies the probability of flooding likely to occur into four flood zones and prescribes the vulnerability of specific land uses considered appropriate within each of these zones.
- 4.1.3 Table 2 classifies each land use in terms of flooding vulnerability. The proposed residential land use is classified as a 'more vulnerable' land use. Based on Table 2 within the guidance the residential dwellings are considered compatible with flood zones 1 and 2.
- 4.1.4 Flood zone mapping data was obtained from the Environment Agency's website in June 2012 and is shown in figure 4.1 below. It is clear from this data that the Application Site is remote from coastal flood zones 2 (light blue area) and 3 (dark blue area). The site does not benefit from tidal flood defences (hatched area) therefore it is located in undefended flood zone 1.

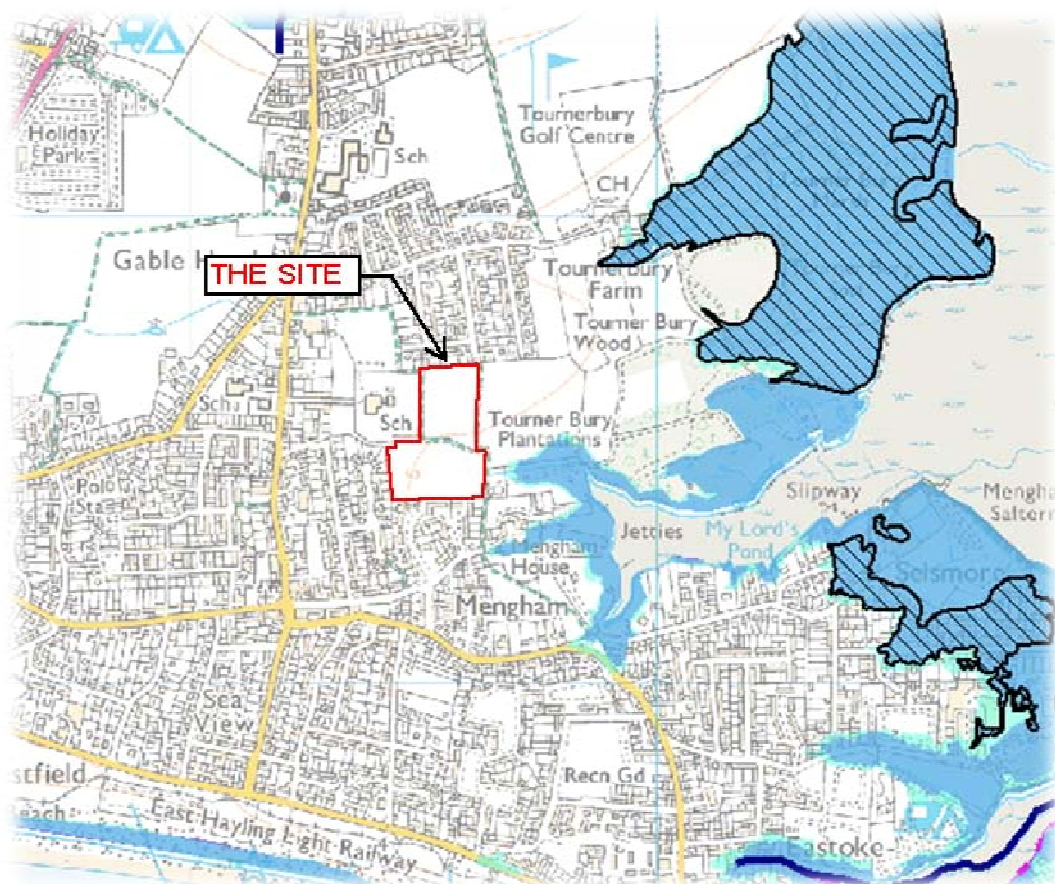


Figure 4.1 – EA flood zone mapping

- 4.1.5 Based on today's climatic conditions Table 3 of the NPPF guidance confirms that the intended 'more vulnerable' land use is appropriate for the Site's flood zone 1 location.

Table 3: Flood risk vulnerability and flood zone 'compatibility'

Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	×	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	×	×	×

Key: ✓ Development is appropriate.
 × Development should not be permitted.

4.2 Climate Change

- 4.2.1 The NPPF guidance recommends that contingencies are made for sea levels that are expected to rise as a consequence of climate change. Such effects should be considered throughout the life time of the development which is expected to be 100 years hence.
- 4.2.2 Based on Table 4 (to 2115) of NPPF guidance the SFRA provides an indication of changes to the coastal flood zones 2 and 3 that may occur in the future. The SFRA mapping suggests (see figure 4.2 below) that both zone 2 (light blue) and 3 (light green) sea levels within My Lord's Pond may potentially encroach onto a small section the site parallel to the eastern boundary to the southern field. By comparing this flood extent to the site contours the coastal flooding scenario reaches a level of approximately 4.5m AOD.

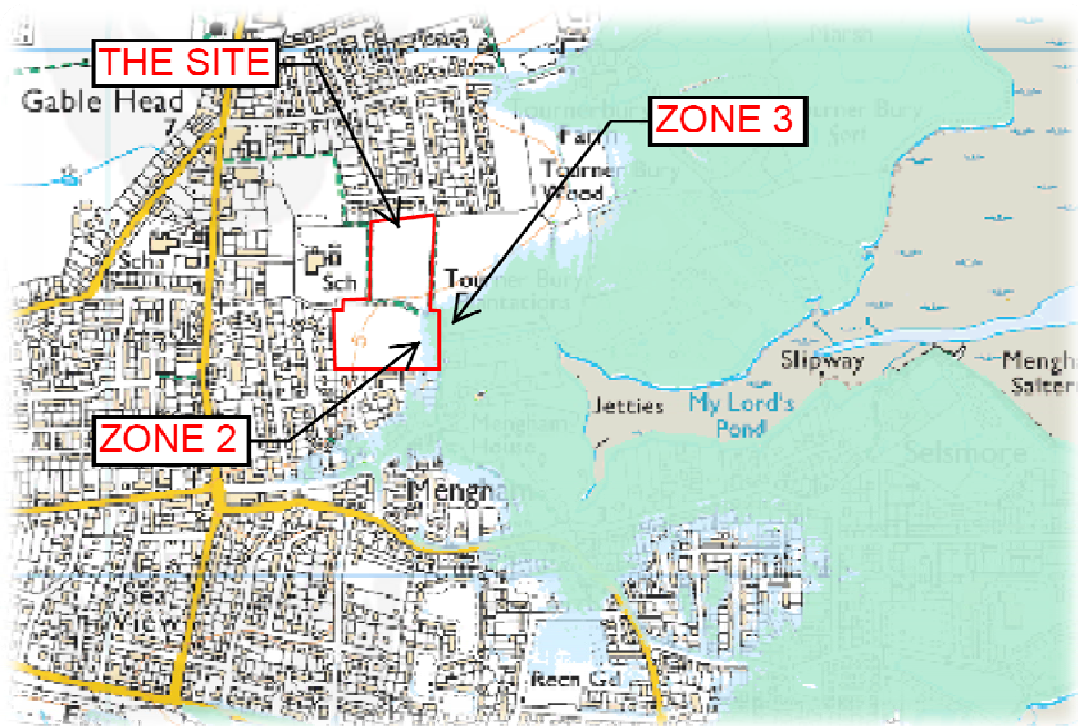


Table 4.2 – 2115 Flood zone extents

- 4.2.3 To protect the site against future climate change and the risk of flooding from rising sea levels it is recommend that surface levels within the affected part of the site are raised.
- 4.2.4 Flood risk to the site as a consequence of climate change is considered to be low risk provided eastern areas are raised.

4.3 Dry Access

- 4.3.1 An outline drainage strategy for the site has been developed to ensure that all storms events anticipated to occur up to and including 1 in 100 year events, including increase in rainfall due to climate change, can be controlled within the site.
- 4.3.2 Should land surrounding the site and drainage ditches within it become inundated the development could potentially be affected. Flow routes will be provided within the development to ensure that entrance thresholds which will be set to a minimum level of 150mm above surrounding ground remain clear. Where required ground levels within the development will be raised to ensure that a minimum level of 4.7m (equivalent to flood zone 1) is achieved throughout the site,
- 4.3.3 Circulation and access routes to the site from Beech Grove will be designed to achieve levels of at least 4.7m. Routes designed for exceedance flows are indicated on the drainage strategy drawing CS/056739/DR/001 (refer to Appendix C).
- 4.3.4 Access to the site is considered to be a low risk.

4.4 Ground Water Flooding

- 4.4.1 The SFRA indicates that the both the bedrock and superficial deposits are potentially susceptible to ground water flooding. It should be noted however that the SFRA confirms that there have been no recorded incidences of ground water flooding at the site or in proximity to it.
- 4.4.2 Discussions with HBC suggest that groundwater levels can potentially be 'locked' at times of high tide. At the detailed stage the ground water will be monitored and this information will inform the detailed design of the development proposals in particular the drainage (SUDS) proposals. At the time of undertaking site investigations groundwater, where it was present, varied between 0.7m and 1.9m below ground levels.
- 4.4.3 Based on the aforementioned information it is considered that groundwater below poses a low risk to the development site.

4.5 Sewer Flooding

- 4.5.1 Southern Water surface water sewer flood mapping contained in the SFRA confirms that there have been no observed incidences of flooding due to surface water sewer overload within or in proximity to the site.
- 4.5.2 At this stage it is not intended to connect to the public surface water system therefore the development does not pose a risk to these sewers.
- 4.5.3 Southern Water confirms that small scale improvements to the system will need to be carried to provide sufficient capacity for the development proposals (refer to section 6).
- 4.5.4 Sewer flooding as a consequence of developing site with mitigation is considered low.

4.6 Wave Energy

- 4.6.1 Wave energy mapping data contained in the SFRA indicates that My Lord's Pond may be susceptible to low wave energy frontage. As a consequence it has been agreed with the EA that finished floor levels within the development are set to at least 4.95mAOD, which is 150mm above the zone 1 coastal flood level of 4.7mAOD.
- 4.6.2 A moderate wave energy frontage is depicted in the SFRA to occur along the south-facing beach front to the island. Historic wave overtopping is confined to the beach front area and is not considered a hazard to the site.
- 4.6.3 On the basis that a small section of the southern field is raised along the eastern boundary the flood risk as a consequence of wave energy is considered low.

4.7 Surface flooding

- 4.7.1 Due to impact of land use change the SFRA indicates that site is at moderate risk of surface water run-off.
- 4.7.2 Although the site is undeveloped the SFRA indicates that the western ditch to the northern field is a potential source of overland flooding. It is recommended that this ditch and indeed others on the site are improved with bases and sides enhanced and managed to provide storage in all storm events up to the 1 in 100 year plus climate change event. Vegetation should be managed to ensure that water is taken up and slow the path of flood water naturally to aid infiltration. Levels within the developed the site will designed to ensure that any flooding to these ditches is locally confined and does affect the proposed properties.
- 4.7.3 Pluvial mapping data contained within the SFRA indicates that should surface water accumulate at times of intense rainfall then it will be confined to the southwest corner of the northern field / northwest corner of the southern field, and extend into the school playing field.
- 4.7.4 At the detailed stage consideration will be given to enhancing the ditches that exist within the site to improve surface water retention and routing. This will also ensure that any runoff from adjacent land does not affect the site. The risk to properties within the development is considered low.

4.8 Flooding from artificial sources

- 4.8.1 There are no reservoirs storing water above the ground on the Island. There are no known canals or 'other' potential artificial sources of flooding on the island therefore the site is considered to be at low risk from flooding from artificial sources.

4.9 Emergency Planning

- 4.9.1 The SFRA indicates that approaches to Langstone bridge and the bridge itself are within flood zone 2. Havant Borough Council has plans in place to deal with emergencies and evacuations should they occur at times of inundation. All building occupiers will be required to sign up to the Councils flood alert programme.

4.10 Residual flood risks

- 4.10.1 Climate change, wave overtopping, and surface water are considered potential hazards to the development. Land raising, improvements to ditches and providing SUDS to developed parts of the site will provide effective mitigation to significantly reduce risks. Overall the risk of flooding to the site is considered low.

5 Outline Surface Water Drainage Strategy

5.1 Developed Site Areas

- 5.1.1 In developing the Application Site replacing existing 'greenfield' areas with potentially impermeable surfaces such as roofs and hardstandings will result in additional runoff. This could lead to increase risk of flooding to the site itself and surrounding properties if adequate control measures are not put in place.
- 5.1.2 When proposing mitigation measures NPPF guidance recommends contingencies are in place to account for climate change. Table 5 of the guidance recommends that peak rainfall intensity increases expected during the lifespan of the development are accounted for. For the residential properties this could be between 2085 and 2115 therefore an allowance of 30% increase in rainfall has been included in this Outline Surface Water Drainage Strategy.
- 5.1.3 In accordance with guidance obtained from the EA and the SFRA it is intended that a suitable approach is taken to cater for surface water runoff generated by the development. To comply with draft National Standards for Sustainable Drainage Systems (NSFSDS) and the SUDS manual (CIRIA report 697) surface water from developed site areas will be collected and managed within the site. Provision will be made to improve water quality prior to discharge, where practical. In accordance with National and local development principles a SUDS will be provided to protect against flood risk.
- 5.1.4 As discussed in 4.2.3 above a component of the development proposals is to mitigate against flood risk by raising ground levels around the eastern side of the southern field. This will be undertaken to a height commensurate with the 1 in 200 year coastal flood level plus a 300mm freeboard to account for varying wave heights and uncertainty up to 2115 (4.8m). To mitigate against potential overland flows within the developed site entrance thresholds to buildings will be raised a further 150mm to a minimum of 4.95m across the site.
- 5.1.5 Controlling surface water in a manner that closely approximates pre-developed conditions is a key principle of SUDS. Consideration will be given at the detailed stage to maximising infiltration opportunities where they exist but where they do not, flows will be controlled within the site and gradually released to mimic existing Greenfield runoff characteristics.
- 5.1.6 Groundwater would need to be monitored to establish the depths and flows paths however for the purposes of this outline drainage strategy it is assumed that infiltration is not appropriate at the development site. At the detailed stage further consideration will be given to infiltration.
- 5.1.7 To ensure the risk of surface water flooding that could arise as a consequence of developing the site, surface water will be intercepted and controlled within the site confines using appropriately designed SUDS. Discharge from the site will be restricted to rates which presently exist with allowances made for climate changes (ie 30% increase in rainfall intensities).

5.2 SUDS Management Train

- 5.2.1 The management train concept promotes division of a development to be drained into sub-catchments with different drainage characteristics and land uses, each with its own drainage strategy. Dealing with the water locally not only reduces the quantity that has to be managed at any one point, but also reduces the need for conveying the water off the site.
- 5.2.2 A key concept of Sustainable Drainage Systems (SUDS) is of the "treatment train", whereby features are constructed at different stages on the source-pathway-receptor model and combine to attenuate, settle and treat surface water. Retention, bio retention basins and wetlands are the principal treatment facilities while ponds, detention basins, treatment swales and infiltration systems are also major forms of site control.
- 5.2.3 A range of sustainable drainage techniques has been considered in formulating the conceptual drainage strategy for the site. Where appropriate they have been identified as suitable or unsuitable and the reason for the decision. This has refined the framework for developing the conceptual drainage strategy by a process of elimination. The drainage strategy has been further refined with consideration of landscape, geology, ecology and amenity to meet the overall objectives of the development.

5.3 SUDS selection process – the ‘Management Train’

- 5.3.1 Where possible the use of SUDS will be incorporated into the development proposals. Such systems have the potential to reduce the peak runoff flows and volumes further and can improve the amenity and biodiversity of the development.
- 5.3.2 Table 5.1 below provides a review of sustainable drainage options identified in the CIRIA SUDS Manual in order to determine techniques appropriate for the site and proposed development. For each technique a short justification is provided for their use, or otherwise.

Approach to management train	Technique	Proposed for use	Justification
Regional controls	Wetland / ponds	No	Site considered to small for large scale wetland
	Dry detention basins / micro basins	Yes	Storage with restricted outflow considered imperative
	Infiltration basins	No	Unlikely to be suitable in isolation due to high groundwater / soil type
	Geocellular	Yes	High storage to volume ratio
Site controls	Grassed swale	Yes	Utilise where possible to convey runoff. May be combined with detention system to provide attenuation
	Permeable paving	Yes	Utilise where possible to convey and attenuate runoff. May be combined with detention system
	Filter strips	Yes	Reuse of existing ditches to act as cut off drains from adjacent land
	Bioretention	Yes*	Utilised where practical, sub-surface to drain to proposed surface water drainage system
	Trenches	No	Unlikely to be suitable due to depth of trench relative to ground conditions
Source controls	Green roofs	No	Not considered suitable for private homes
	Soakaways	No	Unlikely to be suitable due to depth of soakaway relative to ground conditions
	Rainwater harvesting / water butts	Yes	Collected from roofs and stored above ground only

* Not included within this outline strategy but maybe considered further at the detailed stage

Table 5.1 – SUDS technique justification

5.4 Preferred options

5.4.1 Based on the scale of the development and type of land uses, it is recommended that the proposed development utilises the following SUDS techniques (subject to detailed design):

- (i) Rainwater butts or harvesting for non potable uses (not included in any calculations)
- (ii) Permeable paving (draining into underground sub base or cellular storage system) in communal car park areas and roads to attenuate runoff from hard standings and roof areas.
- (iii) Attenuation and treatment within dry retention ponds / swales at a local scale where landscaping permits

5.4.2 Runoff from estate roads will require attenuation and it is proposed to provide a combination of permeable paving and landscaped areas to accommodate dry detention basins

5.4.3 As part of the drainage strategy for each field, consideration has been given to where water will flow. The underlying concept is for runoff to be managed within the site in a manner that does not put people on site at risk and wherever possible reduces flood risk to those off site. This underlying principle has been integrated into the layout of the Masterplan.

5.4.4 Particular consideration will be given to overland flow routes when the capacity of the drainage system is exceeded. Roads and areas of open space are proposed as the secondary flow routes through the development and into the attenuation devices based on existing topography and the Masterplan layout.

5.4.5 Paragraph B2 of NSFSDS states that at times of low rainfall:

“There must be no discharge to a surface water body or sewer that results from the first 5mm of any rainfall event.”

The first 5mm of rainfall remains within the site and will be retained within the system and allowed to drain naturally into the ground or evapotransporate.

5.4.6 At times of high rainfall one of two approaches below must be used to manage the surface runoff discharge:

Approach 1: Restricting both the peak flow rate and volume of runoff

The peak flow rates for the 1 in 1 year rainfall event and 1 in 100 year rainfall event must not be greater than the equivalent greenfield runoff rates for these events. The critical duration rainfall event must be used to calculate the required storage volume for the 1 in 100 year rainfall event. The volume of runoff must not be greater than the greenfield runoff volume from the site for the 1 in 100 year, 6 hour rainfall event.

Approach 2: Restricting the peak flow rate

The critical duration rainfall event must be used to calculate the required storage volume for the 1 in 100 year rainfall event. The flow rate discharged for the 1 in 1 year event must not be greater than either:

- the greenfield runoff rate from the site for the 1 in 1 year event, or
- 2 litres per second per hectare (l/s/ha);

And for the 1 in 100 year event must not be greater than either:

- the greenfield mean annual flood for the site (Qbar), or
- 2 litres per second per hectare (l/s/ha).

- 5.4.7 For master planning purposes approach 2 has been taken as this is likely to require the largest attenuation requirements. At the detailed stage, when more site details are known, the approach will be confirmed.

Greenfield runoff

- 5.4.8 The greenfield mean annual flow rate for the site has been determined using the computer program WINDES based on the methodology contained in the Interim Code of Practice for SUDS (refer to Appendix B)

Developed site runoff

Total impermeable area = North 0.84ha, South 1.03ha

$Qbar + CC \text{ North} = 2.9 + 30\% = 3.77 \text{ l/s}$

$Qbar + CC \text{ South} = 3.5 + 30\% = 4.55 \text{ l/s}$

Storage requirements

- 5.4.9 For the purposes of this outline strategy the attenuation requirements have been calculated for each field within the site. The mean annual flood flow rates (Qbar + CC) indicated in 5.5.8 is slightly lower than it is practical to control using vortex devices, such as Hydrobrakes, or orifice plates. For the purposes of this outline assessment 5 l/s has been taken as the restricted flow rate for each field.
- 5.4.10 To attenuate surface water within the site prior to discharge the following storage volumes will need to be accounted for (Appendix B contains WINDES analysis assuming a pond/void with restricted discharge).

Northern field = 557 m³

Southern Field = 725 m³

Water quality and attenuation requirements

- 5.4.11 To comply with NSFSDS it must be demonstrated that collected surface water is treated prior to discharge to a water body. The level of hazard posed by the development to water quality is defined in table C1: Level of Hazard. It states that roof drainage is considered a 'low' hazard whilst all other areas of the development are considered 'medium' hazards. Land uses attributable to 'high' hazard levels are not proposed within the development.
- 5.4.12 Depending on the hazard rating NSFSDS Table C3 prescribes the number of treatment stages required, in series, to reduce the risk of pollution to surface water bodies. Based on the type of SUDS deemed suitable for the development (see table 5.1 above) it is unlikely that draining at source solely using infiltration techniques is feasible, therefore 3 treatment stages will be required for non-roof drainage)

SUDS Technique (number of treatment stages)	Attenuation provisions (m ³)	
	North	South
Pipe work with trapped gullies (1 treatment stage)	Not analysed within outline design	
Permeable paving with microbial growth layer (1 treatment stage)	222	433
Road side micro storage basins (1 treatment stage)	22	8
Detention basins / swales (1 treatment stage)	313	284
Existing ditches within the site (1 treatment stage)	Not analysed within outline design	
Total	557	725

Table 5.2 – SUDS storage provision

- 5.4.13 At the detailed stage additional hydraulic modelling will be undertaken to confirm pipework routing and precise design profiles of the SUDS features. This will enable a plan for safe operation and maintenance to be developed and agreed with the future appointed SAB (Hampshire C.C. responsibility).
- 5.4.14 The outline surface water drainage strategy for the site is contained in Appendix C (drawing number CS/056739/DR/001).

6 Outline Foul Drainage Strategy

6.1 Existing sewers

- 6.1.1 To define constraints to the development asset record plans have been obtained from Southern Water (SW). These indicate that there are no sewers within the site however there are a number of public sewers external to the site and these are described in section 2.4 above.

6.2 Foul drainage strategy

- 6.2.1 It is intended that foul flows generated by the development site are drained to SW's public foul sewer system. Sewers proposed within the site will be constructed in accordance with Sewers for Adoption (SfA currently 6th edition).
- 6.2.2 Foul flows expected to be generated by the development have been calculated in accordance with SfA and are based on a flow of 4000 litres per dwelling per day. This equates to a peak flow of 6.1 litres per second.
- 6.2.3 In May 2012 SW was commissioned to undertake a level 2 capacity study to establish the impact that the development will have on the existing foul sewer network. This study was carried out by their consultants Atkins and the results were presented under cover of a letter dated 14th June 2012. A copy of the study report is contained in Appendix A.
- 6.2.4 Two points of connection to the existing network were considered and flows were split as follows to account for possible phasing:
- i) 60% (3.6 l/s) discharged to the 225mm sewer located to in the field to the east of the site (manhole reference 6501)
 - ii) 40% (2.5 l/s) discharged to the 150mm sewer located in Goldring Close to the south of the site (manhole reference 4304, invert level 3.96mAOD).
- 6.2.5 Analysis of the network confirmed that the existing pipework downstream of the site is at capacity and that improvements will be required. These enhancements will comprise:
- i) *Increase 225mm diameter pipework to 300mm over a length of 340m.*
 - ii) *Increase capacity of 2 pumping stations downstream of the site*
- 6.2.6 It should be noted that at the time of writing this report SW were unable to confirm the invert levels of the 225mm pipework east of the site.

7 Conclusions

7.1 Flood risk

- 7.1.1 Based on a desktop review of flood mapping obtained from the Environment Agency's website, and flood evidence records contained in the Council's Strategic Flood Risk Assessment, the Application Site is today located in Flood Zone 1 which is considered suitable for all forms of development.
- 7.1.2 The SFRA also confirms that as a consequence of climate change the coastal floodplains are likely to extend on a small part of the site (confined to the eastern side of the southern field). Alterations to ground levels at this location will prevent flooding from affecting the development. Given that this floodplain is related to the sea the effects of displacing water do not require consideration.
- 7.1.3 The proposed development presents no significant impact to existing flood dynamics, either on or adjacent to the site.
- 7.1.4 The approach taken in the report confirms that locating the proposed buildings and parking areas in Flood Zone 1 does not increase the risk of flooding.
- 7.1.5 In accordance with NPPF guidance the development proposed is compatible with the degree of flood risk.

7.2 Surface water drainage with allowances for climate change

- 7.2.1 To minimise the risk of flooding either to or from the proposed development is managed a surface water drainage strategy is proposed in outline. It is proposed to attenuate surface water within the construction layers beneath permeable surfacing, road side micro basins and dry ponds/basins. These will be designed in detail at the appropriate stage.
- 7.2.2 For master planning purposes the areas required for attenuation within the two fields are each based on peak discharge rates up to 5 l/s for 1 in 100year return periods including a 30% increase in rainfall to account for climate change. This is broadly in accordance with NSFSDS Approach 2: restricting the peak flow rate, albeit increased slightly to reflect practicalities of operating/maintaining control devices. At the detailed stage greater details will be defined and consideration given to optimising storage volumes based on Approach 1: restricting both the peak flow rate and volume of runoff.
- 7.2.3 Water quality will be improved through the use of a porous paving and storage system that incorporates a geotextile to encourage growth of a microbial biomass. Prior to discharging into the central ditch (and eventually into My Lord's Pond) the use of road side micro basins, dry ponds and swales prior will improve water quality further. In accordance with NSFSDS surface water will be retained within the attenuation system to ensure that the first 5mm of rainfall does not leave the site.
- 7.2.4 Controlled surface water will be discharged to water bodies within the site. In terms of water quality the SUDS will offer the required number of treatment stages to satisfy NSFSDS.

7.3 Dry access

- 7.3.1 Dry access to the development during extreme rainfall events will be available from the surrounding highway.
- 7.3.2 Topography at the developed site will be such that extreme flooding will be conveyed away from buildings.
- 7.3.3 In accordance with the Council's emergency and flood evacuation arrangements development occupiers will receive flood warnings when necessary.

7.4 Wave energy / Climate change

- 7.4.1 Climate change is expected to impact sea levels such that in 2115 (the life-span of the development) the coastal flood zone 2 is expected to reach a level of approximately 4.5mAOD. To ensure that this does not present future hazards floor levels should be set at a higher level. Based on current best practice an additional 300mm should be allowed for to account for potential wave heights plus a further 150mm freeboard. Ground floor levels should be set at a minimum of 4.95mAOD. This could take the form of engineered banking or land raising.

7.5 Sewer flooding

- 7.5.1 To prevent flooding as a possible consequence of discharging foul flows generated by the development to the public foul sewer improvements will be required.

7.6 Foul drainage

- 7.6.1 SW confirms that foul flows generated by the development can be discharged to the public sewer system. To account for increased flows to the network improvements will be required. This will include pipe upsizing and adaption of existing pumping stations downstream of the site.

Appendix A – background data



- Trial Pit
▲ Dynamic Probe

PROJECT: Land North of Goldring Close and South of Beech Grove, Mengham, Hayling Island, PO11 9PN	DATE: May 2012	 <i>Geotechnical & Environmental Consultants</i>
CLIENT: Pro Vision Planning & Design	SCALE: Not to scale	
TITLE: Figure 2: Trial Hole Layout Plan	REF: 12952	



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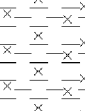
Site: Land North of Goldring Close & South of Beech Grove	Start Date: 26/04/2012	Ground Level: -
Client: Pro Vision	End Date: 26/04/2012	Easting: -
Project No: 12952	Logged By: PL	Northing: -
Site National Grid Reference:	Excavation Method:	
Site Level (mOD): 0.000	Plant:	
	Shoring/Support: None	
	Trial Pit Length: -	Trial Pit Width: -

[illegible]

1. All linear dimensions are in metres unless otherwise stated
2. All relative density/shear strength descriptions are based only on field observations and available in-situ test data.
3. Trial pit logged from the ground surface below 1.2 m depth.

Groundwater Observations: Dry	Stability: Stable	General Remarks: Roots observed to 1.3m bgl
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Site: Land North of Goldring Close & South of Beech Grove	Start Date: 26/04/2012	Ground Level: -
Client: Pro Vision	End Date: 26/04/2012	Easting: -
Project No: 12952	Logged By: PL	Northing: -
Site National Grid Reference:	Excavation Method:	
Site Level (mOD): 0.000	Plant:	
	Shoring/Support: None	
	Trial Pit Length: -	Trial Pit Width: -

Samples & Tests				Strata Details			
Depth	Type	Result	Hand Pen.	Elev.	Legend	Depth	Description
0.20 -	D					0.30	TOPSOIL Turf over light brown silty clay with rare sub-rounded flint gravel
0.50 -	B					0.80	Grey orange brown mottled silty CLAY
1.20 -	D					1.10	Grey sandy clayey GRAVEL
1.50 -	D					1.40	Orange grey mottled sandy CLAY
						1.60	End of Trial Pit at 1.60 m

1. All linear dimensions are in metres unless otherwise stated
2. All relative density/shear strength descriptions are based only on field observations and available in-situ test data.
3. Trial pit logged from the ground surface below 1.2 m depth.

Groundwater Observations: Seepage at 1.3m bgl, standing at 1.4m bgl after 20 minutes	Stability: Stable	General Remarks: Roots observed to 0.9m bgl
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Site: Land North of Goldring Close & South of Beech Grove	Start Date: 26/04/2012	Ground Level: -
Client: Pro Vision	End Date: 26/04/2012	Easting: -
Project No: 12952	Logged By: PL	Northing: -
Site National Grid Reference:	Excavation Method:	
Site Level (mOD): 0.000	Plant:	
	Shoring/Support: None	
	Trial Pit Length: -	Trial Pit Width: -

Samples & Tests				Strata Details			
Depth	Type	Result	Hand Pen.	Elev.	Legend	DepthThick	Description
0.30 -	D					0.10 0.10	TOPSOIL Turf over brown silty clay
0.70 -	B					0.50 0.60	Light brown silty CLAY with occasional sub-rounded gravel
1.20 -	D					0.50 1.10	Grey sandy clayey GRAVEL
						1.30 0.20	Orange grey sandy CLAY
End of Trial Pit at 1.30 m							

1. All linear dimensions are in metres unless otherwise stated
2. All relative density/shear strength descriptions are based only on field observations and available in-situ test data.
3. Trial pit logged from the ground surface below 1.2 m depth.

Groundwater Observations: Seepage at 1.0m bgl, standing at 1.1m bgl after 5 minutes	Stability: Stable	General Remarks: Roots observed to 0.7m bgl
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Trial Pit: TP 4

Site:	Land North of Goldring Close & South of Beech Grove	Start Date:	26/04/2012	Ground Level:	-
Client:	Pro Vision	End Date:	26/04/2012	Easting:	-
Project No:	12952	Logged By:	PL	Northing:	-
Site National Grid Reference:		Excavation Method:			
Site Level (mOD):		0.000		Plant:	
		Shoring/Support:		None	
		Trial Pit Length:		-	
		Trial Pit Width:		-	

Samples & Tests				Strata Details			
Depth	Type	Result	Hand Pen.	Elev.	Legend	Depth	Description
0.30 -	D					0.10	TOPSOIL Turf over brown silt clay
0.60 -	B					1.00	Light brown silty CLAY with occasional fine orange sand and sub-rounded gravel
1.20 -	D					1.10	Grey sandy CLAY with occasional gravel
1.50 -	D					1.30	Orange brown mottled sandy CLAY
						1.60	End of Trial Pit at 1.60 m

General Notes:

1. All linear dimensions are in metres unless otherwise stated

2. All relative density/shear strength descriptions are based only on field observations and available in-situ test data.

3. Trial pit logged from the ground surface below 1.2 m depth.

Groundwater Observations: Seepage at 1.3m bgl, standing at 1.3m bgl after 10 minutes	Stability: Stable	General Remarks: Roots observed to 0.8m bgl
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Trial Pit: TP 5

Site:	Land North of Goldring Close & South of Beech Grove	Start Date:	26/04/2012	Ground Level:	-
Client:	Pro Vision	End Date:	26/04/2012	Easting:	-
Project No:	12952	Logged By:	PL	Northing:	-
Site National Grid Reference:		Excavation Method:			
Site Level (mOD):		0.000		Plant:	
		Shoring/Support:		None	
		Trial Pit Length:		-	
		Trial Pit Width:		-	

Samples & Tests				Strata Details			
Depth	Type	Result	Hand Pen.	Elev.	Legend	DepthThick	Description
0.30 -	D					0.20	TOPSOIL Turf over brown silty clay
0.70 -	D					1.20	Orange brown and grey mottled sandy silty CLAY
1.10 -	D					1.40	Grey sandy gravelly CLAY
1.50 -	D					1.60	End of Trial Pit at 1.60 m

General Notes: 1. All linear dimensions are in metres unless otherwise stated 2. All relative density/shear strength descriptions are based only on field observations and available in-situ test data. 3. Trial pit logged from the ground surface below 1.2 m depth.		
Groundwater Observations: Seepage at 1.2m bgl,	Stability: Stable	General Remarks: Roots observed to 0.9m bgl



soils
LIMITED

Site: Land North of Goldring Close & South of Beech Grove	Start Date: 26/04/2012	Ground Level: -
Client: Pro Vision	End Date: 26/04/2012	Easting: -
Project No: 12952	Logged By: PL	Northing: -
Site National Grid Reference:	Excavation Method:	
Site Level (mOD): 0.000	Plant:	
	Shoring/Support: None	
	Trial Pit Length: 0.60	Trial Pit Width: 0.40

General Notes: 1. All linear dimensions are in metres unless otherwise stated 2. All relative density/shear strength descriptions are based only on field observations and available in-situ test data. 3. Trial pit logged from the ground surface below 1.2 m depth.
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Sheet 1 of 1



soils
LIMITED

Site: Land North of Goldring Close & South of Beech Grove	Start Date: 26/04/2012	Ground Level: -
Client: Pro Vision	End Date: 26/04/2012	Easting: -
Project No: 12952	Logged By: PL	Northing: -
Site National Grid Reference:	Excavation Method:	
Site Level (mOD): 0.000	Plant:	
	Shoring/Support: None	
	Trial Pit Length: 0.00	Trial Pit Width: 0.00

Samples & Tests				Strata Details			
Depth	Type	Result	Hand Pen.	Elev.	Legend	Depth	Description
0.20 -	D					0.10	TOPSOIL Turf over brown silty clay
0.50 -	D					1.00	Light brown sandy silty CLAY with occasional sub-rounded gravel
0.80 -	D					1.10	End of Trial Pit at 1.10 m

1. All linear dimensions are in metres unless otherwise stated
2. All relative density/shear strength descriptions are based only on field observations and available in-situ test data.
3. Trial pit logged from the ground surface below 1.2 m depth.

Groundwater Observations: Standing at 1.0m bgl,	Stability: Stable	General Remarks: Roots observed to 0.8m bgl. Terminated at 1.1m bgl for soakage test
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soils
LIMITED

Site: Land North of Goldring Close & South of Beech Grove	Start Date: 26/04/2012	Ground Level: -
Client: Pro Vision	End Date: 26/04/2012	Easting: -
Project No: 12952	Logged By: PL	Northing: -
Site National Grid Reference:	Excavation Method:	
Site Level (mOD): 0.000	Plant:	
	Shoring/Support: None	
	Trial Pit Length: 1.70	Trial Pit Width: 0.40

General Notes: 1. All linear dimensions are in metres unless otherwise stated 2. All relative density/shear strength descriptions are based only on field observations and available in-situ test data. 3. Trial pit logged from the ground surface below 1.2 m depth.
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Sheet 1 of 1



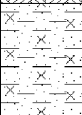
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Site: Land North of Goldring Close & South of Beech Grove	Start Date: 26/04/2012	Ground Level: -
Client: Pro Vision	End Date: 26/04/2012	Easting: -
Project No: 12952	Logged By: PL	Northing: -
Site National Grid Reference:	Excavation Method:	
Site Level (mOD): 0.000	Plant:	
	Shoring/Support: None	
	Trial Pit Length: 0.00	Trial Pit Width: 0.00

General Notes: 1. All linear dimensions are in metres unless otherwise stated 2. All relative density/shear strength descriptions are based only on field observations and available in-situ test data. 3. Trial pit logged from the ground surface below 1.2 m depth.
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Sheet 1 of 1

Site: Land North of Goldring Close & South of Beech Grove	Start Date: 26/04/2012	Ground Level: -
Client: Pro Vision	End Date: 26/04/2012	Easting: -
Project No: 12952	Logged By: PL	Northing: -
Site National Grid Reference:	Excavation Method:	
Site Level (mOD): 0.000	Plant:	
	Shoring/Support: None	
	Trial Pit Length: 0.00	Trial Pit Width: 0.00

Samples & Tests				Strata Details			
Depth	Type	Result	Hand Pen.	Elev.	Legend	DepthThick	Description
0.20 -	D					0.30	TOPSOIL Turf over brown silty clay
0.50 -	D					0.80	Orange grey mottled sandy silty CLAY
1.20 -	D					1.10	Grey clayey sandy GRAVEL / gravelly sand
						1.30	End of Trial Pit at 1.30 m

1. All linear dimensions are in metres unless otherwise stated
2. All relative density/shear strength descriptions are based only on field observations and available in-situ test data.
3. Trial pit logged from the ground surface below 1.2 m depth.

Groundwater Observations: Standing at 0.75m bgl	Stability: Stable	General Remarks: Roots observed to 1.1m bgl
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Site: Land North of Goldring Close & South of Beech Grove	Start Date: 26/04/2012	Ground Level: -
Client: Pro Vision	End Date: 26/04/2012	Easting: -
Project No: 12952	Logged By: PL	Northing: -
Site National Grid Reference:	Excavation Method:	
Site Level (mOD): 0.000	Plant:	
	Shoring/Support: None	
	Trial Pit Length: 0.00	Trial Pit Width: 0.00

Samples & Tests				Strata Details			
Depth	Type	Result	Hand Pen.	Elev.	Legend	DepthThick	Description
0.20 -	D					0.30	TOPSOIL Turf over brown silty clay with rare flint gravel
0.70 -	B					0.60	Grey orange and light brown mottled sandy silty CLAY
1.00 -	D					0.20	Grey clayey sandy GRAVEL
1.20 -	D					0.20	Orange grey clayey gravelly SAND
							End of Trial Pit at 1.30 m
							</

1. All linear dimensions are in metres unless otherwise stated
2. All relative density/shear strength descriptions are based only on field observations and available in-situ test data.
3. Trial pit logged from the ground surface below 1.2 m depth.

Groundwater Observations: Seepage at 1.0m bgl. Standing at 1.10m bgl after 10 minutes	Stability: Stable	General Remarks: Rootlets observe to 1.3m bgl
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Site: Land North of Goldring Close & South of Beech Grove	Start Date: 26/04/2012	Ground Level: -
Client: Pro Vision	End Date: 26/04/2012	Easting: -
Project No: 12952	Logged By: PL	Northing: -
Site National Grid Reference:	Excavation Method:	
Site Level (mOD): 0.000	Plant:	
	Shoring/Support: None	
	Trial Pit Length: 0.00	Trial Pit Width: 0.00

Samples & Tests				Strata Details			
Depth	Type	Result	Hand Pen.	Elev.	Legend	Depth	Description
0.20 -	D					0.30	TOPSOIL Turf over brown silty clay with occasional sub-rounded flint gravel
0.60 -	D					0.50	Grey clayey sandy GRAVEL
1.00 -	D					0.50	Orange grey clayey SAND
						1.30	End of Trial Pit at 1.30 m

1. All linear dimensions are in metres unless otherwise stated
2. All relative density/shear strength descriptions are based only on field observations and available in-situ test data.
3. Trial pit logged from the ground surface below 1.2 m depth.

Groundwater Observations: Seepage at 0.8m bgl. Standing at 1.10m bgl after 10 minutes	Stability: Stable	General Remarks: Roots observed to 1.0m bgl
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Trial Pit: TP 16

Site:	Land North of Goldring Close & South of Beech Grove	Start Date:	26/04/2012	Ground Level:	-
Client:	Pro Vision	End Date:	26/04/2012	Easting:	-
Project No:	12952	Logged By:	PL	Northing:	-
Site National Grid Reference:		Excavation Method:			
Site Level (mOD):		0.000		Plant:	
				Shoring/Support: None	
		Trial Pit Length: 0.00		Trial Pit Width: 0.00	

Samples & Tests				Strata Details			
Depth	Type	Result	Hand Pen.	Elev.	Legend	DepthThick	Description
0.20 -	D					0.30	TOPSOIL Turf over dark brown silty clay
0.60 -	D					0.40	Firm grey brown and orange slightly sandy silty CLAY
1.00 -	D					0.50	Grey orange mottled sandy CLAY with abundant fine to coarse flint gravel with depth and becoming very sandy with depth
1.50 -	D					0.40	Orange clayey gravelly SAND
2.00 -	D					0.60	Firm grey slightly silty CLAY
						2.20	End of Trial Pit at 2.20 m

General Notes: 1. All linear dimensions are in metres unless otherwise stated 2. All relative density/shear strength descriptions are based only on field observations and available in-situ test data. 3. Trial pit logged from the ground surface below 1.2 m depth.		
Groundwater Observations: Seepage at 1.5m bgl. Standing at 1.80m bgl after 10 minutes	Stability: Stable	General Remarks: Rootlets observed to 1.5m bgl



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Site: Land North of Goldring Close & South of Beech Grove	Start Date: 26/04/2012	Ground Level: -
Client: Pro Vision	End Date: 26/04/2012	Easting: -
Project No: 12952	Logged By: PL	Northing: -
Site National Grid Reference:	Excavation Method:	
Site Level (mOD): 0.000	Plant:	
	Shoring/Support: None	
	Trial Pit Length: 0.00	Trial Pit Width: 0.00

[illegible]

1. All linear dimensions are in metres unless otherwise stated
2. All relative density/shear strength descriptions are based only on field observations and available in-situ test data.
3. Trial pit logged from the ground surface below 1.2 m depth.

Groundwater Observations: Seepage at 1.2m bgl.	Stability: Stable	General Remarks: Roots observed to 1.2m bgl
---	----------------------	--

Site: Land North of Goldring Close & South of Beech Grove	Start Date: 26/04/2012	Ground Level: -
Client: Pro Vision	End Date: 26/04/2012	Easting: -
Project No: 12952	Logged By: PL	Northing: -
Site National Grid Reference:	Excavation Method:	
Site Level (mOD): 0.000	Plant:	
	Shoring/Support: None	
	Trial Pit Length: 0.00	Trial Pit Width: 0.00

Samples & Tests				Strata Details			
Depth	Type	Result	Hand Pen.	Elev.	Legend	DepthThick	Description
0.30 -	D					0.40	TOPSOIL Turf over brown silty clay
0.70 -	D					0.80	Brown grey sandy clayey GRAVEL becoming more sandy with depth and less clayey
1.30 -	D					1.20	
						1.50	Orange brown mottled sandy CLAY with occasional gravel and ferruginous nodules
							End of Trial Pit at 1.50 m

1. All linear dimensions are in metres unless otherwise stated
2. All relative density/shear strength descriptions are based only on field observations and available in-situ test data.
3. Trial pit logged from the ground surface below 1.2 m depth.

Groundwater Observations: Seepage at 1.0m bgl. Standing at 1.0 bgl after 20 minutes	Stability: Stable	General Remarks: Roots observed to 1.5m bgl
---	-------------------------------------	---

Soils Limited
Newton House
Cross Road
Tadworth KT20 5SR
Tel: 01737 814221 Fax: 01737 812557



Trial Pit: TP 24

Site:	Land North of Goldring Close & South of Beech Grove	Start Date:	26/04/2012	Ground Level:	-		
Client:	Pro Vision	End Date:	26/04/2012	Easting:	-		
Project No:	12952	Logged By:	PL	Northing:	-		
Site National Grid Reference:		Excavation Method:					
Site Level (mOD):		0.000		Plant:			
		Shoring/Support:		None			
		Trial Pit Length:		0.00			
				Trial Pit Width:		0.00	

Samples & Tests				Strata Details			
Depth	Type	Result	Hand Pen.	Elev.	Legend	Depth	Description
0.20 -	D					0.30	TOPSOIL Turf over brown silty clay with rare flint gravel
0.50 -	D					0.40	Orange brown sandy silty CLAY
0.80 -	D					0.70	Orange grey brown clayey GRAVEL
1.40 -	D					1.50	End of Trial Pit at 1.50 m

General Notes: 1. All linear dimensions are in metres unless otherwise stated 2. All relative density/shear strength descriptions are based only on field observations and available in-situ test data. 3. Trial pit logged from the ground surface below 1.2 m depth.		
Groundwater Observations: Standing at 1.9 bgl	Stability: Stable	General Remarks: No roots observed

Site: Land North of Goldring Close & South of Beech Grove	Start Date: 26/04/2012	Ground Level: -
Client: Pro Vision	End Date: 26/04/2012	Easting: -
Project No: 12952	Logged By: PL	Northing: -
Site National Grid Reference:	Excavation Method:	
Site Level (mOD): 0.000	Plant:	
	Shoring/Support: None	
	Trial Pit Length: -	Trial Pit Width: -

Samples & Tests				Strata Details			
Depth	Type	Result	Hand Pen.	Elev.	Legend	DepthThick	Description
0.20 -	D					0.40	TOPSOIL Turf over brown silty clay with rare flint gravel
0.70 -	D					0.40	Orange brown slightly sandy silty CLAY
1.10 -	D					0.50	Orange grey sandy clayey GRAVEL
1.40 -	D					1.30	Fine grey orange mottled clayey sandy GRAVEL
						1.50	End of Trial Pit at 1.50 m

1. All linear dimensions are in metres unless otherwise stated
2. All relative density/shear strength descriptions are based only on field observations and available in-situ test data.
3. Trial pit logged from the ground surface below 1.2 m depth.

Groundwater Observations: seepage at 1.3m bgl. Standing at 1.15m bgl after 10 minutes	Stability: Stable	General Remarks: Roots observed to 0.9m bgl
---	-------------------------------------	---

Site: Land North of Goldring Close & South of Beech Grove	Start Date: 26/04/2012	Ground Level: -
Client: Pro Vision	End Date: 26/04/2012	Easting: -
Project No: 12952	Logged By: PL	Northing: -
Site National Grid Reference:	Excavation Method:	
Site Level (mOD): 0.000	Plant:	
	Shoring/Support: None	
	Trial Pit Length: -	Trial Pit Width: -

Samples & Tests				Strata Details			
Depth	Type	Result	Hand Pen.	Elev.	Legend	DepthThick	Description
0.20 -	D					0.30	TOPSOIL Turf over brown silty clay
0.50 -	D					0.40	Light brown very silty CLAY with occasional flint gravel
1.00 -	D					0.70	Grey orange mottled sandy silty CLAY
1.50 -	D					1.00	
						1.70	End of Trial Pit at 1.70 m

1. All linear dimensions are in metres unless otherwise stated
2. All relative density/shear strength descriptions are based only on field observations and available in-situ test data.
3. Trial pit logged from the ground surface below 1.2 m depth.

Groundwater Observations: Dry	Stability: Stable	General Remarks: Roots observed to 1.0m bgl
----------------------------------	----------------------	--

Capita Symonds Ltd
Hartham Park,
Corsham,
Wiltshire
SN13 ORP

Attention: Mr. Lennon

Our Ref
CC/001195

Date
14 June 2012

Atkins Limited
Anglo St James House
39A Southgate Street
Winchester
Hampshire SO23 9EH

Telephone +44 (0)1962 858688
Fax +44 (0)1962 810296

winchester.enquiries@atkinsglobal.com
www.atkinsglobal.com

Dear Sir,

Site: Land north of Goldring Close, Mengham, Hayling Island, Hampshire, PO11 9PX

Further to your recent application for a level 2 enquiry regarding the above development site.

FOUL WATER

Please find enclosed the report which details the extent of works required in order for your proposed development site to be accommodated within the local sewerage infrastructure. It should be noted that the report is only a hydraulic solution to provide capacity for the proposed development site. There are other options available to you/ your client in discharging your proposed flows from the site such as making a connection application/requisition to a sewer at a point where capacity is currently available. Section 98 of the Water Industry Act 1991 provides a legal mechanism through which the appropriate infrastructure can be requested (by the developer) and provided to drain a specific location.

As you are aware the owner or occupier of the premises or private sewer or drain must give the sewerage undertaker notice of the proposed works. Upon receipt of the notice the undertaker may, within 21 days, refuse to allow him to make the connection if it considers that the mode of construction or the condition of the connecting sewer or drain either does not satisfy the standards reasonably required by the undertaker, or is such that the making of the communication would be prejudicial to its sewerage system.

The right of refusal is limited to these criteria alone and the undertaker cannot refuse to allow the connection on the grounds that the sewerage system is inadequate to take the extra liquid that the connection will discharge into it. This is a matter that should be dealt with at the planning stage.

Yours faithfully



Network Development

Please note: -

The information provided above does not grant approval for any designs/drawings submitted for the capacity analysis. The results quoted above are only valid for 12 months from the date of issue of this letter.



STUDY INTO THE OPTIONS FOR
FOUL DRAINAGE PROVISION AT
LAND NORTH OF GOLDRING CLOSE
MENGHAM
HAYLING ISLAND
HAMPSHIRE
PO11 9PX

02 July 2012

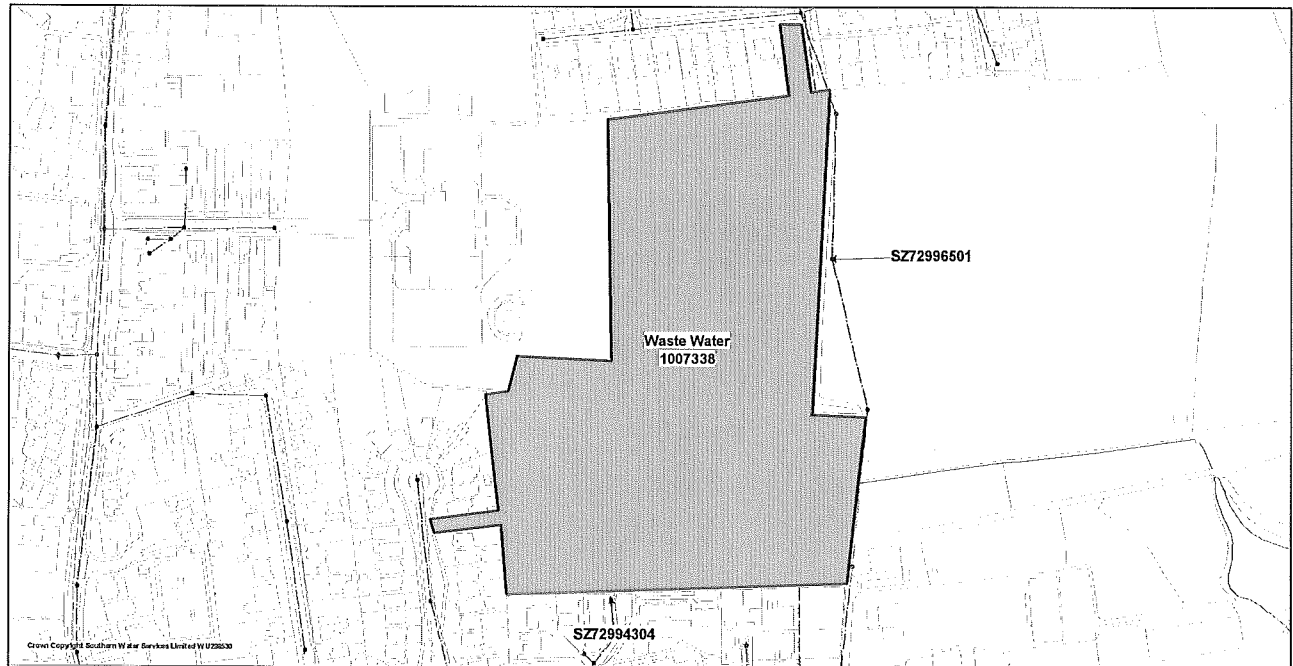
REQUESTED:
CAPITA SYMONDS LTD

Study into the Options for Foul Drainage Provision, Goldring Close, Budds Farm.

I. Development Details:

The proposal is to discharge 6.1 l/s total of foul flow is split in to 3.56 l/s and 2.5l/s to the local foul sewerage systems between manhole references 6501 and 4304 respectively located in Goldring Close.

Figure 1 - Proposed Development



II. Results and Conclusions:

Foul Water:

There is currently inadequate capacity within the local foul sewerage network to accommodate a flow of 3.56 l/s at manhole reference 6501 and 2.5l/s at manhole reference 4304. The proposed development would increase flows to the local network and as a result existing properties and land may be subject to a greater risk of flooding.

Additional off-site sewers or improvements to existing sewers will be required to provide sufficient capacity to service the proposed development as indicated in Figures 2 and Table 1.

Alternatively, the nearest point where capacity is currently available is at Budds Farm WTW located approximately 9400 metres north of the proposed development site.

Study into the Options for Foul Drainage Provision, Goldring Close, Budds Farm.

Figure 2- Proposed Improvements – Foul system

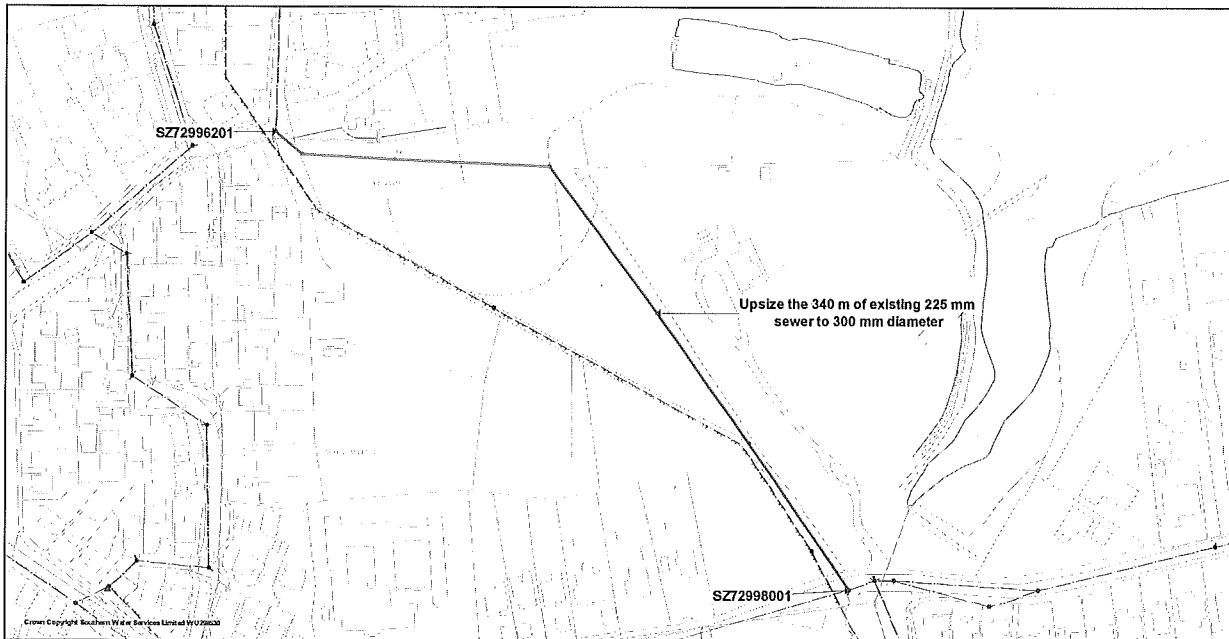


Table 1 - Proposed Improvements Schedule

U/S Manhole	D/S Manhole	Sewer Diameter (mm)		Avg. Depth (m)	Length (m)
		Existing	Proposed		
SZ72996201	SZ72998001	225	300	2.6	340
Increase the existing capacity of Fishery Lane Haylings Island No 2 WPS from 305 l/s to 314 l/s.					
Increase the existing capacity of Stoke Haylings Island WPS from 843 l/s to 852 l/s					

Before any connections are made, an application form needs to be completed and approved by Southern Water Services.

Please note: - The information provided above does not grant approval for any designs /drawings submitted for the capacity analysis. The results quoted above are only valid for 12 months from the date of issue of this letter.

PUBLIC SEWER RECORD

SOUTHERN WATER



The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site.

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O.S. REF: SZ7299NE

Scale: 1:2500

Sewer Plot

WARNING: BAC pipes are constructed of Bonded Asbestos Cement
WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement



Printed By: chandro

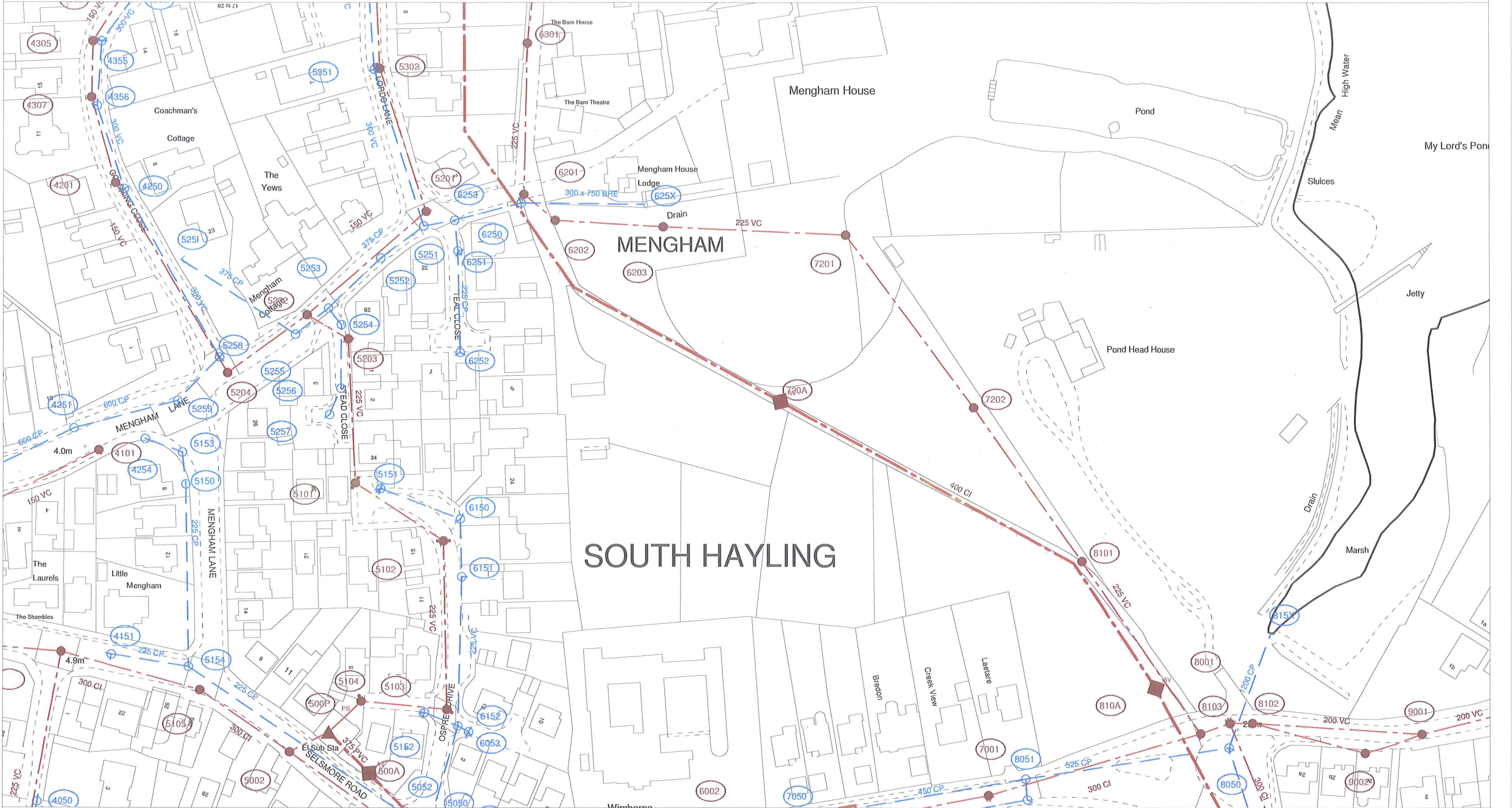
Date: 28-2-2011

Southern Water MapGuide Browser

Requested By:



SOUTHERN WATER



The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site.

Based upon Ordnance Survey Digital Data with the permission of the controller of H.M.S.O. Crown Copyright Reserved Licence No. WU 298530

O.S. REF: SZ7299SE

Scale: 1:1250

Sewer Plot

WARNING: BAC pipes are constructed of Bonded Asbestos Cement

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



Printed By: Roopa
Sewer Improvements - MH6201-8001
Requested By:

Date: 14-6-2012

Guidance Document: Havant Borough Council

Flood Risk Overview

Sources of Flood Risk

Havant is the eastern-most Local Authority in the PUSH sub-region. It covers a total area of approximately 55 km² which is split between the mainland and Hayling Island. The council has approximately 56 km of coastal frontage (including 42 km around Hayling Island) and 32 km of main river. At present, approximately 22% of the Borough's land area is designated as within Flood Zones 2 and 3a/3b (see SFRA Map Set 1A).

The SFRA has shown that the primary source of flood risk to Havant is from the sea. The key parts of the Borough which are currently at risk of flooding from the extreme tides include Brockhampton, Langstone and Emsworth on the mainland and Eastoke, Selmore and Mengham on Hayling Island. Flooding due to wave overtopping is known to occur on Hayling Island, particularly along the southern frontage. Land behind this frontage has suffered significant flooding from wave overtopping even though the land is relatively high and is shown to lie within Flood Zone 1, i.e. the zone of low probability of tidal flooding.

The secondary source of flood risk to Havant Borough is from fluvial sources including the Lavant Stream, the Hermitage Stream and associated tributaries. These watercourses flow through the town centre of Havant and discharge into Langstone Harbour. Additionally, the upper reaches of the Wallington River rise near Waterlooville in Havant Borough. The key parts of the Borough which are currently at risk of fluvial flooding include Havant town centre, Leigh Park, West Leigh and Stockheath.

Historically, Havant has also been susceptible to flooding from other sources including; groundwater, surface water and flooding caused by infrastructure failure. A number of previous groundwater flooding incidents have been observed in the upper parts of the Lavant Stream between Rowlands Castle and Havant in the north of the Borough. The town of Havant has a drainage system which in many places dates back to before the mid-1960s. As such, flooding from surface water drainage systems and sewers has occurred at many locations, including along The Florins, Petersfield Road, Park Lane and Hulbert Road.

Key physical characteristics that may constrain development

Approximately 58% of Havant Borough is currently covered by existing development, suggesting that much future development will need to be concentrated on brownfield sites. A number of environmentally designated areas represent a significant constraint on development in the Borough, covering approximately 24% of its area. As such there may be only limited Greenfield land upon which development can be permitted following consideration of other planning constraints.

The topography of Havant Borough ranges from sea level to approximately 80 metres above ordnance datum (mAOD). Hayling Island is entirely below approximately 9 mAOD. Further development on the island will likely increase the pressure for further maintenance and improvement to existing flood defences, particularly following predicted rises in sea level in future. The town of Havant itself varies in elevation from 5 mAOD near the coast to 40 mAOD in Leigh Park and West Leigh. The majority of the existing development on the mainland in Havant Borough will therefore not face increasing flood risk due to sea level rise. Waterlooville is situated between 30-50 mAOD while elevations in the Purbrook area rise to approximately 65 mAOD on the approach to Portsdown Hill.

Geologically, Havant Borough is underlain by a mix of low, moderate and highly permeable bedrock formations. The towns of Havant and Waterlooville and the southern part of Hayling Island are underlain by low and moderately permeable bedrock formations, while a highly permeable chalk layer exists between these two areas, resulting in the many springs used by Portsmouth Water. However, moderately permeable superficial deposits overlie the majority of this permeable layer, reducing its permeability in terms of surface water runoff generation. This may make the implementation of Sustainable Urban Drainage Systems (SUDS) difficult, which is of particular importance in the Cowplain and Waterlooville area where deep clay strata result in a lack of positive drainage and more frequent small surface water flooding incidents.

The existing drainage systems in Havant are known to be at or below capacity in key areas and it may therefore be difficult to provide new development in parts of the town without significant investment in drainage infrastructure.

Vulnerability to Climate Change

The SFRA has generated predicted tidal outlines for a number of years up to 2115 (see SFRA Map Set 1E). These outlines account for the most up-to-date predicted rises in sea-level over the coming century due to climate change and therefore allow the identification of locations that will be most vulnerable to this change due to their local topography. In Havant Borough, Hayling Island is the most sensitive area to sea level rise, particularly the southern half of the island. With much of the island low-lying, predicted sea-level rise could result in extreme tidal events inundating more of the island. In addition to this effect of rising sea levels, it is anticipated that climate change will result in an increase in fluvial flood flows. This may put additional pressure on areas in the town of Havant adjacent to the streams.

Vulnerability of existing communities

In general, the wards of Havant Borough have a mix of average and high social vulnerability to flooding (see SFRA Map Set 2). However, within Flood Zones 2 and 3 (i.e. those areas potentially likely to experience flooding) the wards generally have a high social vulnerability to flooding on the mainland and average social vulnerability to flooding on Hayling Island. It is likely that future investment in flood defences measures will need to strike a balance between protecting high risk areas on Hayling Island and areas of high social vulnerability on the mainland.

Existing defence assets and likely future investment

The coastal frontages of Havant Borough are almost entirely defended from either wave overtopping or tidal flooding by some form of coastal defence. Approximately half the coastal defences in Havant Borough have a crest level which is higher than a present day 1 in 200 year tide. Areas where defences are below the minimum standard of protection required for new development are the north western coast of Hayling Island south of Northney, the Chichester harbour frontage at Emsworth and the frontage at Langstone. The coastal defences in Havant Borough are, however, likely to be susceptible to climate change, as 100 years of predicted sea level rise would mean that most man-made defences at their current level would fail to offer protection from a 1 in 20 year tidal flood, with the exception of the southern frontage of Hayling Island. To sustain future development in Havant Borough, particularly on Hayling Island, significant investment in flood defences and flood defence infrastructure will be required (see SFRA Map Set 3). In order to consider the sustainability of investing in improved defences, the 'danger to people from breaching' index (SFRA Map Set 1D) will provide indications as to where the residual risk due to breaching may remain unfavourably high following improvements to defences to protect from extreme tidal floods.

Sequential and Exception Test

Planning Policy Statement 25 (PPS25) sets out the Government's objectives for achieving sustainable development through the avoidance and management of flood risk. The aim of PPS25 is to ensure that flood risk is taken into account at all stages of the planning process to avoid inappropriate development in areas of flood risk. To achieve this aim, PPS25 provides a decision making tool to ensure that sites with a low probability of flooding are developed in preference to areas at higher risk. The Sequential Test is the decision process which Local Authorities must demonstrate when developing their Local Development Frameworks and Local Development Documents. This SFRA has developed a suite of mapping outputs to assist Local Authorities in applying the Sequential Test.

When applying the Sequential Test, Output Package 1 of the SFRA will provide all the necessary information required upon which to base decisions regarding the location of future development in relation to flood risk. Within Output Package 1, the key map required for applying the Sequential Test is the Flood Zones map, shown as Map Set 1A. This map shows the spatial extent of 3 of the 4 Flood Zones identified in PPS25, these include:

Map Set 1A

- **Flood Zone 2** – Medium Probability of Flooding



Fluvial (river) and Tidal Flooding

- **Flood Zone 3a** – High Probability of Flooding, sub-divided into:



Fluvial Flooding

Tidal Flooding

Tidal / Fluvial (combined flooding processes where known)

- **Flood Zone 3b** – Functional Floodplain



Fluvial Flooding only

The area outside of these zones is considered to be the fourth zone, 'Flood Zone 1' which has a low probability of flooding.

Output Package 1 also contains 5 other Map sets which provide useful information to support Local Authorities when applying the Sequential Test, these include:

- Map Set 1B – Un defended Flood Hazard Maps (Zones 2 & 3)
- Map Set 1C – Indicative Areas Benefiting From Defences
- Map Set 1D – Danger to People from Breaching Maps
- Map Set 1E – Climate Change Outlines for 2025, 2055, 2085 and 2115
- Map Set 1F – Other sources of Flooding including:
 - Wave Energy
 - Groundwater Flooding
 - Impact of Land Use Change on Surface Water Runoff
 - Overland Flow
 - Historic Incidents of Surface Water Sewer Overload

When allocating a site in line with the Sequential Test, Figure 1 illustrates the decision process, the key questions that need to be answered and details of how the outputs of the SFRA can help inform the process.

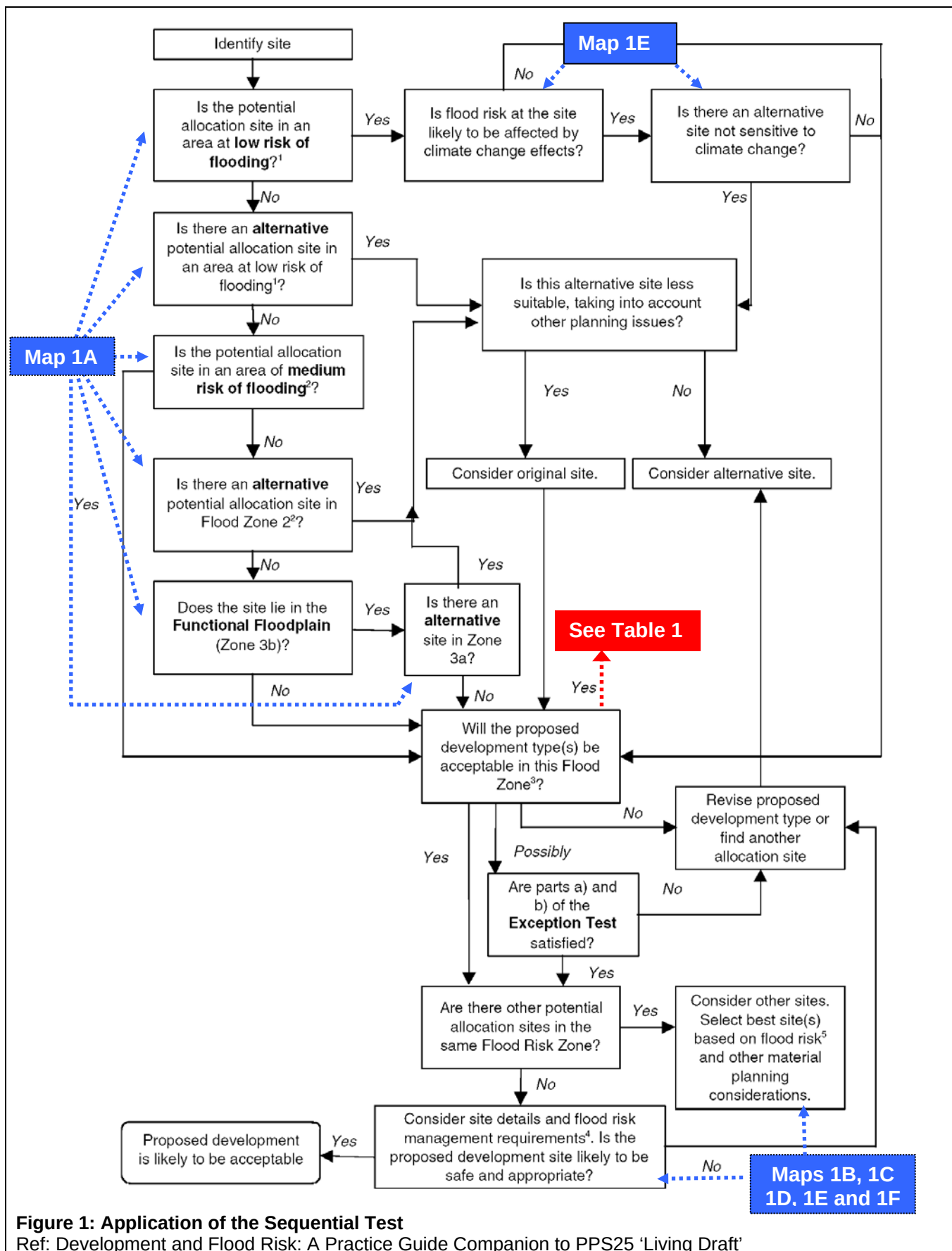


Figure 1: Application of the Sequential Test

Ref: Development and Flood Risk: A Practice Guide Companion to PPS25 'Living Draft'

Notes on Figure 1 Flow Chart

- 1 Flood Zone 1 for fluvial and tidal flooding and with a low risk of flooding from other sources.
- 2 Flood Zone 2 for fluvial and tidal flooding and with a medium risk of flooding from other sources.
- 3 As defined by the Sequential Test.
- 4 Development to be safe and to not increase flood risk elsewhere. Required to pass part c) of the Exception Test, where applicable.
- 5 Including susceptibility to future climate change and residual flood risk.

Flood Risk Vulnerability Classification

Where there are no reasonably available sites in Flood Zone 1, Local Authorities should take account of the flood risk vulnerability of land uses when considering the suitability of sites in Flood Zone 2 and then if necessary Flood Zone 3, applying the Exception Test if required. With reference to PPS25, Table 1 provides a summary of the appropriateness of land uses in relation to the Flood Zones.

	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception Test required	✓	✓
Zone 3a	Exception Test required	✓	✗	Exception Test required	✓
Zone 3b	Exception Test required	✓	✗	✗	✗

Table 1: Flood Risk Vulnerability and Flood Zone Compatibility (Ref: PPS25)

Key: ✓ Development is appropriate, subject to demonstrating the Sequential Test
✗ Development should not be permitted.

(*This table does not show: the application of the Sequential Test which guides development to FZ1 first, then FZ2, and then FZ3; FRA requirements; or the policy aims for each Flood Zone.)

If the application of the Sequential Test demonstrates a need to consider allocating sites within Flood Zones 2 or 3, a 'Sequential Approach' should also be applied within each of these Zones to steer new development to areas with the lowest probability and consequences of flooding. To facilitate this approach to site allocations within the Flood Zones, the SFRA Outputs (in particular Map Sets 1B, 1C, 1D and 3A / 3B) will provide useful information on the variation of flood hazard and the level of benefit provided by existing defences.

The findings of the Statistical Analysis undertaken in Stage 1 of this SFRA suggest that Havant Borough Council can achieve their draft South East Plan housing allocation in line with the Sequential Test. However, the need for potential commercial regeneration of the town centre and possible 'windfall' sites may mean that Havant Borough Council will need to consider development within Flood Zones 2 and 3. Where the Sequential Test alone cannot identify acceptable sites for urban regeneration or where windfall sites, having satisfied the Sequential Test, are located in Flood Zones 2 or 3, the Exception Test may need to be applied.

Exception Test

The Exception Test should only be applied following application of the Sequential Test. There are 3 elements of the Exception Test, all of which need to be demonstrated before the test can be passed. The 3 elements are:

- a) It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared. If the DPD has reached the 'submission' stage – see Figure 4 of PPS12: Local Development Frameworks – the benefits of the development should contribute to the Core Strategy's Sustainability Appraisal;
- b) The development should be on developable previously-developed land or, if it is not on previously-developed land, that there are no reasonable alternative sites on developable previously-developed land; and
- c) A FRA must demonstrate that the development will be safe, without increasing flood risk

elsewhere, and, where possible, will reduce flood risk overall.

When developing LDDs, Local Authorities are advised by PPS25 to prepare criteria-based policies in line with their Core Strategy's Sustainability Appraisal, against which item a) of the Exception Test can be tested. This will minimise the need to consider this element of the Exception Test for each individual planning application.

By assisting Local Authorities, at the site allocation level, in steering new development to areas with the lowest probability and hazard of flooding, the use of the SFRA outputs (in particular Map Sets 1B, 1C, 1D and 3A / 3B) will mean that site specific flood risk assessments in these areas will be more likely to satisfy criteria c) of the Exception Test.

SFRA Mapping Outputs

Table 2 summaries the most relevant mapping outputs and their purpose, for each of the key users of the PUSH SFRA.

Key Users	Relevant SFRA Mapping Outputs	Purpose
Forward Planners	Output Package 1: PPS25 Sequential Test and Relevant Supporting Information	Output Package 1 provides all the necessary information to help planners apply the Sequential Test and Exception Test when allocating new sites for development. Output Package 1 also allows planners to identify sites with the lowest probability of flooding and lowest flood hazard / danger and how the extent of flooding is likely to change in the future due to climate change.
Flood Risk Managers	Output Package 1: PPS25 Sequential Test and Relevant Supporting Information	Output Package 1 helps Flood Risk Managers to identify variations in flood hazards / dangers to existing development. The data also provides mapping to show how the extent of flooding is likely to increase over time due to climate change.
	Output Package 2: Social Vulnerability of and Flood Hazard / Danger to Existing Development	Output Package 2 can help Flood Risk Managers to: - o Identify critical areas where social vulnerability and flood hazard / danger are high. - o Help inform assessments of the sustainability of existing development. - o Help identify and prioritise asset management and improvements.
	Output Package 3: Appropriate Defence Standards and Levels of Investment	Output Package 3 can help Flood Risk Managers to: - o Identify shortfalls in existing defences in providing appropriate standards of defence, now and in the future. - o Identify indicative levels of investment required to provide the appropriate standards, now and in the future.
Development Control	Output Package 1: PPS25 Sequential Test and Relevant Supporting Information	Output Package 1 can help Development Control personnel to: - o Prepare specifications for site specific FRAs. - o Review site specific FRAs for new development sites and check for compliance with PPS25.
Emergency Planners	Output Package 1: PPS25 Sequential Test and Relevant Supporting Information	Output Package 1 can provide emergency planners with information on the variation of flood probability and hazard across the sub region. Such information can aid in the development of emergency plans and evacuation routes during flood events.
	Output Package 2: Social Vulnerability of and Flood Hazard / Danger to Existing Development	Output Package 2 can inform emergency planners of the locations where social vulnerability and flood hazard are highest. Such information can help emergency planners prioritise evacuation plans.

Table 2: The Mapping Output Packages appropriate for key users of the SFRA

Recommendations for Site Specific Flood Risk Assessments

Whilst the information presented in this SFRA will inform Local Authorities and facilitate their strategic allocation of sites for future development, it should not preclude the need for developers to undertake site specific flood risk assessments (FRAs). A SFRA, by its very nature, is a high level assessment of flood risk at the local authority level. It does not provide sufficiently detailed information to satisfy all of the requirements of a site specific FRA as outlined in PPS25.

On the 1st October 2006, the Town and Country Planning (General Development Procedure) (Amendment) (No 2) (England) Order 2006 (GDPO), made the Environment Agency a statutory consultee for planning applications involving flood risk in specified circumstances. To improve the efficiency of disseminating general guidance, the Environment Agency has produced a suite of standing advice. The advice is available to Local Authorities and the Public, via a web page <http://www.pipernetworking.com/floodrisk/>. The standing advice also includes guidance on the requirements for site specific FRAs for both low and high risk developments. The web page provides Guidance Notes for 3 types of FRAs and advice on operational development less than 1 hectare in Flood Zone 1 as summarised below:

- Operational Development less than 1 hectare in Flood Zone 1.
- FRA Guidance Note 1: Development Greater than 1 hectare in Flood Zone 1.
- FRA Guidance Note 2: Minor Extensions.
- FRA Guidance Note 3: Development in Flood Zones 2 and 3.

The following sections provide additional specific guidance for assessing flood risk at the site specific level within Havant Borough and indicate how the outputs from the SFRA can inform such assessments.

Tidal Flooding

As previously discussed, flooding from tidal sources is the primary source of flood risk within Havant Borough and the areas at risk are predicted to increase significantly by 2115. Map Set 1A shows the existing areas at risk of tidal flooding and Map Set 1B shows the associated undefended flood hazard. The index of flood hazard represents a gradation of hazard within the Flood Zones based on a combination of the depth of flood water and the velocity of the water (indicative ranges for which have been assumed based on distance from the coastline).

The frontages where existing defences provide the minimum standards required for new development (i.e. 1 in 200 years for tidal flooding), are identified in Map Set 1C by a purple line. Indicative Areas Benefiting from Defences (ABDs) are also shown in Map Set 1C. The Indicative ABDs have been defined as areas where the crest levels of the existing defences are consistently equal to or higher than the present day 1 in 200 year extreme sea level.

If small lengths of defences have crest levels which fall below the 1 in 200 year extreme sea level (even for a short length), the area behind the defence has not been classed as an Indicative ABD. The frontage of Brockhampton is an example of where this study has not been able to define an Indicative ABD due to small lengths of defence where the crest levels fall below the 1 in 200 year extreme sea level. The gaps in the defence level can also be viewed in more detail using Map Set 3A. Further details of methodology and reasoning used to define the Indicative ABDs are described in Section 4.2.1.3 of the main report. It should be noted that other areas may potentially be classified as ABDs if more detailed modelling assessments of the defences, which is beyond the scope of this SFRA, are carried out.

Map Set 1D shows the flood hazard (in terms of danger to people) associated with a hypothetical breach in the defences for the whole of the tidal frontage. The Indicative ABDs shown in Map Set 1C define which of the hazard maps (1B or 1D) is most appropriate for consideration. Map Set 1D is only appropriate for considering present day flood hazards within an ABD. To aid the interpretation of Map Set 1D the areas where this index is not appropriate for present day analysis are hatched out. The benefit of showing hazard information in the hatched out areas is to allow planners and developers to understand the likely residual risks that would remain if they were to invest in defending an area to a 1 in 200 year standard. Map Set 1B (Undefended Flood Hazard) should be used to assess the variation of flood hazard within the Flood Zones for all areas outside the Indicative ABDs.

The benefit of both the undefended flood hazard maps (Map Set 1B) and the danger from breaching maps (Map Set 1D), is that the gradation of flood hazard within the Flood Zones can facilitate both planners and developers to ensure that development is steered away from the areas of highest hazard. The hazard mapping presented in Map Sets 1B and 1D, however, should only be applied when appropriate consideration has been taken of alternative sites at a lower probability of flood risk (i.e. within Flood Zone 1).

The flood hazard information, for both the undefended and breach scenario, developed as part of this SFRA, has been undertaken at a strategic level and is therefore at an appropriate level of detail to allow Local Authorities to strategically allocate sites for development. The hazard data has been classified into 4 categories to illustrate the gradation of flood hazard within Flood Zones 2 and 3 in line with best practice guidance as set out in Defra FD2320. The hazard data has not been calculated using modelling or other detailed numerical methods and is therefore not appropriate for identifying design parameters as part of site specific FRAs. It is therefore recommended that FRAs for sites located within the flood hazard zones should still include a quantitative assessment of flood hazard based on more detailed assessments of defence standards, defence failure scenarios and overland conveyance of flood flow.

The impact of climate change on increasing sea levels has a significant effect on the extents of Flood Zones 2 and 3 by 2115, especially on Hayling Island. Although present day planning decisions are based on the Flood Zones for 2007, at the site specific level consideration should be given to increases in risk as a result of climate change. The climate change flood extents presented in Map Set 1E should be used when undertaking a site specific FRA to inform the assessment of the long term sustainability of developments currently within Flood Zone 1 and the likely increases in flood risk in Flood Zones 2 and 3.

The defence information provided in Map Set 3 can provide developers undertaking site specific FRAs with an indication of the equivalent tidal return period of the crest level of the existing defences in 2007 and an indicative level of investment that may be required to raise defence standards to the minimum required for new development. Such investment could be secured through the development process by Section 106 agreements.

Wave Overtopping

Map Set 1F-1, Wave Energy, shows how exposure to wave energy varies along the frontage of the study area. Such information can be used to assess, at a high level, the risk of flooding caused by extreme wave overtopping. Historically, Hayling Island has suffered from flooding caused by extreme wave overtopping, most recently in November 2005. During this event, properties which are classified in Flood Zone 1 were flooded, as indicated on the historical information layer. It is recommended that all applications for development within the vicinity of the southern frontage of Hayling Island include an assessment of extreme wave overtopping, regardless of which Flood Zone the site is in. This will ensure that this risk is always considered for new development in the relevant locations. The assessment of extreme wave overtopping should be appropriate to the scale of risk and may, in some cases, be ruled out as a significant risk quite easily, but should nevertheless be addressed.

Fluvial Flooding

The mainland part of Havant Borough is at risk of fluvial flooding from the Lavant Stream, Hermitage Stream and, during extreme events (1 in 1000 years), the upper reaches of the River Wallington. Map Set 1A shows the fluvial Flood Zones, which show the town centre of Havant to be the key area at risk of fluvial flooding in the Borough.

Across Havant Borough, gaps in available fluvial flood risk data exist, which are being addressed by the Environment Agency's ongoing Strategic Flood Risk Mapping programme. Therefore, for the purposes of this SFRA, Flood Zone 3b (defined by PPS25 as the 'functional floodplain') has been defined as the entire extent of Flood Zone 3, as recommended by the PPS25 Draft Practice Guide. This is a precautionary approach and should be tested by site specific FRAs, where required.

Unlike the tidal Flood Zones, flood levels associated with the fluvial Flood Zones have not been identified as part of this SFRA. The variations in previous modelling approaches (some of which are awaiting EA approval) for the rivers within the PUSH sub-region, coupled with the spatial variation on flood levels along the river valleys, meant that it was not possible to provide a consistent approach to identifying fluvial flood levels without re-

modelling a number of rivers. Such detailed assessments were outside the scope of this SFRA. Developers undertaking a FRA for a site within the fluvial Flood Zones should obtain the most up to date flood risk data from the Environment Agency. If no further information is available then a site specific FRA may need to include a numerical assessment to refine the understanding of fluvial flood risk, and agree the form of this assessment with the Environment Agency.

The impacts of climate change on fluvial flooding are likely to result in a 10% increase in flows up to 2025 and 20% from 2025 to 2115. Again due to current gaps in available data that are being addressed by the Environment Agency's ongoing flood mapping programme, there are no consistent estimates for Havant Borough of the extreme fluvial flood extent taking climate change into account. Based on Environment Agency guidance, this SFRA has assumed that the present day Flood Zone 2 (medium probability) becomes Flood Zone 3 (high probability) by 2025. This is a conservative assumption which should be tested by site specific FRAs, where required. This also means that there is no data available to estimate Flood Zone 2 after the present day. Therefore, the fluvial climate change outline shown in Map Set 1E only shows a Flood Zone 3.

Undefended flood hazard information, shown in Map Set 1B, has also been developed for the fluvial Flood Zones 2 and 3. This information can provide developers with an indication of the varying degree of flood hazard within the Flood Zones which can facilitate the design and layout of development sites to avoid areas of high hazard. As with the tidal flood hazard data, it is recommended that FRAs for sites located within the flood hazard zones undertake a more detailed quantitative assessment of flood hazard based on an improved understanding of defences and flow routes.

Surface Water/Overland Flow Flooding

Map Set 1F-4 shows the variation in the potential source of overland flow across the PUSH sub-region. The areas shown in red and orange relate to areas of very high and high potential for generating overland flow. Notably, the urban areas are indicated as red or orange due to the high runoff potential from urban land uses. Within Havant Borough there is a large area of the mainland which has a high to very high potential for generating overland flow. FRAs for sites that are found to be within or in the vicinity of these areas, especially if the local topography places the site at a lower elevation than the surrounding land and hence downstream of the source, should consider the impacts and management of flooding due to overland flow.

In addition to the information provided in relation to the source of overland flow flooding, Map Set 1F-3 provides information to inform Local Authorities of the potential impacts of land use changes on the local surface water runoff regime. The areas showing diagonal hatching represent the urban areas, where a change in land use is unlikely to significantly affect the existing surface water runoff rates and volumes. This representation is a high level assessment across the PUSH sub-region and would therefore need to be confirmed when undertaking a site specific FRA. The areas outside of the hatching represent the effect that changes in land use are likely to have on the surface runoff rates and volumes from Greenfield sites. The data shows that new development located on the majority of the Greenfield Land in Havant Borough is likely to have a moderate impact on the surface water runoff regime. Site specific FRAs should therefore carefully consider the impact of development on the local surface water runoff regime and should investigate SUDS options to manage surface water where achievable.

Groundwater Flooding

Within the PUSH region the key areas at risk of groundwater flooding are north of Havant Borough in East Hampshire, Winchester, Eastleigh and Test Valley where highly permeable geology meets lower permeability geology as shown by Map Set 1F-2, which has been verified by inspection of the historical incident records. The key risks to new development in the Havant Borough come from increases in flows in the Lavant Stream as a result of high groundwater levels emerging in East Hampshire District. It is therefore recommended that site specific FRAs for sites located within the Flood Zone of the upper reaches of the Lavant Stream consider the joint effects of high groundwater flows in the Lavant Stream combined with rapid runoff from intense rainfall events.

Flooding from Infrastructure

Historically, the mainland part of Havant Borough has recorded the most incidents of flooding caused by problems relating to the drainage infrastructure as shown by Map Set 1F-5. The majority of these incidents have occurred in the vicinity of Havant Town Centre, Purbrook, Cowplain and Emsworth. When undertaking a site specific FRA for a large development site, consultation with Southern Water should always be undertaken to investigate whether the proposed development will have an adverse impact on the local drainage system.

Furthermore, a parallel study being undertaken on behalf of PUSH, 'Hampshire Integrated Water Management Study', is investigating the issues relating to the future management of surface water within the region with respect to the anticipated increases in housing as indicated in the draft South East Plan. It is recommended that those undertaking a site specific FRA within the urban areas of Havant Borough make reference to the findings of this study.

Sustainable Urban Drainage Systems (SUDS)

Conventional surface water drainage systems have traditionally used underground pipe networks to efficiently convey water away from sites. In the past this has led to problems of downstream flooding, reductions in groundwater recharge and waste pollution incidents associated with surface water overwhelming combined sewers. Both 'Making Space for Water' and the 'Water Framework Directive' have highlighted the need for an improved understanding and better management of how our urban environments are drained. The SUDS management train approach, as shown in Figure 2, is the principle that a range of SUDS which feed into each other can often offer benefits to the delivery of a successful surface water system/strategy.

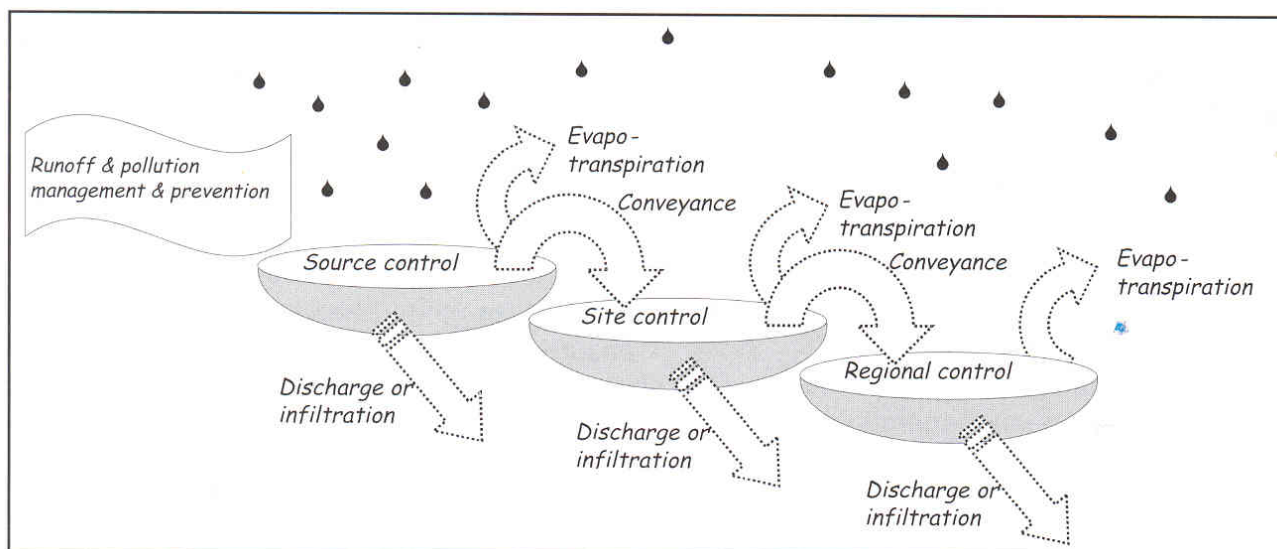


Figure 2: SUDS Management Train Approach

PPS25 states that Local Authorities should prepare and implement planning strategies that help to deliver sustainable development, by using opportunities offered by new development to reduce the causes and impacts of surface water flooding. By implementing policies to encourage developers to incorporate SUDS wherever possible, Local Authorities can help to mitigate the impacts that development has on surface water runoff rates and volumes. Appendix F of PPS25 states:

'the surface water drainage arrangements for any development site should be such that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates/volumes prior to the proposed development, unless specific off-site arrangements are made and result in the same net affect.'

Map set 1F-2 provides information relating to the spatial variation of permeability across Havant Borough. This information can be used as a first estimate of the suitability of different types of SUDS within the Borough as shown in Table 3.

Permeability	Indicative Suitability of SUDS Techniques
High Permeability	Infiltration and Combined Systems
Moderate Permeability	Infiltration and Combined Systems
Low Permeability	Attenuation Systems

Table 3: Suitability of SUDS

It is important to note that the above assessment of the spatial suitability of SUDS is an indicative estimate and should be confirmed at the site specific level, using ground investigation data.

Infiltration Systems

Infiltration systems allow surface water to discharge directly into the ground. These systems are only appropriate 1) where ground conditions permit a suitable water acceptance potential and 2) in locations where groundwater recharge will not adversely affect drinking water aquifers as identified by the Environment Agency's source protection zones, available on their website <http://www.environment-agency.gov.uk>. Such systems may include:

- Permeable surfaces
 - o Gravel
 - o Permeable Paving
 - o Block Paving with voids
 - o Grassed areas
- Sub Surface Infiltration
 - o Filter Drains
 - o Geocellular Systems
 - o Soakaways

Infiltration systems may not be appropriate in areas of potentially contaminated land. In such circumstances, other systems, such as contained attenuation systems, that avoid mobilisation of contaminants may be more appropriate.

Attenuation Systems

If ground conditions cannot support infiltration systems, surface water may need to be attenuated using measures to store surface water. Attenuation systems, if designed above ground, have the potential to take up large areas of development sites. Early consideration of such constraints is therefore essential. Attenuation systems may include:

- Landscaped
 - o Detention Basins
 - o Balancing Ponds
 - o Retention Ponds
 - o Wetlands
 - o Lagoons
- Engineered
 - o Underground Tanks
 - o Ornate Water Features
 - o Rainwater Harvesting
 - o Green Roofs
 - o Oversized Pipes

Combined Systems

SUDS designs for most sites can include a combination of infiltration and attenuation systems and they have

been categorised above according to the dominant process. Other forms of SUDS which can provide more balanced benefits of infiltration and attenuation include:

- Swales
- Filter Strips

Emergency Planning

As well as informing the development control process, the outputs of the SFRA can also be used by the Local Authority to inform their Emergency Planning Policies. Map Sets 1A, 1B, 1C, 1D and 1E are particularly useful when considering the feasibility and sustainability of key access routes within their administrative boundaries. The benefit of producing such outputs on a sub-regional scale mean that the Local Authority can also consider access to the Borough beyond their administrative boundary where key access routes (e.g. M27) cross a number of Local Authorities.

Additional Guidance

In addition to the guidance provided by the Environment Agency <http://www.pipernetworking.com/floodrisk/>, there are a number of other documents that provide detailed advice and guidance for undertaking site specific FRAs:

- Planning Policy Statement 25: Development and Flood Risk, (2006), Communities and Local Government.
- Development and Flood Risk: A Practice Guide Companion to PPS25 - 'Living Draft', (2007), Communities and Local Government
- Development and Flood Risk: Guidance for the Construction Industry, (2004), CIRIA (Based on PPG25)
- Flood Risk Assessment Guidance for New Development: FD2320/TR2, (2005), Defra (Based on PPG25)
- Sustainable Urban Drainage Systems: Best Practice Manual, (2001), CIRIA

Annex 1 – Data Source for Havant Borough Council

Further to the general technical details provided in the main SFRA Stage 2 report, this annex includes data issues specific to Havant Borough Council.

Defence Data

The majority of Havant Borough Council defence data is provided by the Havant Asset Database which holds details of most of the Borough's coastal defences from recent surveys. Surveys recorded in the database were undertaken between 2002 and 2003. The defence database for Havant was supplemented with data from the Eastoke Sectoral Strategy Study (2005) and Portchester Castle to Emsworth Coastal Defence Strategy Study (2006). Coastal defence works in other parts of Havant's coastline undertaken since 2003 may supersede records in the SFRA Defence Database.

No information on fluvial defences in Havant was available.

Topographic Data

95% of the topographic grid in Havant Borough is composed of LiDAR data. Areas where LiDAR was not available are the northern slope of Portsdown Hill to the west of Bedhampton and to the north of the Borough between Lovedean and Cowplain. In these areas, NextMap data was used to fill in the gaps in the LiDAR.

Fluvial Flood Zone 3b

In Havant Borough, fluvial Flood Zone 3b was represented as the whole of Flood Zone 3. In the absence of data to prove otherwise (i.e. detailed 1 in 20 year modelling or observed historic flood extents), this approach is in accordance with PPS25 practice guide section 3.17 and was recommended by the Environment Agency.

Fluvial Climate Change Outlines

In Havant Borough, the fluvial outlines after the present day were represented by assuming that Flood Zone 3 will expand to fill the current area of Flood Zone 2. This means there is no estimate of fluvial Flood Zone 2 after the present day for the Borough. This approach was recommended by the Environment Agency.

Appendix B - calculations

Capita Symonds		Page 1
Sundial House 63 Cheap Street Newbury RG14 5DH	LAND NORTH OF GOLDRIN... QBAR CALCS NORTH	
Date 20/07/12 File	Designed by ML Checked by	
Micro Drainage Source Control W.12.6.1		
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 100 Soil 0.400 Area (ha) 0.840 Urban 0.000 SAAR (mm) 700 Region Number Region 7 Results 1/s QBAR Rural 2.9 QBAR Urban 2.9 Q100 years 9.1 Q1 year 2.4 Q30 years 6.5 Q100 years 9.1		
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Capita Symonds		Page 1
Sundial House 63 Cheap Street Newbury RG14 5DH	LAND NORTH OF GOLDRIN... QBAR CALCS SOUTH	
Date 20/07/12 File	Designed by ML Checked by	
Micro Drainage Source Control W.12.6.1		
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 100 Soil 0.400 Area (ha) 1.030 Urban 0.000 SAAR (mm) 700 Region Number Region 7 Results 1/s QBAR Rural 3.5 QBAR Urban 3.5 Q100 years 11.2 Q1 year 3.0 Q30 years 7.9 Q100 years 11.2		
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Capita Symonds			Page 1		
Sundial House 63 Cheap Street Newbury RG14 5DH		GOLDRING CLOSE, HAYLI... 1IN100YR+30%CC STORAGE NORTHERN CATCHMENT			
Date 18/07/12 File North.srcx		Designed by ML Checked by			
Micro Drainage		Source Control W.12.6.1			
<u>Summary of Results for 100 year Return Period (+30%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	4.313	0.313	2.7	180.2	O K
30 min Summer	4.419	0.419	3.1	241.1	O K
60 min Summer	4.532	0.532	3.6	306.2	O K
120 min Summer	4.647	0.647	4.0	372.3	O K
180 min Summer	4.710	0.710	4.1	408.1	O K
240 min Summer	4.748	0.748	4.3	430.3	O K
360 min Summer	4.796	0.796	4.4	457.5	O K
480 min Summer	4.823	0.823	4.5	473.0	O K
600 min Summer	4.837	0.837	4.5	481.4	O K
720 min Summer	4.844	0.844	4.5	485.1	O K
960 min Summer	4.848	0.848	4.5	487.7	O K
1440 min Summer	4.847	0.847	4.5	486.9	O K
2160 min Summer	4.829	0.829	4.5	476.9	O K
2880 min Summer	4.802	0.802	4.4	461.3	O K
4320 min Summer	4.741	0.741	4.2	426.1	O K
5760 min Summer	4.682	0.682	4.1	392.0	O K
7200 min Summer	4.628	0.628	3.9	361.0	O K
8640 min Summer	4.581	0.581	3.7	334.0	O K
10080 min Summer	4.540	0.540	3.6	310.4	O K
15 min Winter	4.351	0.351	2.9	201.9	O K
30 min Winter	4.470	0.470	3.3	270.3	O K
60 min Winter	4.598	0.598	3.8	343.6	O K
120 min Winter	4.727	0.727	4.2	418.2	O K
Storm Event	Rain (mm/hr)		Time-Peak (mins)		
15 min Summer	115.731		23		
30 min Summer	77.804		37		
60 min Summer	49.937		68		
120 min Summer	30.956		126		
180 min Summer	23.058		186		
240 min Summer	18.577		244		
360 min Summer	13.656		364		
480 min Summer	10.974		482		
600 min Summer	9.254		602		
720 min Summer	8.046		720		
960 min Summer	6.447		822		
1440 min Summer	4.709		1070		
2160 min Summer	3.432		1472		
2880 min Summer	2.739		1880		
4320 min Summer	1.989		2720		
5760 min Summer	1.583		3512		
7200 min Summer	1.325		4320		
8640 min Summer	1.147		5096		
10080 min Summer	1.015		5848		
15 min Winter	115.731		23		
30 min Winter	77.804		37		
60 min Winter	49.937		66		
120 min Winter	30.956		124		
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Capita Symonds		Page 2			
Sundial House 63 Cheap Street Newbury RG14 5DH	GOLDRING CLOSE, HAYLI... 1IN100YR+30%CC STORAGE NORTHERN CATCHMENT				
Date 18/07/12 File North.srcx	Designed by ML Checked by				
Micro Drainage		Source Control W.12.6.1			
<u>Summary of Results for 100 year Return Period (+30%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
180 min Winter	4.798	0.798	4.4	459.1	O K
240 min Winter	4.843	0.843	4.5	484.7	O K
360 min Winter	4.899	0.899	4.7	516.7	O K
480 min Winter	4.932	0.932	4.8	535.8	O K
600 min Winter	4.951	0.951	4.8	547.0	O K
720 min Winter	4.962	0.962	4.9	553.2	O K
960 min Winter	4.968	0.968	4.9	556.4	O K
1440 min Winter	4.959	0.959	4.8	551.2	O K
2160 min Winter	4.930	0.930	4.8	534.6	O K
2880 min Winter	4.888	0.888	4.7	510.5	O K
4320 min Winter	4.796	0.796	4.4	457.9	O K
5760 min Winter	4.711	0.711	4.2	408.6	O K
7200 min Winter	4.635	0.635	3.9	365.1	O K
8640 min Winter	4.571	0.571	3.7	328.2	O K
10080 min Winter	4.515	0.515	3.5	296.4	O K
Storm Event	Rain (mm/hr)		Time-Peak (mins)		
180 min Winter	23.058		182		
240 min Winter	18.577		240		
360 min Winter	13.656		356		
480 min Winter	10.974		470		
600 min Winter	9.254		584		
720 min Winter	8.046		694		
960 min Winter	6.447		904		
1440 min Winter	4.709		1126		
2160 min Winter	3.432		1584		
2880 min Winter	2.739		2048		
4320 min Winter	1.989		2900		
5760 min Winter	1.583		3752		
7200 min Winter	1.325		4544		
8640 min Winter	1.147		5360		
10080 min Winter	1.015		6144		
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Capita Symonds		Page 3
Sundial House 63 Cheap Street Newbury RG14 5DH	GOLDRING CLOSE, HAYLI... 1IN100YR+30%CC STORAGE NORTHERN CATCHMENT	
Date 18/07/12 File North.srcx	Designed by ML Checked by	
Micro Drainage Source Control W.12.6.1		

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time / Area Diagram

Total Area (ha) 0.840

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.420	4-8	0.420

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Capita Symonds		Page 4
Sundial House 63 Cheap Street Newbury RG14 5DH	GOLDRING CLOSE, HAYLI... 1IN100YR+30%CC STORAGE NORTHERN CATCHMENT	
Date 18/07/12 File North.srcx	Designed by ML Checked by	
Micro Drainage Source Control W.12.6.1		

Model Details

Storage is Online Cover Level (m) 5.000

Tank or Pond Structure

Invert Level (m) 4.000

Depth (m) Area (m ²)	
0.000	575.0

Orifice Outflow Control

Diameter (m) 0.049 Discharge Coefficient 0.600 Invert Level (m) 4.000

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Capita Symonds			Page 1		
Sundial House 63 Cheap Street Newbury RG14 5DH		GOLDRING CLOSE, HAYLI... 1IN100YR+30%CC STORAGE SOUTHERN CATCHMENT			
Date 18/07/12 File South.srcx		Designed by ML Checked by			
Micro Drainage		Source Control W.12.6.1			
<u>Summary of Results for 100 year Return Period (+30%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	4.305	0.305	2.7	221.5	O K
30 min Summer	4.409	0.409	3.1	296.5	O K
60 min Summer	4.521	0.521	3.5	377.5	O K
120 min Summer	4.635	0.635	3.9	460.7	O K
180 min Summer	4.699	0.699	4.1	507.0	O K
240 min Summer	4.740	0.740	4.2	536.5	O K
360 min Summer	4.793	0.793	4.4	574.6	O K
480 min Summer	4.825	0.825	4.5	598.4	O K
600 min Summer	4.846	0.846	4.5	613.4	O K
720 min Summer	4.859	0.859	4.6	622.5	O K
960 min Summer	4.869	0.869	4.6	629.8	O K
1440 min Summer	4.872	0.872	4.6	632.2	O K
2160 min Summer	4.864	0.864	4.6	626.2	O K
2880 min Summer	4.846	0.846	4.5	613.4	O K
4320 min Summer	4.799	0.799	4.4	579.3	O K
5760 min Summer	4.748	0.748	4.3	542.7	O K
7200 min Summer	4.700	0.700	4.1	507.8	O K
8640 min Summer	4.657	0.657	4.0	476.4	O K
10080 min Summer	4.618	0.618	3.9	447.9	O K
15 min Winter	4.342	0.342	2.8	248.2	O K
30 min Winter	4.458	0.458	3.3	332.4	O K
60 min Winter	4.584	0.584	3.7	423.4	O K
120 min Winter	4.713	0.713	4.2	517.2	O K
Storm Event	Rain (mm/hr)		Time-Peak (mins)		
15 min Summer	115.731		23		
30 min Summer	77.804		38		
60 min Summer	49.937		68		
120 min Summer	30.956		126		
180 min Summer	23.058		186		
240 min Summer	18.577		246		
360 min Summer	13.656		364		
480 min Summer	10.974		484		
600 min Summer	9.254		602		
720 min Summer	8.046		722		
960 min Summer	6.447		936		
1440 min Summer	4.709		1154		
2160 min Summer	3.432		1540		
2880 min Summer	2.739		1960		
4320 min Summer	1.989		2768		
5760 min Summer	1.583		3584		
7200 min Summer	1.325		4392		
8640 min Summer	1.147		5184		
10080 min Summer	1.015		5952		
15 min Winter	115.731		23		
30 min Winter	77.804		37		
60 min Winter	49.937		66		
120 min Winter	30.956		124		
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Capita Symonds		Page 2			
Sundial House 63 Cheap Street Newbury RG14 5DH	GOLDRING CLOSE, HAYLI... 1IN100YR+30%CC STORAGE SOUTHERN CATCHMENT				
Date 18/07/12 File South.srcx	Designed by ML Checked by				
Micro Drainage	Source Control W.12.6.1				
<u>Summary of Results for 100 year Return Period (+30%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
180 min Winter	4.786	0.786	4.4	569.7	O K
240 min Winter	4.832	0.832	4.5	603.5	O K
360 min Winter	4.893	0.893	4.7	647.7	O K
480 min Winter	4.932	0.932	4.8	676.0	O K
600 min Winter	4.958	0.958	4.8	694.5	O K
720 min Winter	4.975	0.975	4.9	706.7	O K
960 min Winter	4.992	0.992	4.9	718.9	O K
1440 min Winter	4.990	0.990	4.9	717.8	O K
2160 min Winter	4.975	0.975	4.9	707.1	O K
2880 min Winter	4.947	0.947	4.8	686.7	O K
4320 min Winter	4.875	0.875	4.6	634.6	O K
5760 min Winter	4.801	0.801	4.4	580.8	O K
7200 min Winter	4.732	0.732	4.2	530.5	O K
8640 min Winter	4.670	0.670	4.0	486.0	O K
10080 min Winter	4.616	0.616	3.9	446.3	O K
Storm Event	Rain (mm/hr)		Time-Peak (mins)		
180 min Winter	23.058		182		
240 min Winter	18.577		242		
360 min Winter	13.656		358		
480 min Winter	10.974		474		
600 min Winter	9.254		588		
720 min Winter	8.046		700		
960 min Winter	6.447		922		
1440 min Winter	4.709		1314		
2160 min Winter	3.432		1644		
2880 min Winter	2.739		2104		
4320 min Winter	1.989		2988		
5760 min Winter	1.583		3864		
7200 min Winter	1.325		4688		
8640 min Winter	1.147		5528		
10080 min Winter	1.015		6344		
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Capita Symonds		Page 3																																
Sundial House 63 Cheap Street Newbury RG14 5DH	GOLDRING CLOSE, HAYLI... 1IN100YR+30%CC STORAGE SOUTHERN CATCHMENT																																	
Date 18/07/12 File South.srcx	Designed by ML Checked by																																	
Micro Drainage Source Control W.12.6.1																																		
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Capita Symonds		Page 4
Sundial House 63 Cheap Street Newbury RG14 5DH	GOLDRING CLOSE, HAYLI... 1IN100YR+30%CC STORAGE SOUTHERN CATCHMENT	
Date 18/07/12 File South.srcx	Designed by ML Checked by	
Micro Drainage Source Control W.12.6.1		
<u>Model Details</u> Storage is Online Cover Level (m) 5.000 <u>Tank or Pond Structure</u> Invert Level (m) 4.000 Depth (m) Area (m²) 0.000 725.0 <u>Orifice Outflow Control</u> Diameter (m) 0.049 Discharge Coefficient 0.600 Invert Level (m) 4.000		
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Appendix B - calculations

Capita Symonds		Page 1
Sundial House 63 Cheap Street Newbury RG14 5DH	LAND NORTH OF GOLDRIN... QBAR CALCS NORTH	
Date 20/07/12 File	Designed by ML Checked by	
Micro Drainage Source Control W.12.6.1		
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 100 Soil 0.400 Area (ha) 0.840 Urban 0.000 SAAR (mm) 700 Region Number Region 7 Results 1/s QBAR Rural 2.9 QBAR Urban 2.9 Q100 years 9.1 Q1 year 2.4 Q30 years 6.5 Q100 years 9.1		
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Capita Symonds		Page 1
Sundial House 63 Cheap Street Newbury RG14 5DH	LAND NORTH OF GOLDRIN... QBAR CALCS SOUTH	
Date 20/07/12 File	Designed by ML Checked by	
Micro Drainage Source Control W.12.6.1		
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 100 Soil 0.400 Area (ha) 1.030 Urban 0.000 SAAR (mm) 700 Region Number Region 7 Results 1/s QBAR Rural 3.5 QBAR Urban 3.5 Q100 years 11.2 Q1 year 3.0 Q30 years 7.9 Q100 years 11.2		
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Capita Symonds			Page 1		
Sundial House 63 Cheap Street Newbury RG14 5DH		GOLDRING CLOSE, HAYLI... 1IN100YR+30%CC STORAGE NORTHERN CATCHMENT			
Date 18/07/12 File North.srcx		Designed by ML Checked by			
Micro Drainage		Source Control W.12.6.1			
<u>Summary of Results for 100 year Return Period (+30%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	4.313	0.313	2.7	180.2	O K
30 min Summer	4.419	0.419	3.1	241.1	O K
60 min Summer	4.532	0.532	3.6	306.2	O K
120 min Summer	4.647	0.647	4.0	372.3	O K
180 min Summer	4.710	0.710	4.1	408.1	O K
240 min Summer	4.748	0.748	4.3	430.3	O K
360 min Summer	4.796	0.796	4.4	457.5	O K
480 min Summer	4.823	0.823	4.5	473.0	O K
600 min Summer	4.837	0.837	4.5	481.4	O K
720 min Summer	4.844	0.844	4.5	485.1	O K
960 min Summer	4.848	0.848	4.5	487.7	O K
1440 min Summer	4.847	0.847	4.5	486.9	O K
2160 min Summer	4.829	0.829	4.5	476.9	O K
2880 min Summer	4.802	0.802	4.4	461.3	O K
4320 min Summer	4.741	0.741	4.2	426.1	O K
5760 min Summer	4.682	0.682	4.1	392.0	O K
7200 min Summer	4.628	0.628	3.9	361.0	O K
8640 min Summer	4.581	0.581	3.7	334.0	O K
10080 min Summer	4.540	0.540	3.6	310.4	O K
15 min Winter	4.351	0.351	2.9	201.9	O K
30 min Winter	4.470	0.470	3.3	270.3	O K
60 min Winter	4.598	0.598	3.8	343.6	O K
120 min Winter	4.727	0.727	4.2	418.2	O K
Storm Event	Rain (mm/hr)		Time-Peak (mins)		
15 min Summer	115.731		23		
30 min Summer	77.804		37		
60 min Summer	49.937		68		
120 min Summer	30.956		126		
180 min Summer	23.058		186		
240 min Summer	18.577		244		
360 min Summer	13.656		364		
480 min Summer	10.974		482		
600 min Summer	9.254		602		
720 min Summer	8.046		720		
960 min Summer	6.447		822		
1440 min Summer	4.709		1070		
2160 min Summer	3.432		1472		
2880 min Summer	2.739		1880		
4320 min Summer	1.989		2720		
5760 min Summer	1.583		3512		
7200 min Summer	1.325		4320		
8640 min Summer	1.147		5096		
10080 min Summer	1.015		5848		
15 min Winter	115.731		23		
30 min Winter	77.804		37		
60 min Winter	49.937		66		
120 min Winter	30.956		124		
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Capita Symonds		Page 2			
Sundial House 63 Cheap Street Newbury RG14 5DH	GOLDRING CLOSE, HAYLI... 1IN100YR+30%CC STORAGE NORTHERN CATCHMENT				
Date 18/07/12 File North.srcx	Designed by ML Checked by				
Micro Drainage		Source Control W.12.6.1			
<u>Summary of Results for 100 year Return Period (+30%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
180 min Winter	4.798	0.798	4.4	459.1	O K
240 min Winter	4.843	0.843	4.5	484.7	O K
360 min Winter	4.899	0.899	4.7	516.7	O K
480 min Winter	4.932	0.932	4.8	535.8	O K
600 min Winter	4.951	0.951	4.8	547.0	O K
720 min Winter	4.962	0.962	4.9	553.2	O K
960 min Winter	4.968	0.968	4.9	556.4	O K
1440 min Winter	4.959	0.959	4.8	551.2	O K
2160 min Winter	4.930	0.930	4.8	534.6	O K
2880 min Winter	4.888	0.888	4.7	510.5	O K
4320 min Winter	4.796	0.796	4.4	457.9	O K
5760 min Winter	4.711	0.711	4.2	408.6	O K
7200 min Winter	4.635	0.635	3.9	365.1	O K
8640 min Winter	4.571	0.571	3.7	328.2	O K
10080 min Winter	4.515	0.515	3.5	296.4	O K
Storm Event	Rain (mm/hr)		Time-Peak (mins)		
180 min Winter	23.058		182		
240 min Winter	18.577		240		
360 min Winter	13.656		356		
480 min Winter	10.974		470		
600 min Winter	9.254		584		
720 min Winter	8.046		694		
960 min Winter	6.447		904		
1440 min Winter	4.709		1126		
2160 min Winter	3.432		1584		
2880 min Winter	2.739		2048		
4320 min Winter	1.989		2900		
5760 min Winter	1.583		3752		
7200 min Winter	1.325		4544		
8640 min Winter	1.147		5360		
10080 min Winter	1.015		6144		
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Capita Symonds		Page 3
Sundial House 63 Cheap Street Newbury RG14 5DH	GOLDRING CLOSE, HAYLI... 1IN100YR+30%CC STORAGE NORTHERN CATCHMENT	
Date 18/07/12 File North.srcx	Designed by ML Checked by	
Micro Drainage Source Control W.12.6.1		

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time / Area Diagram

Total Area (ha) 0.840

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.420	4-8	0.420

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Capita Symonds		Page 4
Sundial House 63 Cheap Street Newbury RG14 5DH	GOLDRING CLOSE, HAYLI... 1IN100YR+30%CC STORAGE NORTHERN CATCHMENT	
Date 18/07/12 File North.srcx	Designed by ML Checked by	
Micro Drainage Source Control W.12.6.1		
<u>Model Details</u> Storage is Online Cover Level (m) 5.000 <u>Tank or Pond Structure</u> Invert Level (m) 4.000 Depth (m) Area (m²) 0.000 575.0 <u>Orifice Outflow Control</u> Diameter (m) 0.049 Discharge Coefficient 0.600 Invert Level (m) 4.000		
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Capita Symonds			Page 1		
Sundial House 63 Cheap Street Newbury RG14 5DH		GOLDRING CLOSE, HAYLI... 1IN100YR+30%CC STORAGE SOUTHERN CATCHMENT			
Date 18/07/12 File South.srcx		Designed by ML Checked by			
Micro Drainage		Source Control W.12.6.1			
<u>Summary of Results for 100 year Return Period (+30%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	4.305	0.305	2.7	221.5	O K
30 min Summer	4.409	0.409	3.1	296.5	O K
60 min Summer	4.521	0.521	3.5	377.5	O K
120 min Summer	4.635	0.635	3.9	460.7	O K
180 min Summer	4.699	0.699	4.1	507.0	O K
240 min Summer	4.740	0.740	4.2	536.5	O K
360 min Summer	4.793	0.793	4.4	574.6	O K
480 min Summer	4.825	0.825	4.5	598.4	O K
600 min Summer	4.846	0.846	4.5	613.4	O K
720 min Summer	4.859	0.859	4.6	622.5	O K
960 min Summer	4.869	0.869	4.6	629.8	O K
1440 min Summer	4.872	0.872	4.6	632.2	O K
2160 min Summer	4.864	0.864	4.6	626.2	O K
2880 min Summer	4.846	0.846	4.5	613.4	O K
4320 min Summer	4.799	0.799	4.4	579.3	O K
5760 min Summer	4.748	0.748	4.3	542.7	O K
7200 min Summer	4.700	0.700	4.1	507.8	O K
8640 min Summer	4.657	0.657	4.0	476.4	O K
10080 min Summer	4.618	0.618	3.9	447.9	O K
15 min Winter	4.342	0.342	2.8	248.2	O K
30 min Winter	4.458	0.458	3.3	332.4	O K
60 min Winter	4.584	0.584	3.7	423.4	O K
120 min Winter	4.713	0.713	4.2	517.2	O K
Storm Event	Rain (mm/hr)		Time-Peak (mins)		
15 min Summer	115.731		23		
30 min Summer	77.804		38		
60 min Summer	49.937		68		
120 min Summer	30.956		126		
180 min Summer	23.058		186		
240 min Summer	18.577		246		
360 min Summer	13.656		364		
480 min Summer	10.974		484		
600 min Summer	9.254		602		
720 min Summer	8.046		722		
960 min Summer	6.447		936		
1440 min Summer	4.709		1154		
2160 min Summer	3.432		1540		
2880 min Summer	2.739		1960		
4320 min Summer	1.989		2768		
5760 min Summer	1.583		3584		
7200 min Summer	1.325		4392		
8640 min Summer	1.147		5184		
10080 min Summer	1.015		5952		
15 min Winter	115.731		23		
30 min Winter	77.804		37		
60 min Winter	49.937		66		
120 min Winter	30.956		124		
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Capita Symonds		Page 2			
Sundial House 63 Cheap Street Newbury RG14 5DH	GOLDRING CLOSE, HAYLI... 1IN100YR+30%CC STORAGE SOUTHERN CATCHMENT				
Date 18/07/12 File South.srcx	Designed by ML Checked by				
Micro Drainage	Source Control W.12.6.1				
<u>Summary of Results for 100 year Return Period (+30%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
180 min Winter	4.786	0.786	4.4	569.7	O K
240 min Winter	4.832	0.832	4.5	603.5	O K
360 min Winter	4.893	0.893	4.7	647.7	O K
480 min Winter	4.932	0.932	4.8	676.0	O K
600 min Winter	4.958	0.958	4.8	694.5	O K
720 min Winter	4.975	0.975	4.9	706.7	O K
960 min Winter	4.992	0.992	4.9	718.9	O K
1440 min Winter	4.990	0.990	4.9	717.8	O K
2160 min Winter	4.975	0.975	4.9	707.1	O K
2880 min Winter	4.947	0.947	4.8	686.7	O K
4320 min Winter	4.875	0.875	4.6	634.6	O K
5760 min Winter	4.801	0.801	4.4	580.8	O K
7200 min Winter	4.732	0.732	4.2	530.5	O K
8640 min Winter	4.670	0.670	4.0	486.0	O K
10080 min Winter	4.616	0.616	3.9	446.3	O K
Storm Event		Rain (mm/hr)	Time-Peak (mins)		
180 min Winter		23.058	182		
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4320 min Winter		1.989	2988		
5760 min Winter		1.583	3864		
7200 min Winter		1.325	4688		
8640 min Winter		1.147	5528		
10080 min Winter		1.015	6344		
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Capita Symonds		Page 3																																
Sundial House 63 Cheap Street Newbury RG14 5DH	GOLDRING CLOSE, HAYLI... 1IN100YR+30%CC STORAGE SOUTHERN CATCHMENT																																	
Date 18/07/12 File South.srcx	Designed by ML Checked by																																	
Micro Drainage Source Control W.12.6.1																																		
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Capita Symonds		Page 4
Sundial House 63 Cheap Street Newbury RG14 5DH	GOLDRING CLOSE, HAYLI... 1IN100YR+30%CC STORAGE SOUTHERN CATCHMENT	
Date 18/07/12 File South.srcx	Designed by ML Checked by	
Micro Drainage Source Control W.12.6.1		

Model Details

Storage is Online Cover Level (m) 5.000

Tank or Pond Structure

Invert Level (m) 4.000

Depth (m) Area (m ²)	
0.000	725.0

Orifice Outflow Control

Diameter (m) 0.049 Discharge Coefficient 0.600 Invert Level (m) 4.000

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Appendix C - drawings



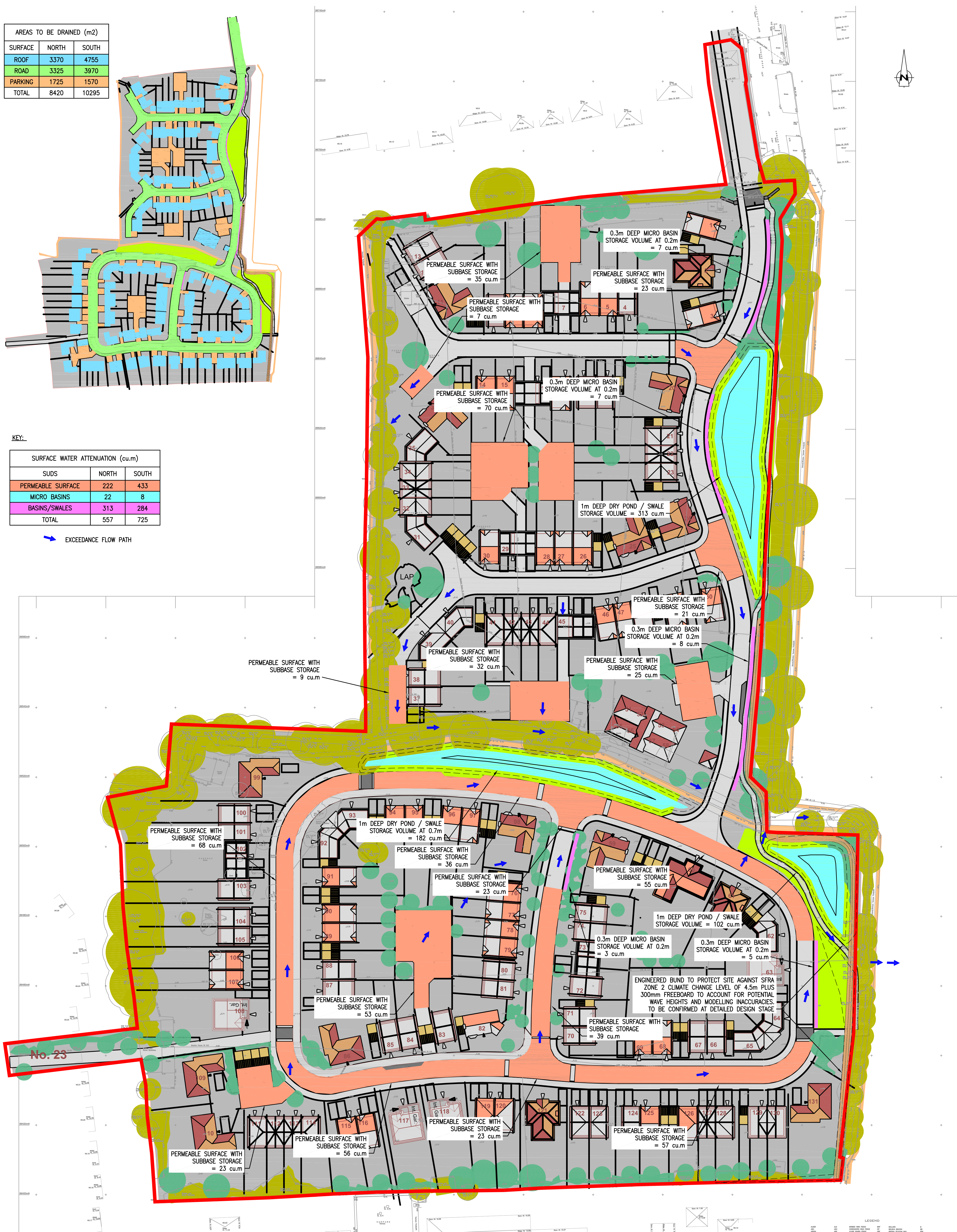
REV				DE	DR	CH	PA	DATE	REV				DE	DR	CH	PA	DATE	NOTES	LAND NORTH OF GOLDRING CLOSE, MENGHAM, SOUTH HAYLING					TOLCARNE DRIVE DEVELOPMENTS LTD	
																		1. THIS DRAWING IS INTENDED TO SHOW THE APPROXIMATE EXTENT OF THE APPLICATION SITE AND DOES NOT INFER LAND OWNERSHIP.	SITE EXTENT AND TOPOGRAPHICAL SURVEY					CAPITA SYMONDS Capita Symonds House, Wood Street, East Grinstead, West Sussex RH19 1UJ Tel: +44 (0)1342 327161 Fax: +44 (0)1342 315927	
																		DESIGNED BY ML DATE							

AREAS TO BE DRAINED (m2)		
SURFACE	NORTH	SOUTH
ROOF	3370	4755
ROAD	3325	3970
PARKING	1725	1570
TOTAL	8420	10295

KEY:

SURFACE WATER ATTENUATION (cu.m)		
SUDS	NORTH	SOUTH
PERMEABLE SURFACE	222	433
MICRO BASINS	22	8
BASINS/SWALES	313	284
TOTAL	557	725

➡ EXCEEDANCE FLOW PATH



REV				DE	DR	CH	PA	DATE	REV				DE	DR	CH	PA	DATE	NOTES	LAND NORTH OF GOLDRING CLOSE MENGHAM, SOUTH HAYLING						TOLCARNE DRIVE DEVELOPMENTS LTD	
																		1. THIS OUTLINE STRATEGY IS FOR PLANNING PURPOSES ONLY AND IS SUBJECT TO DETAILED DESIGN	OUTLINE SURFACE WATER DRAINAGE STRATEGY						CAPITA SYMONDS Capita Symonds House, Wood Street, East Grinstead, West Sussex RH19 1UU Tel: +44 (0)1342 327161 Fax: +44 (0)1342 315927	
																	2. OUTFALL LOCATIONS TO CENTRAL DITCH AND UPSTREAM PIPEWORK NOT SHOWN FOR CLARITY									
																		3. DEVELOPMENT MASTERPLAN TAKEN FROM PROVISION DRAWING NO. 9711 SK103 REV B	DESIGNED BY	DRAWN BY	CHECKED BY	PASSED BY	SCALES @ A1 SIZE	ISSUE STATUS	DRAWING NUMBER	REV.
																			ML	TH	ML		1:500	PLANNING	CS056739-DR-001	-
																			DATE	DATE	DATE	DATE				