POLICEMAN'S LANE, UPTON, DORSET

FLOOD RISK ASSESSMENT

WYATT HOMES LTD

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PFA Consulting
Stratton Park House
Wanborough Road
Swindon
SN3 4HG

Tel: 01793 828000
Fax: 01793 835500
Email: admin@pfaplc.com
Web: www.pfaplc.com

engineering the future

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3	09/08/2017	Drainage strategy for eastern part of development amended.	C Isherwood BSc CEng DipM MICE MCIHT MCMI
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APPENDICES

1. INTRODUCTION

1.1. This Flood Risk Appraisal has been prepared on behalf of Wyatt Homes Ltd to support the promotion of residential development to the west of Upton, Dorset.

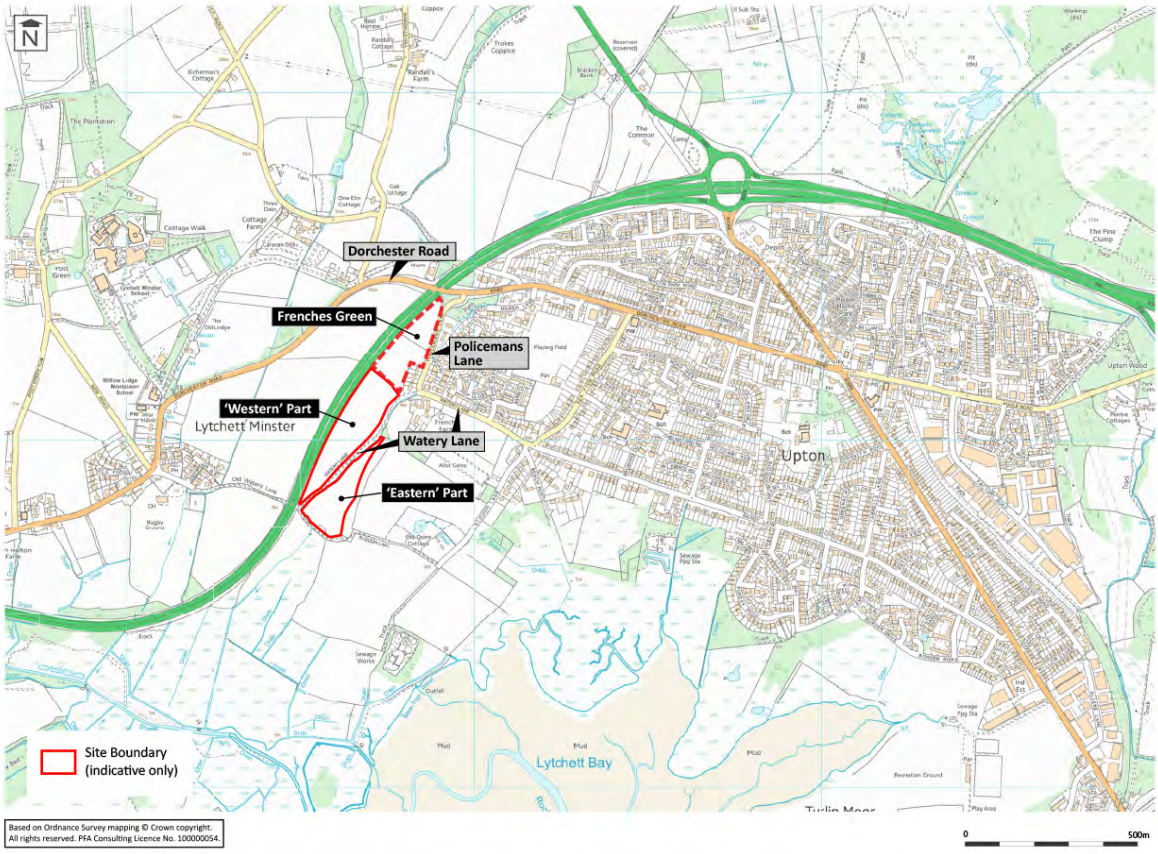


Figure 1: Site Location Plan

1.2. The site is currently being promoted for development though the Purbeck Local Plan Review and this report has been prepared to feed into the master planning process in order that representations can be made to Purbeck District Council (PDC).

1.3. The adjacent northern site (Frenches Green) was granted planning permission (Ref. 6/2016/0311) in July 2016 and is currently under construction. Given the considered suitability of the location of Frenches Green a further phase of development consisting of up to 105 new dwellings is being promoted for inclusion within the Local Plan Review. This is situated to the south and south-east of the development under construction at Frenches Green as highlighted in **Figure 1.**

1.4. The main purpose of this Flood Risk Appraisal is to provide sufficient flood risk information to support the promotion of land at Policeman's Lane as part of the Purbeck Local Plan Review. An initial flood risk assessment has been undertaken to inform the Appraisal and a detail flood risk assessment would be required to support a future planning application. This Appraisal also sets out an initial strategy for draining the site in terms of surface water runoff and foul drainage.

2. SCOPE OF THE ASSESSMENT

2.1. The Government's National Planning Policy Framework (NPPF), published in March 2012, sets out the Government's policy on development and flood risk. On 6 March 2014 the Department for Communities and Local Government (DCLG) launched the Government's planning practice guidance to the NPPF as a web-based resource. The category dealing with flooding is contained in Flood Risk and Coastal Change (Reference ID: 7 Updated: 16 11 2016).

2.2. The NPPF states in paragraph 100 that Local Plans should be supported by a Strategic Flood Risk Assessment (SFRA), and should apply a sequential, risk-based approach to the location of development. As set out in the NPPF, 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.

2.3. As set out in paragraph 101 of the NPPF, the aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding. Paragraph 19 in Section 5 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-019-20140306) states that the flood zones, as refined in the SFRA for the area, provide the basis for applying the Sequential Test.

2.4. A copy of the Environment Agency's Flood Map for Planning, obtained from its website, which shows the Flood Zones in the vicinity of the site, is reproduced as **Figure 2** below.

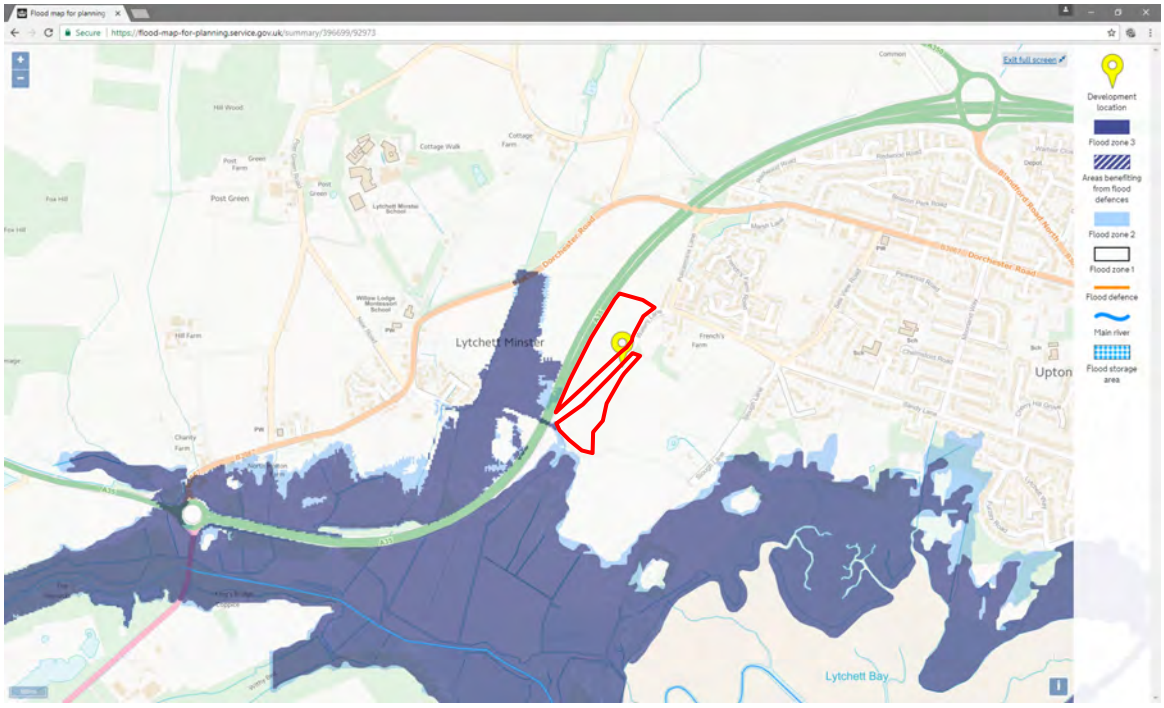


Figure 2: EA Flood Map for Planning

2.5. The Environment Agency's Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences, and show the extent of the natural floodplain and the additional extent of an extreme flood. The Environment Agency's Flood Map for Planning shows the area that could be affected by flooding, either from rivers or the sea, coloured dark blue corresponding to Flood Zone 3. The light blue area is Flood Zone 2 and shows the additional extent of an extreme flood from rivers or the sea. These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements. Where there

is no blue shading, this shows the area where flooding from rivers and the sea is very unlikely corresponding to Flood Zone 1.

2.6. The red line site boundary has been added to the Environment Agency's Flood Map for Planning as shown on Figure 2. From an inspection of the Flood Map it can be seen that the majority of the site falls within Flood Zone 1. A very small area of the site, in the south-west corner of the eastern part of the development, is shown as falling within Flood Zone 2 and Flood Zone 3. However all built development will be within Flood Zone 1

2.7. As set out in paragraph 103 of the NPPF, local planning authorities should only consider development in flood risk areas appropriate where informed by a site-specific flood risk assessment. Footnote 20 in the NPPF states that a site-specific flood risk assessment is required for proposals of 1 hectare or greater in Flood Zone 1; all proposals for new development (including minor development and change of use) in Flood Zones 2 and 3, or in an area within Flood Zone 1 which has critical drainage problems; and where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

2.8. Paragraph 30 in Section 10 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-030-20140306) advises that a site-specific flood risk assessment is carried out to assess the flood risk to and from a development site. The assessment should demonstrate how flood risk will be managed now and over the development's lifetime, taking climate change into account, and with regard to the vulnerability of its users.

Flood Risk Assessment Guidance

2.9. For the purposes of applying the NPPF, paragraph 2 in Section 1 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-002-20140306) advises that "flood risk" is a combination of the probability and the potential consequences of flooding from all sources - including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

2.10. Paragraph 31 in Section 10 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-031-20140306) advises that the information provided in the flood risk assessment should be credible and fit for purpose. Site-specific flood risk assessments should always be proportionate to the degree of flood risk and make optimum use of information already available, including information in a SFRA for the area, and the interactive flood risk maps. A flood risk assessment should also be appropriate to the scale, nature and location of development.

2.11. Section 26 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-068-20161116) provides a model checklist for a site specific flood risk assessment.

2.12. With regard to what further advice is available on the preparation of a site-specific flood risk assessment, paragraph 32 in Section 10 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-032-20150415) refers to the Environment Agency Standing Advice on flood risk.

2.13. Guidance from the Department for Environment, Food & Rural Affairs and Environment Agency, published on the Government's GOV.UK website, sets out when local planning authorities must consult the Environment Agency, their lead local flood authority or both, on any proposed developments at a higher risk from flooding before making a decision.

2.14. The proposed development is classed as 'major development' if the number of dwellings is more than 10 or the site has an area of more than 0.5 hectares. For 'major development' with surface water drainage in Flood Zone 1 the local planning authority needs to consult their lead local flood authority, and if the development is in an area with critical drainage problems, they also need to consult the Environment Agency.

2.15. Local planning authorities also need to consult the Environment Agency if the development is within 20m of a main river in Flood Zones 1, 2 or 3.

2.16. The proposed development is classed as 'major development' as it is for more than 10 dwellings. The local planning authority therefore needs to consult their lead local flood authority. However, it is not in an area with critical drainage problems and is not within 20m of a main river, so they do not need to consult the Environment Agency.

2.17. Guidance from Department for Environment, Food & Rural Affairs (DEFRA) and Environment Agency, on the Government's GOV.UK website, includes guidance on how to carry out a flood risk assessment entitled 'Flood risk assessment in flood zone 1 and critical drainage areas'. This guidance provides information on the range of factors that need to be considered when assessing flood risk.

2.18. The relevant guidance for the proposed development is entitled: 'Flood risk assessment in flood zone 1 and critical drainage areas'. A copy of this guidance is reproduced in **Appendix 1**.

Local Plan Policies

2.19. The Purbeck Local Plan Part 1: Planning Purbeck's Future was formally adopted in November 2013 and provides a planning policy framework for Purbeck District Council for the period up to 2027.

2.20. Relevant policies from the Core Strategy include Policy FR: Flood Risk

2.21. Core Policy FR: Flood Risk states:

> *"The impact of flooding will be managed by locating development in accordance with Purbeck's Strategic Flood Risk Assessment (SFRA)."*
>
> *"In Flood Zone 1, an FRA will be required for planning applications with a site area under 1 hectare that:*
>
> - *Will alter the natural rate of surface water run-off; or*
> - *Are located in areas where there is known to be a localised flooding, or drainage problem as set out in the SFRA maps; or*
> - *Are located in areas below 3.55 metres above ordnance datum; or*
> - *Are located in areas below 6 metres above ordnance datum and are within 50 metres of the coast (defined as back edge of beach or coast protection line)."*
>
> *"An FRA will not normally be required for householder development in Flood Zone 1. Exceptional circumstances will need to be agreed with the Council on a site by site basis."*
>
> *"All FRAs should include topographic survey with levels reduced to ordnance datum. Finished Floor levels must be set at an agreed level above ordnance datum which should include 600 millimetres freeboard."*

"Where appropriate, sustainable drainage systems (SuDS) should be incorporated into the design of the development."

Summary of Scope

2.22. The scope of this Flood Risk Assessment is to provide sufficient information to satisfy the relevant requirements of the NPPF, guidance published by DEFRA and Environment Agency, the planning practice guidance checklist, and Local Plan Policies.

3. INITIAL FLOOD RISK ASSESSMENT

Development Site and Location

3.1. The Site Location Plan and the Environment Agency's Flood Map for Planning are based on the Ordnance Survey map of the area, and show geographical features and identify watercourses and other bodies of water in the vicinity of the site.

3.2. The western part of the site is currently being used for topsoil storage in conjunction with the development of Frenches Green to the north whilst the eastern part of the site consists of a smaller, open triangular field in pasture.

3.3. A small unnamed watercourse runs along Watery Lane and flows north to south. Further to the south, and approximately 600m from the site, is the Sherford River which is designated as a 'main river'.

Development Proposals

3.4. The development proposals comprise of up to 105 dwellings.

3.5. A copy of the Framework Plan, Drawing Number 098_DI_03.1, prepared by New Masterplanning, showing the development proposals, is reproduced in **Appendix 2**.

Site Levels

3.6. A Topographical Survey was undertaken by Dorset Land Surveying in March 2016. A copy of Drawing Number 5428 Revision C is reproduced in **Appendix 3.**

3.7. The Topographical Survey indicates that the western part of the development falls downhill north to south from around 6.75m AOD, in the north-western corner of the site, to around 2.75m AOD to the south-east of the site.

3.8. The eastern part of the development fall from approximately 2.75m AOD alongside Watery Lane to 1.80m AOD to the south of the site.

Flood Risk Vulnerability and Flood Zone 'Compatibility'

3.9. Paragraphs 65-67 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-065-20140306) sets out 3 Flood Zone and Flood Risk Tables, available on the Government's GOV.UK website.

3.10. Table 1: Flood Zones provides a definition of each Flood Zone. Table 2: Flood Risk Vulnerability Classification categorises different types of development according to their vulnerability to flood risk. Table 3: Flood risk vulnerability and flood zone 'compatibility' maps these vulnerability classes against the flood zones to indicate where development is appropriate and where development should not be permitted.

3.11. The Environment Agency's Flood Map for Planning indicates that the majority of the site falls within Flood Zone 1. There will be no built development in Flood Zones 2 or 3.

3.12. With reference to Table 2, as proposed development will be 'buildings used for dwelling houses', it falls into the 'More Vulnerable' flood risk vulnerability classification.

3.13. With reference to Table 3, all uses of land are appropriate in Flood Zone 1.

The Sequential Test and Exception Test

3.14. Paragraph 100 of the NPPF states that 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.

3.15. Paragraph 101 of the NPPF states:

> *"The aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding. The Strategic Flood Risk Assessment will provide the basis for applying this test. A sequential approach should be used in areas known to be at risk from any form of flooding."*

3.16. Paragraph 102 of the NPPF states:

> *"If, following application of the Sequential Test, it is not possible, consistent with wider sustainability objectives, for the development to be located in zones with a lower probability of flooding, the Exception Test can be applied if appropriate. For the Exception Test to be passed:*
>
> - *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; and*
> - *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."*

3.17. Paragraph 103 of the NPPF states:

> *"When determining planning applications, local planning authorities should ensure flood risk is not increased elsewhere and only consider development appropriate in areas at risk of flooding where, informed by a site-specific flood risk assessment following the Sequential Test, and if required the Exception Test, it can be demonstrated that:*
>
> - *within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location; and*
> - *development is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed, including by emergency planning; and it gives priority to the use of sustainable drainage systems."*

3.18. The Notes to Table 3 in Paragraph 67 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-067-20140306) indicate that the application of the Sequential Test should be applied first to guide development to Flood Zone 1, then Zone 2, and then Zone 3.

3.19. All built development falls within Flood Zone 1 and on this basis the Sequential Test is passed.

Probability

3.20. All built development falls within Flood Zone 1. Table 1: Flood Zones, in Paragraph 65 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-065-20140306), provides a definition of each Flood Zone and probability of river or sea flooding. Flood Zone 1 Low Probability is defined as land having a less than a 1 in 1000 (0.1%) annual probability of river or sea flooding.

Climate Change

3.21. The NPPF requires development to take account of the impacts of climate change. The allowances to be made for climate change effects when assessing flood risk are related to the lifetime of the development.

3.22. Guidance on the lifetime of development is provided in paragraph 26 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-026-20140306). Residential development should be considered for a minimum of 100 years, unless there is specific justification for considering a shorter period. The lifetime of a non-residential development depends on the characteristics of that development. Developers would be expected to justify why they have adopted a given lifetime for the development.

3.23. Under heading 4 in the Site-Specific Flood Risk Assessment Checklist in paragraph 68 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-068-20140306), it asks how is flood risk at the site likely to be affected by climate change and states that further information on climate change and development and flood risk is available on the Environment Agency's web site. Guidance published by the Environment Agency on 19 February 2016, and last updated on 3 February 2017, entitled 'Flood risk assessments: climate change allowances', sets out the climate change allowances to be used for peak river flow by river basin district, peak rainfall intensity, sea level rise, offshore wind speed and extreme wave height.

3.24. The peak rainfall intensity allowances to be used when designing urban drainage systems are given in Table 2 of 'Flood risk assessments: climate change allowances'. Both the central and upper end allowances need to be assessed to understand the range of impact. The total potential change anticipated for 2060 to 2115 is 20% for the central category, and 40% for the upper end category. The previous normal climate change allowance used for peak rainfall intensity was 30%.

Standard of Protection

3.25. In terms of providing an acceptable standard of protection against flooding for new development, paragraph 54 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-054-20150415) advises how development can be made safe from flood risk. Reference is made to the ability of residents and users to safely access and exit a building during a 'design flood'. Paragraph 55 in Section 22 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-055-20140306) defines a 'design flood': '*This is a flood event of a given annual probability, which is generally taken as:*

- *a fluvial (river) flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year) or ;*
- *tidal flooding with a 0.5 per cent annual probability (1 in 200 chance each year),*

against which the suitability of a proposed development is assessed and mitigation measures, if any, are designed.'

3.26. Therefore, in terms of providing an acceptable standard of protection against flooding for new development, no flooding of property should occur as a result of the 'design flood' corresponding to a 1 in 100 year fluvial flood event, or a 1 in 200 year tidal flood event, taking account of climate change.

3.27. The Government published its 'Non-statutory technical standards for sustainable drainage systems' in March 2015. They should be used in conjunction with the NPPF and planning practice guidance. Standard S7 states that the drainage system must be designed so that flooding does not occur on

any part of the site for a 1 in 30 year rainfall event. Standard S8 goes on to state that the drainage system must be designed so that flooding does not occur during a 1 in 100 year rainfall event in any part of a building (including a basement); or in any utility plant susceptible to water within the development.

Site Specific Flood Risk

3.28. In addition to flooding from rivers and the sea it is also necessary to consider the potential consequences of flooding from all other sources, which include directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

3.29. The Government's GOV.UK website contains 'Long Term Flood Risk Information' which includes interactive maps showing 'Flood risk from rivers or the sea' and 'Flood risk from surface water'. These maps show the chance of flooding in one of four risk categories - High: greater than 1 in 30 (3.3%), Medium: between 1 in 100 (1%) and 1 in 30 (3.3%), Low: between 1 in 1000 (0.1%) and 1 in 100 (1%), and Very Low: less than 1 in 1000 (0.1%). The 'Flood risk from surface water' map indicates the extent, depth and velocity of water for High, Medium and Low risk scenarios. The Long Term Flood Risk Information also includes a 'Flood risk from reservoirs' map, which includes flood depth and flood speed.

3.30. The GOV.UK website advises that when planning a development the detailed flood risk from rivers or the sea information is not suitable for land-use planning, and the Environment Agency's Flood Map for Planning must be used for this purpose.

Flooding from Watercourses

3.31. The nearest local watercourse in the vicinity of the site is the unnamed watercourse which runs alongside Watery Lane.

3.32. The Environment Agency's Flood Map for Planning shows the extent of the natural floodplain and the additional extent of an extreme flood. The Environment Agency's Flood Map for Planning indicates that the built development is unaffected by any floodplain and falls entirely within Flood Zone 1 where flooding from rivers and the sea is very unlikely. In Flood Zone 1 there is a less than a 0.1 per cent (1 in 1000) chance of flooding occurring each year.

Flooding from Surface Water

3.33. The GOV.UK's Flood risk from surface water map indicates where surface water may be expected to flood or pond. Surface water flooding happens when rainwater does not drain away through the normal drainage systems or soak into the ground, but lies on or flows over the ground instead. The GOV.UK website advises that flooding from surface water is difficult to predict as rainfall location and volumes are difficult to forecast. The information shows the approximate areas that would flood, and which parts would be shallower or deeper. A copy of the GOV.UK's Flood risk from surface water map is reproduced in **Figure 3** below.

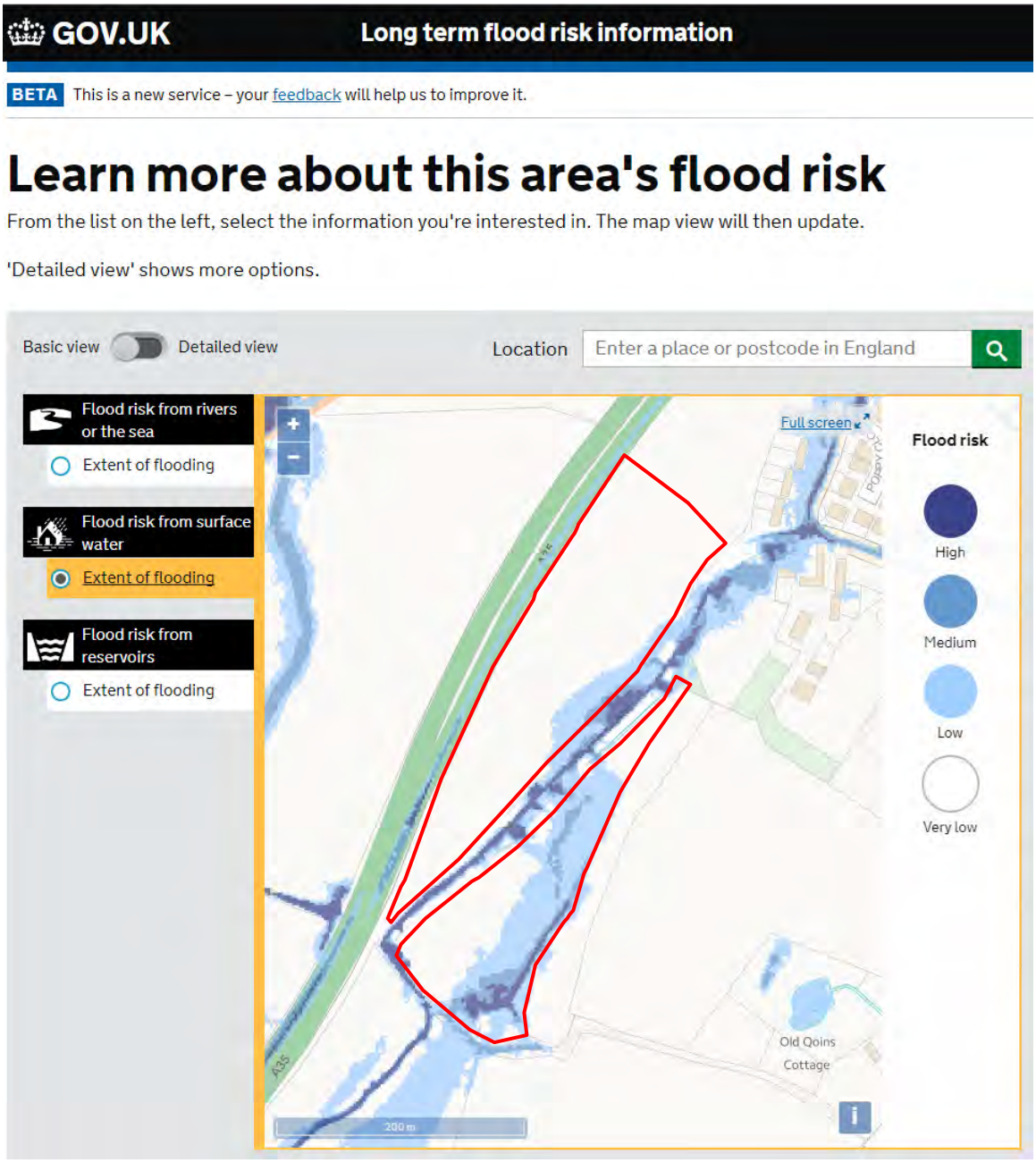


Figure 3: Flood risk from surface water map

3.34. The GOV.UK's Flood risk from surface water map shows the small areas of both the western and eastern parts of the development lie in an area with a High: greater than 1 in 30 (3.3%) chance of surface water flooding, but this assumes the existing drainage system is blocked.

3.35. The required standard of protection against flooding for the development is that no flooding of property should occur as a result of a 1 in 100 year flood event, which corresponds to the Medium risk scenario on the GOV.UK's 'Long Term Flood Risk Information' maps.

3.36. The Medium risk: depth map indicates that for the Medium risk scenario, between 1 in 100 (1%) and 1 in 30 (3.3%), there would be flooding within the western part alongside Watery Lane and within the eastern part towards the south of the site. A copy of the GOV.UK's Medium risk: depth map is reproduced in **Figure 4** below.

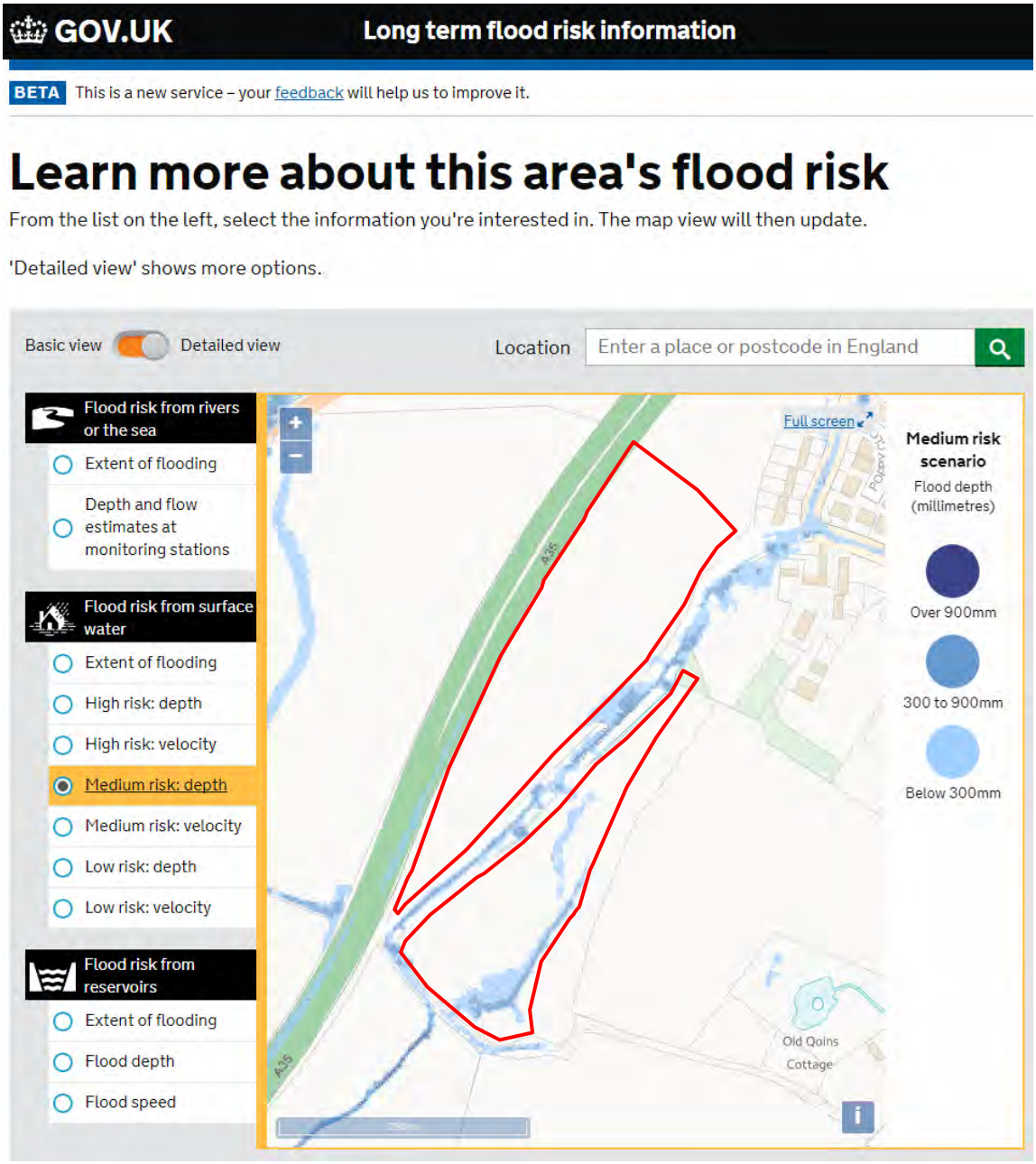


Figure 4: Medium risk: depth map

3.37. The associated Medium risk: depth and Medium risk: velocity maps indicate that for the Medium risk scenario, between 1 in 100 (1%) and 1 in 30 (3.3%), there would be surface water flooding within the eastern part of the development to a depth of 300-900mm with a velocity of greater than 0.25 m/s.

3.38. This was confirmed on a site visit where there was evidence of surface water collecting within a depression on site, as seen in **Figure 5**. There appears to be the remains of a headwall as shown in Figure 5, which is assumed to connect to the ditch within the site immediately to the south. As the culvert connecting the depression to the ditch to the south is blocked, there is no outfall from the site for surface water.

Figure 5: Evidence of surface water flooding on site

3.39. From examining the surface water flood maps, it is evident that there is not a surface water flow route from off-site sources across the site and the flooding is caused from on-site surface water only. Therefore this will be dealt with as part of the drainage strategy.

3.40. As part of the Frenches Green development, there was some surface water improvement works undertaken to reduce localised surface water flooding in the vicinity. This involved replacing an existing 450mm diameter culvert near Number 1, Policeman's Lane that passed under Policeman's Lane with a 750mm diameter culvert.

Flooding from Groundwater

3.41. Groundwater flooding is most likely to occur in low-lying areas underlain by water-bearing permeable rocks such as sands, gravels, limestone and chalk. Groundwater flooding occurs as a result of water rising from the underlying rocks or from water flowing from abnormal springs. This tends to occur after long periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels. In low-lying areas the water table is usually at shallower depths, so during very wet periods, all the additional groundwater flowing towards these areas can cause the water table to rise to the surface causing groundwater flooding.

3.42. In relation to groundwater flooding, Fig 5.2 in the Dorset County Council PFRA indicates the site falls within an area with a 'high' (75% – 100%) likelihood of groundwater flooding. This is based upon the Environment Agency's national dataset – Areas Susceptible to Groundwater Flooding.

Flooding from Overwhelmed Sewers and Drainage Systems

3.43. Flooding from sewers and drainage systems occurs when the sewer or drainage system is overwhelmed as a result of a blockage or excessive flow exceeding its capacity. Enquiries have been made to Wessex Water to establish the location of the existing public sewers in the vicinity of the site.

3.44. There are foul and surface water sewers within the western part of the development that are currently under construction to drain the Frenches Green development. The surface water sewer has a controlled outfall into the watercourse alongside Watery Lane. There are no other sewers within the vicinity of the site.

3.45. The SFRA does not identify any incident of sewer flooding affecting the site.

Flooding from Artificial Sources

3.46. The GOV.UK's Flood risk from reservoirs map indicates the site is unaffected by flooding from any reservoirs.

Summary of Flood Risk

A summary of the potential risk from all sources of flooding associated with existing conditions pre-development is shown in Tables A and B below.

Table A: Pre-development Potential Flood Risk from All Sources of Flooding

Flood Source	Potential Risk				Description
	Very Low	Low	Medium	High	
Watercourses		X			The site is located in Flood Zone 1.
Surface Water				X	Evidence of surface water flooding on site.
Groundwater				X	The PFRA indicates the site falls within an area with a 'high' (75% – 100%) likelihood of groundwater flooding.
Overwhelmed Sewers		X			There is a sewer network currently under construction within the western part of the development. The SFRA does not identify any incident of sewer flooding affecting the site.
Artificial Sources	X				The site is not affected

3.47. The PFRA, and historic flood information provided by the Environment Agency, provides an assessment of the impact of other sources of potential flooding. Based on Purbeck District Council's SFRA there are two reported flooding incidents on Watery Lane

3.48. The pre-development potential flood risk to the site from all sources of flooding is considered to be high.

4. DRAINAGE STRATEGY

Sustainable Drainage Systems

4.1. Government policy set out in paragraph 103 of the NPPF expects local planning authorities to give priority to the use of sustainable drainage systems (SuDS) in determining planning applications.

4.2. Paragraph 51 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-051-20150323) advises that sustainable drainage systems are designed to control surface water runoff close to where it falls and mimic natural drainage as closely as possible. Sustainable drainage systems provide opportunities to:

- reduce the causes and impacts of flooding;
- remove pollutants from urban runoff at source;
- combine water management with green space with benefits for amenity, recreation and wildlife.

4.3. In terms of what sort of sustainable drainage system should be considered, paragraph 80 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-080-20150323) advises that, generally, the aim should be to discharge surface water runoff as high up the following hierarchy of drainage options as reasonably practicable:

- into the ground (infiltration);
- to a surface water body;
- to a surface water sewer, highway drain, or another drainage system;
- to a combined sewer.

4.4. The Government published its 'Non-statutory technical standards for sustainable drainage systems' in March 2015. The technical standards relate to the design, construction, operation and maintenance of sustainable drainage systems and have been published as guidance. The Government expect these standards to apply to all developments of 10 homes or more and to major commercial development.

4.5. Paragraph 81 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-081-20150323) states that in considering a development that includes a sustainable drainage system the local planning authority will want to be satisfied that the proposed minimum standards of operation are appropriate. Paragraph 82 (Reference ID: 7-082-20150323) advises that the decision on whether a sustainable drainage system would be inappropriate is a matter of judgement for the local planning authority, taking advice from the relevant flood risk management bodies , including on what sort of sustainable drainage system they would consider to be 'reasonably practicable'. Paragraph 82 states that the judgement of what is reasonably practicable should be by reference to the technical standards.

4.6. The Government's 'Non-statutory technical standards for sustainable drainage systems' set out peak flow control standards (S2 and S3) and volume control technical standards (S4, S5 and S6). For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event. For developments which were previously developed, the corresponding runoff rate for these events must be as close as reasonably practicable to the greenfield runoff rate from the development, but should never exceed the rate of discharge from the development prior to redevelopment for that event.

4.7. In terms of volume control, where reasonably practicable, for greenfield development, the runoff volume in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event. Where reasonably practicable, for developments which have been previously developed this runoff volume must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume, but should never exceed the runoff volume prior to redevelopment for that event. Where it is not reasonably practicable to constrain the volume of runoff as described it must be discharged at a rate that does not adversely affect flood risk.

4.8. Paragraph 83 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-083-20150323) advises that in terms of the overall viability of a proposed development, expecting compliance with the technical standards is unlikely to be reasonably practicable if more expensive than complying with building regulations provided that where there is a risk of flooding the development will be safe and flood risk is not increased elsewhere.

4.9. Paragraph 85 in Section 21 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-085-20150323) advises that any sustainable drainage system should be designed so that the capacity takes account of the likely impacts of climate change.

4.10. Guidance on the design and construction of SuDS is also provided in the 'Interim Code of Practice for Sustainable Drainage Systems', published by the National SUDS Working Group in July 2004, in other Ciria documents including 'The SuDS Manual' (Ciria C753) published in November 2015, as well as in the Environment Agency's document entitled 'Sustainable Drainage Systems (SUDS) An introduction'.

4.11. There are a number of potential SUDS techniques that might be used on any particular site. These include rainwater harvesting systems, pervious pavements, infiltration devices such as soakaways and infiltration trenches, as well as flow balancing methods including swales, ponds/detention basins, and underground storage facilities.

4.12. Approved Document H of the Building Regulations states at Section 3.2 that surface water drainage should discharge to a soakaway or other infiltration system where practicable; discharge to a watercourse may require consent from the Environment Agency; and where other forms of outlet are not practicable, discharge should be made to a sewer.

4.13. The use of soakaways, pervious pavements and infiltration devices to discharge surface water runoff to ground depends upon the underlying strata having a suitable permeability. In addition, the Environment Agency will seek to control discharges into underground strata from areas subject to contamination or where groundwater is judged to be at risk from pollution caused by possible contamination.

4.14. The SuDS Manual, and CIRIA C687 'Planning for SuDs - making it happen', promote the use of a SuDS 'management train', which seeks to address the quality and quantity of runoff at all stages of a drainage system. It uses a hierarchy of techniques, namely: i) prevention, ii) source control, iii) site control and iv) regional control. The drainage strategy for the proposed development seeks to follow the concept of a SuDS management train.

Ground Conditions

4.15. The British Geological Survey (BGS) geological mapping of the area shows the western part is underlain by London Clay Formation – Clay, Silt and Sand, whilst the eastern part is underlain by Poole Formation – Sand, Silt and Clay.

4.16. Based on the Flood Studies Report Winter Rainfall Acceptance Potential (WRAP) Map, as shown reproduced on Drawing Number W521/02 in **Appendix 4**, the site is located in a 'Soil Index Class 1' area. Soil Index Class 1 has the highest winter rainfall acceptance potential and lowest standard percentage runoff, and which suggests the underlying soil has good permeability.

4.17. The Cranfield Soil and AgriFood Institute (CSAI), incorporating the National Soil Resources Institute (NSRI,) at Cranfield University maintains soil reports and maps for England and Wales. The Soilscapes dataset map indicates that soils in the area are 'freely draining slightly acid loamy soils'. These soils are identified as 'freely draining'.

4.18. Soakaway tests were undertaken by Structural Soils for the Frenches Green development in February 2012 in accordance with BRE Digest 365. There was no infiltration into the soil, and the water level within the excavations actually rose during some of the tests. A copy of the soakage tests are reproduced in **Appendix 5**.

4.19. From excavations during construction for the Frenches Green development, there is evidence of ground water being very close to the surface. During construction of a new rising main connection chamber the field to the south of Watery Lane, it was found the ground water was affected by the tide and rose and fell during the day. This will need to be taken into account during the detailed design process.

4.20. On the basis of the soakaway tests and knowledge of the site, and with reference to the WRAP Map, the soils underlying the site more closely relate to Soil Index Class 4 with a relatively low winter rainfall acceptance potential and higher standard percentage runoff.

4.21. Based on the foregoing it is considered that the use of soakaways would not provide a suitable means of draining surface water runoff from development on the site.

Groundwater Source Protection

4.22. From an inspection of the Environment Agency's Aquifer Designation Map on its website the site is underlain by a 'secondary A aquifer'. A copy of the Environment Agency's Aquifer Designation Map is reproduced in **Figure 6** below.

Figure 6: EA Aquifer Designation Map

4.23. From an inspection of the Environment Agency's Groundwater Source Protection Zone Map the site does not fall within any groundwater source protection zone.

Surface Water Management

4.24. A sustainable drainage strategy, involving the implementation of SuDS, is proposed for managing the disposal of surface water runoff from the proposed development on the site.

4.25. As the use of infiltration devices is not feasible it is necessary to use flow balancing methods in order to store and attenuate surface water runoff to greenfield runoff rates with discharges to the local watercourse, ditch system, or sewer network. The required storage may be provided using swales, ponds/detention basins, oversized pipes and underground cellular storage facilities.

4.26. A preliminary surface water drainage strategy is shown on the Preliminary Surface Water Drainage Strategy Plan, Drawing No. W521/03 Revision A, a copy of which is contained in **Appendix 6**.

4.27. The proposed surface water drainage measures incorporate flow balancing facilities, to attenuate and store surface water runoff, comprising a detention basin and swale. Outflow from the storage facilities is controlled by means of suitable flow control devices. The western part of the development will discharge direct to the watercourse whilst the eastern part will discharge to the marsh habitat area, which then outfalls to the watercourse. The detention basin within the western part is currently under construction to serve the Frenches Green development. A suitable allowance was made for the contributing areas from the western part when the basin and drainage network were designed.

4.28. The design currently under construction for Frenches Green restricts the discharge for a 1 in 1 year storm to 9.4l/s, and to QBAR (12l/s) for all events above this, in accordance with the approved Flood Risk Assessment. As the western part will be combined in the same system and using the same detention basin, it will need to be considered together with Frenches Green.

4.29. Pollution control measures include the use of deep trapped gullies and separator systems. All road areas and other areas that drain to gullies should pass through deep trapped gullies. All larger parking areas should drain via pervious paving or pass through a separator, which meets the requirements of BS EN 858 'Separator systems for light liquids (e.g. oil and petrol)', before discharging into the downstream drainage system.

4.30. The proposed drainage strategy would ensure that surface water arising from the developed site would be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account.

4.31. In terms of the SuDS 'management train', the drainage strategy for the proposed development seeks to address the quality and quantity of runoff as follows:-

i) Prevention

4.32. Prevention is the use of good site design and housekeeping measures to prevent pollution. Good site design includes the provision of trapped gullies to retain sediment, and suitably designed ponds or grassed detention basins contribute to the pollutant and sediment removal capability of the management train. The housekeeping measures cover maintenance of the drainage system, including the ponds/detention basins, and general site maintenance.

ii) Source Control

4.33. Source control is defined in the 'The SuDS Manual' (Ciria C753) as the control of runoff at or near its source, so that it does not enter the drainage system or is delayed and attenuated before it enters the drainage system. Source control measures such as detention areas are priority features of SuDS networks serving urbanised networks and highways. Planting within these areas encourages evapotranspiration.

iii) Site Control

4.34. Site control is the management of water from several sub-catchments within a site. The proposed surface water drainage system amalgamates the runoff from the roofs, roads, and paved areas, for each area of development on the site, and deals with it in a combination of swales and detention basins, to attenuate flows and reduce the rate of runoff from the site.

4.35. The detention basin and swale would provide attenuation, and would also contribute to the pollutant and sediment removal capability of the SuDS management train, as well as enhance the site's amenity value and provide biodiversity betterment.

4.36. The detention basin and swale could incorporate a sediment forebay, designed in accordance with the guidance given in The SuDS manual, to enhance water quality.

iv) Regional Control

4.37. Regional control is the management of runoff from more than one site and so in this case is covered by the site control techniques.

Greenfield Runoff

4.38. The 'Interim Code of Practice for Sustainable Drainage Systems' states that further information on the calculation of greenfield runoff can be found in DEFRA/Environment Agency R&D Technical Report W5-074/A 'Preliminary rainfall runoff management for developments'. The latest update of R&D Technical Report W5-074/A/TR/1 Revision E was produced in January 2012. This was updated and published by the Environment Agency as 'Rainfall runoff management for developments' Report – SC030219 in October 2013.

4.39. Table 1 in the 'Rainfall Runoff Management for Developments – Interim National Procedure Principles' set out in Report – SC030219 states that for developments between 0-50 hectares one of two approaches can be used:

> *"1. The Institute of Hydrology (IH) Report 124 Flood Estimation for Small Catchments (1994) method can be used to estimate the greenfield site flow rate, QBAR (the Mean Annual Flood).*
>
> *2. The Index Flood, QMED (the median of the set of annual maximum flood peaks) regression equation that forms part of the FEH statistical method can also be used where the appropriate parameters are known or can be derived/estimated.*
>
> *Where developments are smaller than 50 ha, the analysis for determining the greenfield index flood flow rate should use 50 ha in the formula and linearly interpolate the flow rate value based on the ratio of the development area."*

4.40. Discharge rate criteria are set out in Point 8 of the 'Rainfall Runoff Management for Developments – Interim National Procedure Principles' in the Environment Agency's Report – SC030219. It states: *'The Environment Agency will normally require that, for the range of annual flow rate probabilities, up to and including the 1% annual probability (1 in 100 year) event, the developed rate of runoff into a watercourse should be no greater than the undeveloped rate of runoff for the same event based on the calculation of Q_{BAR} or Q_{MED} and the use of FSSR growth curves. Exceptions only apply where it is not practical to achieve this due to either constraints on the size of the hydraulic control unit (see point 17), or excessive storage volumes. The purpose of this is to retain a natural flow regime in the receiving watercourse and not increase peak rates of flow for events of an annual probability greater than 1%. Three annual probabilities are used to define discharge compliance limits though the critical criteria are for the lowest and highest frequency events; 100% (1 year), 3.33% (30 year) and 1% (100 year).'*

4.41. Volumetric criteria are set out in Point 10 of the 'Rainfall Runoff Management for Developments – Interim National Procedure Principles' in the Environment Agency's Report – SC030219. It states that theoretically the stormwater runoff volume from a site should be limited to the greenfield runoff volume for all event frequencies. However this is technically extremely difficult to achieve and therefore compliance to two criteria on runoff volume is required.

4.42. The two criteria are set out in Point 10.1 and 10.2 as 'Interception' and 'Additional runoff due to development'. Under 'Interception' it states: Where possible, infiltration or other techniques are to be used to try and achieve zero discharge to receiving waters for rainfall depths up to 5mm. For the second criteria, the difference in runoff volume pre- and post- development for the 100 year 6 hour event should be disposed of by way of infiltration, or where this is not feasible due to soil type, discharged from the site at flow rates below 2 l/s/ha.

4.43. Point 10.3, of the 'Rainfall Runoff Management for Developments – Interim National Procedure Principles' in the Environment Agency's Report – SC030219, states that where compliance to 100 year volumetric criterion is not provided, the limiting discharge for any return period up to the 100

year event shall not be greater than the mean annual peak rate of runoff for the greenfield site (Referred to as Q_{BAR} in IH Report 124) or 2 l/s/ha, whichever is greater. As the additional runoff generated cannot be disposed of by infiltration it is proposed that the outflow from the drainage system is constrained to Q_{BAR}, which approximates to a return period of 2.3 years, and hence a reduced rate of runoff for higher return periods, or the practicable minimum limit on the discharge rate.

4.44. A practicable minimum limit on the discharge rate from a flow attenuation device is set at 5 litres per second. This is set out in Point 17 of the 'Rainfall Runoff Management for Developments – Interim National Procedure Principles' in the Environment Agency's Report – SC030219. This is due to constraints on the size of the hydraulic control unit while keeping the risk of blockage to an acceptable level.

4.45. A practicable minimum limit on the discharge rate from a flow attenuation device is set at 5 litres per second. This is set out in Point 17 of the 'Rainfall Runoff Management for Developments – Interim National Procedure Principles' in the Environment Agency's Report – SC030219. This is due to constraints on the size of the hydraulic control unit while keeping the risk of blockage to an acceptable level.

4.46. Greenfield runoff rates have been determined using XP Solutions' Micro Drainage software system (Version 2017.1.2) based on the method set out in IH Report 124. Rainfall and soil parameters have been obtained from maps in Volume V of the Flood Studies Report (FSR) and within the Micro Drainage Source Control software. FSSR 2 and 14 regional growth curve factors are used to calculate the greenfield peak flow rates for 1, 30 and 100 year return periods.

4.47. The FSR WRAP Map, shown in **Appendix 4**, indicates the site is located in 'Soil Index Class 1', which has the lowest standard percentage runoff and suggests the underlying soil has good permeability. However, the site investigation shows the overlying superficial deposits are relatively impermeable.

4.48. Due to the observed relatively impermeable nature of the site, using a Soil Index Class 1 in IH 124 would underestimate Q_{BAR}. On the basis of the site investigation and soakaway tests, and with reference to the WRAP Map, the soils underlying the site more closely relate to Soil Index Class 4 with a relatively higher standard percentage runoff. A Soil Index value of 0.45, which more closely represents the site specific soil value, has there been used to calculate Q_{BAR} in IH Report 124.

4.49. Copies of the MicroDrainage greenfield runoff calculations for the site are included in **Appendix 7**. A summary of the greenfield runoff rates for the various return period events is shown in **Table B**. The mean annual peak rate of runoff, referred to as Q_{BAR} in IH Report 124, is 29.9 l/s for the combined systems of Frenches Green and western part, and 4.9 l/s for the eastern part.

Table B: Greenfield Runoff Rates

Return Period (Years)	1	Q_{bar}	30	100
Western & FG Greenfield Runoff Rates (l/s)	23.4	29.9	57.1	72.5
Eastern Greenfield Runoff Rates (l/s)	3.8	4.9	9.2	11.7

4.50. By limiting the developed rate of runoff to the mean annual peak rate of runoff, Q_{BAR}, for all rainfall events up to the 100 year return period event, including an allowance for climate change, for the western part of the development and 5.0l/s for the eastern part of the development as a practicable minimum, the proposed overall development would reduce flood risk overall when compared to existing greenfield rates.

Surface Water Flow Balancing

4.51. The use of flow balancing methods, comprising of a detention basin for the western part of the development and a swale for the eastern part, are proposed in order to attenuate surface water runoff to greenfield runoff rates with discharge to the local watercourse and ditch system.

4.52. Preliminary storage calculations have been undertaken to establish the required storage for the development catchment areas on the site using the Quick Storage Estimate module in XP Solutions' Micro Drainage software system (Version 2017.1.2) for the 1 in 1, 30 and 100 year events plus a 20% and 40% increase in peak rainfall intensity to take account of climate change. The outflow from the drainage system has been constrained to Q_{BAR}, which approximates to a return period of 2.3 years, or 5.0 l/s, and hence a reduced rate of runoff for higher return periods. Copies of the Micro Drainage storage estimate screenshot results output for the development catchment areas are reproduced in **Appendix 8**.

4.53. For the preliminary storage calculations it has been assumed that the developed areas of Frenches Green and the western part of this development would give rise to net impermeable areas of 60% of the respective development catchment and the eastern part of the development would give rise to a net impermeable area 50%. **Table D** below shows the development catchment areas, the allowable discharge based on the catchment area and Q_{BAR} values as shown in Table C, the required average storage in the detention basins for the 1 in 100 year event, including 20% and 40% allowances for climate change, and the resulting discharge.

4.54. **Table C** shows the peak runoff rate from the development during the 1 in 100 year + 40% rainfall events for the greenfield and post development situations.

Table C: Runoff Rates

Dev Catchment Area	Area (ha)	Assumed % Impermeability	Allowable Discharge (l/s)	1 in 100 yr + 20% CC Storage Vol. (m^3)	1 in 100 yr + 40% CC Storage Vol. (m^3)
Western & FG	5.43	60	29.9	2087	2552
Eastern	0.88	50	5.0	264	323

4.55. The detention basin and proposed swale are shown on the Preliminary Surface Water Drainage Strategy Plan, Drawing No. W521/03 in Appendix 6, which indicates the location and sizes of the required storage facilities to serve the various development areas and are subject to detailed design.

4.56. Further work will need to be undertaken to the swale in eastern part of the development to ensure that it is not affected by ground water levels.

4.57. The above plan and calculations demonstrate that a suitable means of drainage can be provided to drain the developed site in terms of surface water runoff in accordance with the guidance and standards laid down.

4.58. Consent would need to be obtained for the construction of the outfall from the eastern part of the development to the marsh area under Section 23 of the Land Drainage Act 1991. The outfall from the basin within the western part of the development already has the benefit of consent.

Non-statutory technical standards for sustainable drainage systems

4.59. The Government published its 'Non-statutory technical standards for sustainable drainage systems' in March 2015. The technical standards relate to the design, construction, operation and

maintenance of sustainable drainage systems and have been published as guidance. The Government expect these standards to apply to all developments of 10 homes or more and to major commercial development.

4.60. The 'Non-statutory technical standards for sustainable drainage systems' set out peak flow control standards (S2 and S3) and volume control technical standards (S4, S5 and S6).

4.61. Standard S2 states: *For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.*

4.62. Standard S3 states: *For developments which were previously developed, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.*

4.63. In terms of volume control, standard S4 states: *Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.*

4.64. Standard S5 states: *Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event*.

4.65. Standard S6 states: *Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with S4 or S5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk*.

4.66. In accordance with Points 8 and 10 of the 'Rainfall Runoff Management for Developments – Interim National Procedure Principles' in the Environment Agency's Report – SC030219, the limiting discharge rate that does not adversely affect flood risk, for any return period up to the 100 year event, is the mean annual peak rate of runoff for the greenfield site referred to as Q_{BAR}.

4.67. In terms of flood risk within the development, the Government's 'Non-statutory technical standards for sustainable drainage systems' include standards S7, S8 and S9.

4.68. Standard S7 states: *The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event*.

4.69. Standard S8 states: *The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development*.

4.70. Standard S9 states: *The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of 1 in 100 year rainfall event are managed in exceedance routes that minimise the risk to people or property.*

4.71. Table E demonstrates how the proposed development complies with the relevant standards of the Government's 'Non-statutory technical standards for sustainable drainage systems'.

Table D: Compliance with Non-statutory technical standards for sustainable drainage systems

Standard	Justification for compliance
Flood risk outside the development	
S1	N/A
Peak flow control	
S2	The peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event never exceed the peak greenfield runoff rate for the same event.
S3	N/A. Greenfield development so S2 applies.
Volume control	
S4	The runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event never exceeds the peak greenfield runoff rate for the same event.
S5	N/A. Greenfield development so S4 applies.
S6	N/A
Flood Risk within the development	
S7	The surface water drainage system would be designed so that flooding does not occur on any part of the site for a 1 in 30 year rainfall event.
S8	The surface water drainage system would be designed so that flooding does not occur during a 1 in 100 year rainfall event within the development.
S9	The design of the site ensures that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100 year rainfall event are managed in exceedance routes that minimise the risks to people and property.
Structural integrity	
S10	Components would be designed to ensure structural integrity of the drainage system under anticipated loading conditions over the design life of the development.
S11	The materials specified by the designer at the detailed design stage would be of a suitable nature and quality for their intended use.
Designing for maintenance considerations	
S12	N/A. Pumping is not proposed.
Construction	
S13	The mode of construction with the existing ditch would be designed in order not be prejudicial to the structural integrity and functionally of the drainage system.
S14	Any damage to the drainage system would be rectified before the drainage system is completed to the satisfaction of the relevant authority.

Minimum Ground Floor Levels

4.72. Minimum ground floor levels for all built development on the site would be set at least 150mm above existing ground. There may be requirements to lift the levels of the eastern part of the

development to facilitate the surface water drainage strategy which would be further developed as part of the detail design.

Flood Risk Management Measures

4.73. A summary of the potential risk from all sources of flooding post-development with the various development mitigation measures incorporated is shown in **Table E** below.

Table E: Post-development Potential Flood Risk from All Sources of Flooding

Flood Source	Potential Risk				Description
	Very Low	Low	Medium	High	
Watercourses		X			The site is located within Flood Zone 1
Surface Water			X		The risk would be further mitigated by ensuring finished floor levels are above existing levels. Additionally the existing blocked culvert in the eastern part of the development would be cleared and maintained to reduce surface water flooding. No built development within surface water flood routes.
Groundwater			X		The risk would be further mitigated by ensuring finished floor levels are above existing levels.
Overwhelmed Sewers		X			The proposed drainage system and detention basin would further mitigate any potential off-site sewer flooding affecting the site.
Artificial Sources	X				The site is not affected
Off-site Impacts	X				By reducing the rate of runoff and intercepting overland flows the proposed development would reduce flood risk overall.

4.74. The incorporation of flood mitigation measures for the proposed development would further reduce any risk from river, surface water, and groundwater flooding. By maintaining the existing rate of runoff, providing surface water attenuation, and intercepting overland flows the proposed development would reduce flood risk overall.

Overland Flood Flow Paths

4.75. Standard S9 in the Government's 'Non-statutory technical standards for sustainable drainage systems' states that the design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of 1 in 100 year rainfall event are managed in exceedance routes that minimise the risk to people or property.

4.76. Overland flood flow paths from the western part of the development would follow the natural topography of the land towards Watery Lane and into the adjacent stream. In the eastern part of the development, exceedance routes would be directed to the ditch on the southern boundary.

Off Site Impacts

4.77. By reducing the rate of runoff and intercepting uncontrolled overland flows the proposed development would reduce flood risk overall.

Residual Risk

4.78. Paragraph 41 in Section 14 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-041-20140306) advises that residual risks are those remaining after applying the sequential approach to the location of development and taking mitigating actions.

4.79. The proposed built development lies within Flood Zone 1 and so the proposed development is fully in accordance with the sequential approach to development set out in the NPPF, the aim of which is to steer new development to areas with the lowest probability of flooding.

4.80. The proposed drainage measures would ensure that there is little or no residual risk of property flooding occurring during events well in excess of the minimum acceptable standard of protection for new property, which requires that no flooding of property should occur as a result of a one in 100 year storm event including an appropriate allowance for climate change.

4.81. For extreme events it is considered that the proposed development would intercept any uncontrolled overland flow and direct it into the proposed drainage system. The proposed drainage measures would ensure the proposed development would have adequate flood protection for extreme events over the lifetime of the development.

Foul Water Drainage

4.82. During the design of the proposed pumping station serving Frenches Green located in the southern corner of the western part of this development, allowances were made in the storage calculations for account for the western part. This pumping station will pump flows via a new rising main in Watery Lane and connect to the existing rising main from Lytchett Minster SPS to the STW. At present time, the new rising main and associated wash out chamber have been constructed, and the new connection chamber is currently under construction.

4.83. There will be a requirement to upgrade the existing foul rising main running from Lytchett Minster to the Sewage Treatment Works to the east to serve any further development post Frenches Green. This will be done via a sewer requisition and the cost will be proportioned between this development and the 650 units allocated in Lytchett Minster.

4.84. Due to levels, the eastern part will require a separate pumping station. This will either pump flows to the new SPS under construction, or directly connect to the existing rising main. Enquires will be made to Wessex Water to develop the best strategy.

4.85. A copy of the Public Sewer map is reproduced in **Appendix 9**.

4.86. In terms of foul water drainage, it has been demonstrated that a suitable means of drainage can be provided to serve the proposed development.

Maintenance Strategy

4.87. Paragraph 81 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-085-20150323) advises that in considering a development that includes a sustainable drainage system the local planning authority will want to be satisfied that there are clear arrangements in place for ongoing maintenance. Paragraph 85 goes onto advise that when planning a sustainable drainage system, developers need to ensure their design takes account of maintenance requirements of both surface and subsurface components so that it continues to provide effective drainage for properties.

4.88. In terms of the maintenance strategy for the proposed drainage measures, the main surface and foul water drainage systems would be adopted by Wessex Water, in its role as sewerage

undertaker, under a Section 104 Agreement of the Water Industry Act 1991. Wessex Water would therefore be responsible for the future maintenance of the adopted drainage systems

4.89. It is proposed that the detention basins would be maintained by a Management Company.

4.90. Roads and footways, including highway drainage and gullies, to be adopted under Section 38 of the Highways Act 1980, would be maintained by Dorset County Council in its role as local highway authority.

4.91. Guidance on the operation and maintenance requirements of sustainable drainage systems is contained in The SuDS Manual (CIRIA C753). There are three categories of maintenance: regular, occasional and remedial. The Management Company would be responsible for putting in place a suitable maintenance plan.

4.92. Regular maintenance consists of basic tasks including litter and debris removal, grass cutting, and vegetation management, and includes inspections and monitoring to identify potential system failures such as blockages, silt and sediment build-up, eroded or damaged areas, and condition of inlets and outlets.

4.93. Occasional Maintenance comprises tasks that are likely to be required periodically for example sediment removal and vegetation replacement.

4.94. Remedial Maintenance comprises intermittent tasks to rectify faults and would comprise inlet/outlet repairs, erosion repairs, and dealing with a spillage event.

5. CONCLUSIONS

5.1. This Flood Risk Assessment has been prepared in connection with proposals for a residential development on land at Policeman's Lane.

5.2. The development comprises 5.4 hectares, and is located to the west and east of Watery Lane respectively in Upton, Dorset.

5.3. The development proposals comprise of up to 105 dwellings.

5.4. With reference to the Environment Agency's Flood Map for Planning, all proposed built development falls within Flood Zone 1, which has the lowest probability of flooding.

5.5. In relation to Flood Risk Vulnerability and Flood Zone 'Compatibility', the planning practice guidance to the NPPF advises that all uses of land are appropriate in Flood Zone 1. On this basis the Sequential Test is passed.

5.6. In addition to flooding from rivers, this Flood Risk Assessment has considered the potential consequences of flooding from all other sources, which include directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

5.7. An assessment has been made of the potential risk from all sources of flooding to and from the development site, with reference to available flood risk information, for existing conditions pre-development, and post-development with the various development mitigation measures incorporated.

5.8. The available flood risk information includes: The Environment Agency's Flood Map for Planning; details of historic flood events; local flood history data from all sources of flooding; the GOV.UK 'Long Term Flood Risk Information' interactive maps; and flooding information in the SFRA.

5.9. The SFRA, and historic flood information, provides an assessment of the impact of other sources of potential flooding. Based on the SFRA there are two historic flood incidents recorded on Watery Lane from all sources of potential flooding.

5.10. The pre-development potential flood risk to the site from all sources is considered to be high.

5.11. In terms of providing an acceptable standard of protection against flooding for new development, no flooding of property should occur as a result of the 'design flood' corresponding to a 1 in 100 year fluvial flood event, taking account of climate change.

5.12. The British Geological Survey (BGS) geological mapping of the area shows the development is underlain by London Clay Formation and by Poole Formation.

5.13. Soakaway tests were undertaken by Structural Soils for the Frenches Green Development in February 2012 in accordance with BRE Digest 365. There was no infiltration into the soil.

5.14. A sustainable drainage strategy, involving the implementation of SuDS, is proposed for managing the disposal of surface water runoff from the proposed development on the site.

5.15. As the use of infiltration devices is not appropriate for the site flow balancing methods are proposed, comprising of two detention basins, in order to attenuate surface water runoff to greenfield runoff rates with discharges to the local watercourse and ditch system.

5.16. The proposed drainage strategy would ensure that surface water arising from the developed site would be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account.

5.17. Greenfield runoff peak flow rates have been derived using the guidance in the Environment Agency's 'Rainfall runoff management for developments' Report – SC030219 published in October 2013. In accordance with this guidance the limiting discharge for any return period up to the 100 year event would not be greater than the mean annual peak rate of runoff for the greenfield site, referred to as $Q_{BAR,}$ which approximates to a return period of 2.3 years, and hence a reduced rate of runoff for higher return periods.

5.18. By limiting the development rate of runoff to the mean annual peak rate of runoff, Q_{BAR}, for all rainfall events up to the 1 in 100 year return period event, including an allowance for climate change, the proposed development would reduce flood risk overall when compared to existing greenfield rates.

5.19. The proposed drainage measures would ensure that there is little or no residual risk of property flooding occurring during events well in excess of the minimum acceptable standard of protection for new property, which requires that no flooding of property should occur as a result of a one in 100 year storm event taking account of climate change.

5.20. For extreme events it is considered that the proposed development would intercept any uncontrolled overland flow and direct it into the proposed drainage system. The proposed drainage measures would therefore ensure the proposed development would have adequate flood protection for extreme events over the lifetime of the development.

5.21. The Micro Drainage calculations contained in this Flood Risk Assessment demonstrate that a suitable means of drainage can be provided to drain the developed site in terms of surface water runoff in accordance with the guidance and standards laid down.

5.22. The proposed development complies with the relevant standards of the Government's 'Non-statutory technical standards for sustainable drainage systems'.

5.23. In terms of foul water drainage, it has been demonstrated that a suitable means of drainage can be provided to serve the proposed development.

5.24. The proposed foul and surface water drainage arrangements can be covered by a suitably worded condition requiring the submission of details to be submitted to and approved by the Local Planning Authority.

5.25. A maintenance strategy for the proposed foul and surface water drainage measures to serve the development has been set out in this document.

5.26. This Flood Risk Assessment has demonstrated that the proposed development is compliant with the NPPF, DEFRA/Environment Agency guidance, and Local Plan Policies.

5.27. The overall conclusions drawn from this Flood Risk Assessment are that the development would be appropriately safe for its lifetime taking account of the vulnerability of its users, the development would not increase flood risk elsewhere, and would reduce flood risk overall.

Appendices

Appendix 1

Flood risk assessment in flood zone 1 and critical drainage areas - Detailed guidance

You need to do a flood risk assessment if your development is in flood zone 1 and:

- more than 1 hectare
- in an area with critical drainage problems as notified by the Environment Agency

You also need to do a flood risk assessment if your development could be subject to other sources of flooding (eg surface water drains). This includes a change of use to an existing development that makes it more vulnerable to flooding.

Check with your lead local flood authority to see if your development would be affected by other sources of flooding.

Contact your local planning authority to check if your development is in an area with critical drainage problems as notified by the Environment Agency.

You also need to do a flood risk assessment if your development could be affected by other sources of flooding (eg surface water drains) or if the development is now classed as 'more vulnerable' following a change of use. Check this with your lead local flood authority - contact your local council to find out who this is.

Your written flood risk assessment can be in any format but must include the relevant plans, surveys and assessments. Check with your local planning authority if they have any specific software requirements, eg for producing detailed hydraulic models.

Research your development site

Contact the following organisations for information about flood risk in your area:

- your lead local flood authority

Contact your local planning authority or check the planning section of their website for their strategic flood risk assessment if one has been adopted as part of the local plan. Refer to the strategic flood risk assessment in your own flood risk assessment.

Check with the Environment Agency if you need to get Environment Agency flood defence consent (permission to do work on or near a main river in England).

Plans

You need to provide a location plan showing:

- street names
- any rivers, streams, ponds, wetlands or other bodies of water
- other geographical features, eg railway lines or local landmarks such as schools or churches

You can buy a location plan from the Ordnance Survey.

You also need to provide a site plan showing:

- the existing site
- your development proposal
- any structures that could affect water flow, eg bridges, embankments

Surveys

You need to provide a survey showing:

- existing site levels
- the levels of your proposed development

Check with your local planning authority if you also need to show your site in relation to its surroundings.

If you do, you'll have to put site levels in relation to the Ordnance Datum (the height above average sea level). You may be able to find Ordnance Datum information from the Ordnance Survey. If not, you'll need to pay for a land survey carried out by a qualified surveyor.

Assessments

Assess what the risk would be to your development if there was a flood. Consider flooding from other sources (eg surface water drains, a canal) as well as from rivers and the sea.

You should also consider climate change in your assessment.

Surface water drainage

You also need to assess surface water runoff on the site and provide:

- an estimate of how much surface water runoff your development will generate
- details of existing methods for managing surface water runoff, eg drainage to a sewer

- your plans for managing surface water and for making sure there's no increase in the volume of surface water and rate of surface water runoff

Surface water runoff describes flooding from sewers, drains, groundwater, and runoff from land, small water courses and ditches that occurs as a result of heavy rainfall.

Make sure your plans for managing surface water are in line with:

- guidance on managing surface water runoff in your local planning authority's strategic flood risk assessment
- guidance from your lead local flood authority

Developments on or near main rivers

State in your assessment if you need Environment Agency flood defence consent and if you've applied for it if so.

Submit your flood risk assessment

Submit your completed flood risk assessment with your planning application to your local planning authority.

They'll review your flood risk assessment and tell you if it's satisfactory.

Appendix 2

Land at Policemans Lane creates the opportunity to continue the delivery of high quality new homes and accessible green spaces with potential for around 105 new homes:

1. New access connection created from the Frenches Green development with links through to Policemans Lane.
2. Dwellings set back to overlook the focal green space and retained feature Oak trees.
3. New homes front the access street and the green boundary to Watery Lane.
4. Courtyard spaces with feature trees and greens overlooked by new homes.
5. Dwellings back and side onto the A35 with planting and fencing forming a boundary screen to the bypass.
6. Focal public green space, linking with the SANG and continuing the character of a greens created around retained mature trees.
7. Rural 'barn' style apartment building addressing the rural edge to the site and feature pond created to support sustainable drainage requirements.
8. Pedestrian and cycle route connection along Watery Lane enclosed by retained trees and hedgerows.
9. Access connection positioned to ensure minimal impact to existing trees and hedgerows along Watery Lane.
10. New homes positioned to overlook a central green space (SANG) with deep rear gardens ensuring protection of mature trees along Watery Lane.
11. Larger dwellings with spacious gaps creates a rural low scale character.
12. Feature green space with habitat creation and enhancement and sustainable drainage systems.
13. Strengthened planting to screen inward views and enhance the SANG setting.
14. SANG area with potential for expansion on land south of the allotments.

Dorchester Road
A35
Policemans Lane
Watery Lane
Purbeck Local Plan Option
Preferred Employment & School Site
SANG
Watery Lane
Slough Lane

0 20m 40m

Policeman's Lane, Upton
Phase 2 & 3
Wyatt Homes

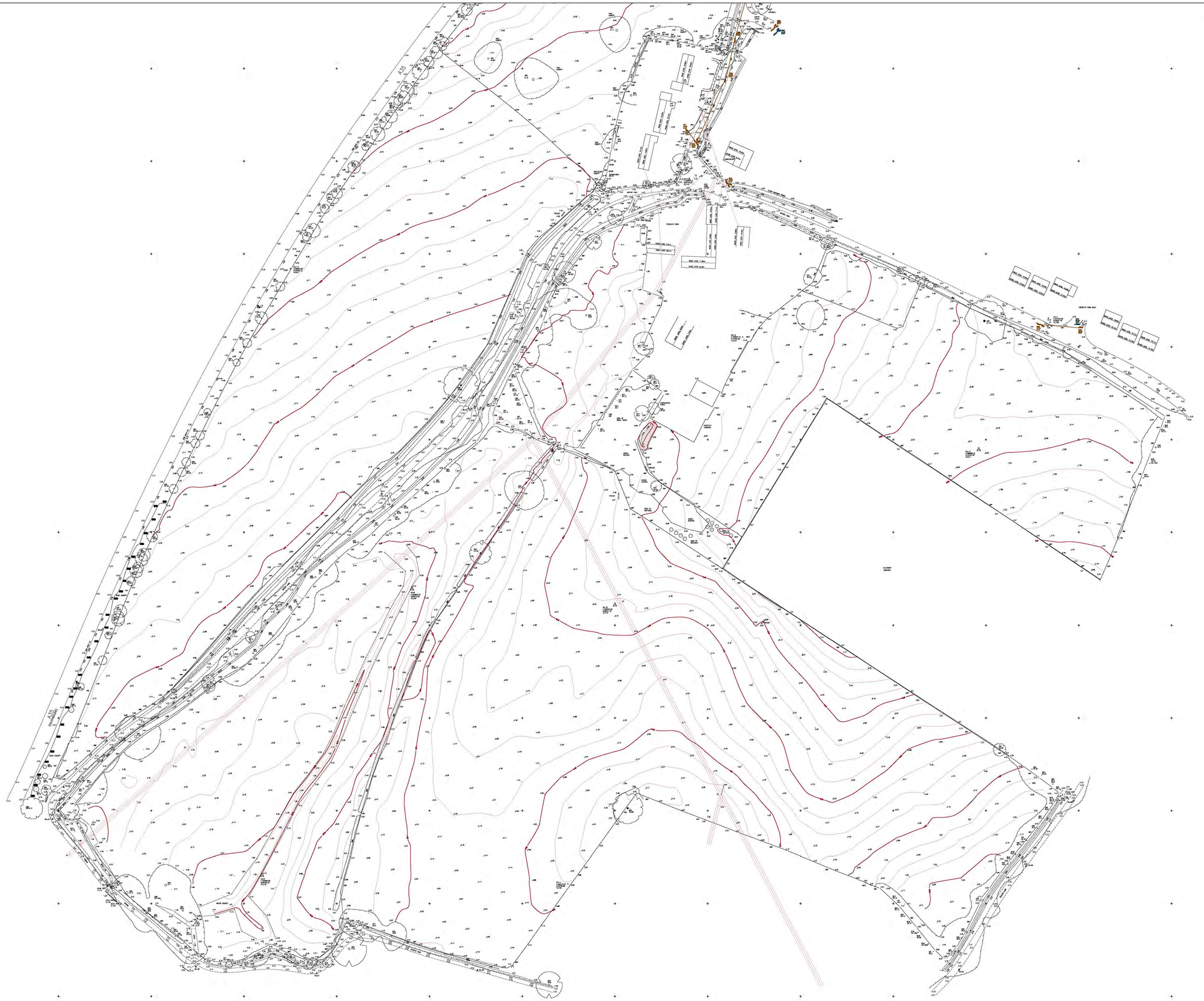
Framework Plan

Drwg. no: 098_DI_03.6

2017-08-07
1:1000 @ A1
1:2000@ A3
DA ref: 098_DA_05.2

NEW masterplanning
Second Floor 107 Bournemouth Road
Poole, Dorset BH14 9HR
+44 (0)1202 742228
www.newmasterplanning.com

Appendix 3



LEGEND

GENERAL

B	BOLLARD
BB	BELISHA BEACON
BH	BOREHOLE
BS	BUS STOP
CONC	CONCRETE
CPS	CONCRETE PAVING SLABS
DK	DROP KERB
FB	FLOWER BED
FP	FLAG POLE
GP	GATE POST
LB	LIGHT BOX
MP	ROAD STUD/ MAKE PLATE
PCE	PRE-CAST CONCRETE EDGING
PCK	PRE-CAST CONCRETE KERBS
PM	PARKING METER
RS	ROAD SIGN
SP	SIGN POST
SWCP	SURFACE WATER CATCHPIT
TCB	TELEPHONE CALL BOX
TH	TRIAL HOLE
TL	TRAFFIC LIGHT
VENT	VENT PIPE
WL	WATER LEVEL
WT	WATER TROUGH

SURVEY

AOD	ABOVE ORDNANCE DATUM
OSBM	O.S. BENCHMARK
TBM	TEMPORARY BENCHMARK
STN	SURVEY STATION

SERVICES

AV	AIR VALVE
BT	BRITISH TELECOM COVER
BTB	BRITISH TELECOM JUNC. BOX
CATV	CABLE TELEVISION COVER
ECB	ELECTRICITY CONTROL BOX
ELCP	ELECTRICITY CABLE PIT
EP	ELECTRICITY POLE
ERC	EARTH ROD COVER
FH	FIRE HYDRANT
GU	GULLEY
GV	GAS VALVE
IC	INSPECTION COVER
LH	LAMP HOLE
LP	LAMP POST
MH	MANHOLE
MP	MARKER POST
RE	RODDING EYE
SV	STOP VALVE/COCK
TAP	WATER TAP/STANDPIPE
TP	TELEGRAPH POLE
WM	WATER METER
WMSV	WATER METER/STOP VALVE
WO	WASH OUT

SYMBOLS

GATE

STILE

TELEPHONE CABLE

ELECTRICITY CABLE

TREES

ACR	ACER
ALD	ALDER
BCH	BEECH
BCHY	BIRD CHERRY
CED	CEDAR
CHY	CHERRY
CON	CONIFER
CYP	CYPRESS
EUC	EUCALYPTUS
FMPL	FIELD MAPLE
FIR	FIR
HAW	HAWTHORN
HCH	HORSE CHESTNUT
HLY	HOLLY
HOAK	HOLM OAK
LAB	LABURNAM
LAR	LARCH
LIM	LIME
LOC	LOCUST
LRL	LAUREL
MIM	MIMOSA
MPL	MAPLE
PNE	PINE
POP	POPLAR
RWN	ROWAN
SCH	SWEET CHESTNUT
SIB	SILVER BIRCH
SPR	SPRUCE
STR	STRAWBERRY
SYC	SYCAMORE
WLW	WILLOW
UNK/SPU	SPECIES UNKNOWN

Species eg OAK
Dia x 00.2
No of trunks x3

BUILDINGS

C	CILL HEIGHT
CL	CEILING LEVEL
DP	DOWNPIPE
DPC	DAMP PROOF COURSE
EL	EAVES LEVEL
FL	FLOOR LEVEL
FRL	FLAT ROOF LEVEL
H	HEAD HEIGHT
RL	RIDGE LEVEL
RWP	RAINWATER DOWNPIPE
STP	SOIL STACK PIPE

FENCES & BOUNDARY

BWF	BARBED WIRE FENCE
CBF	CLOSE BOARDED FENCE
CIF	CORRUGATED IRON FENCE
CLF	CHAIN LINK FENCE
CPF	CHESTNUT PALING FENCE
CWF	CHICKEN WIRE FENCE
GP	GATE POST
IRF	IRON RAILING FENCE
PMF	POST & MESH FENCE
PRF	POST & RAIL FENCE
PWF	POST & WIRE FENCE
TRF	TRELLIS FENCE
WMF	WIRE MESH FENCE
WPF	WOODEN PANEL FENCE

Note

Tree species named on this plan are for general information only and should be confirmed by a taxonomist prior to any design.

project
Land at Policeman's Lane
Upton
Poole

client
Lewis Wyatt (Construction)Ltd

drawing title
Land Survey

Dorset Land Surveying

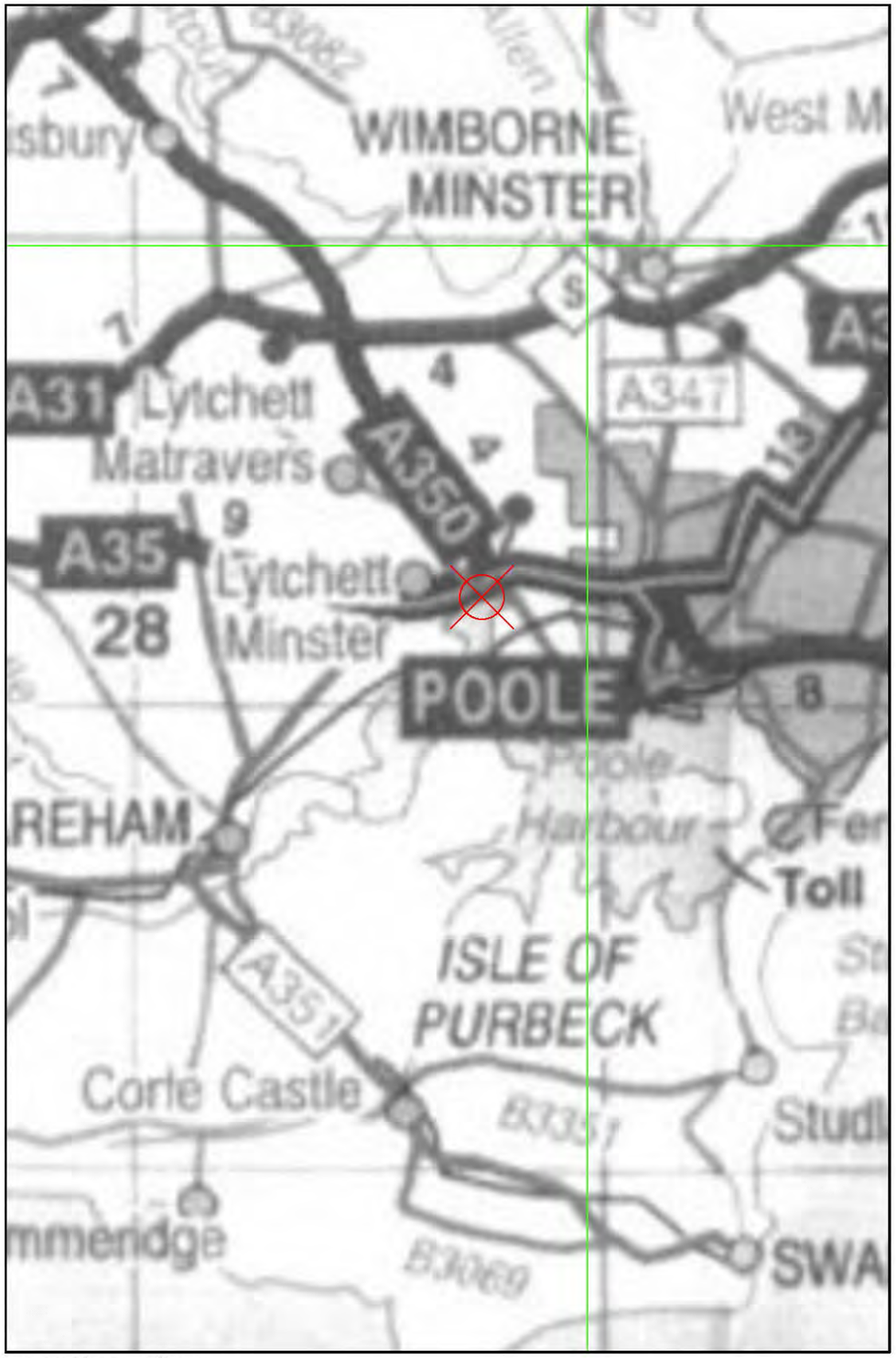
Land Surveyors
Setting Out Engineers
Civil Engineering Design
Measured Building Surveys
Elevations and Street Scenes
Expert Witness Reports
GPS Surveys
Monitoring

'Rosemary Cottage'
419 Wimborne Road East
Ferndown, Dorset BH22 9LZ

T. (01202) 896481
F. (01202) 896343
office@dorsetland.co.uk

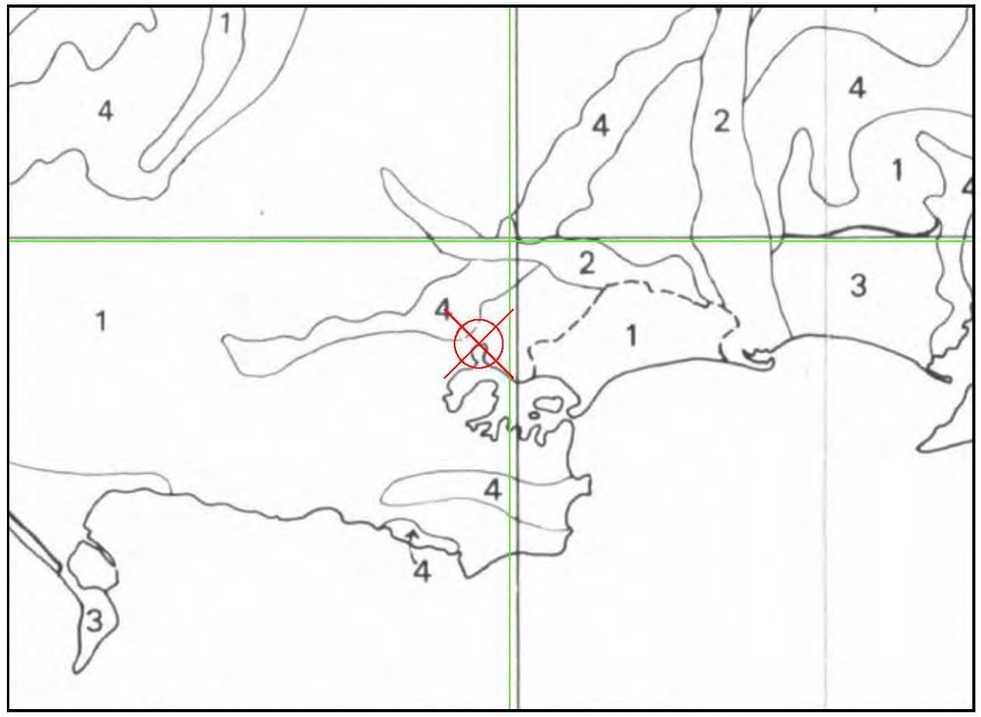
scale	1:1000	paper size	A1
drawn by	PAW	date	3 March 2016
checked	GV	grid	OSGB36 See Note.
datum			OSGM02
drawing number	5428	revision	C

Appendix 4



Location Plan

Standard Average Annual Rainfall (SAAR) (in hundreds of mm)



Winter Rain Acceptance Potential (WRAP)

PFA consulting

Stratton Park House, Wanborough Road
Swindon, SN3 4HG

Telephone
01793 828000

Facsimile
01793 835500

Email
admin@pfaplc.com

Website
www.pfaplc.com

For Planning
These drawings are produced for the purposes of supporting a planning application and should not be relied upon for tender, pricing, or construction purposes.

NOTES

1. Standard Average Annual Rainfall (SAAR) and Winter Rain Acceptance Potential (WRAP) map extracts shown on this drawing are reproduced from the maps contained in Volume V of the Flood Studies Report – NERC:1975.

Soil Classification			
Soil Class (WRAP)	Soil Index (IoH)	SPR (FEH)	SI (ADAS)
1	0.15	10	0.1
2	0.30	30	0.5
3	0.40	37	0.8
4	0.45	47	1.0
5	0.50	53	1.3

Rev	Date	Description	Initials	Check

Status
FOR PLANNING

Client
WYATT HOMES

Project
Land at Policeman's Lane
Upton
Poole

Drawing Title
SAAR
and
WRAP Maps

Drawing No.
W521/02

Date	July 2017		
Scale	N.T.S @ A3		
Drawn By	RML	Checked By	CI
E-Mail	rlucas@pfaplc.com		
File Ref.	\Drawings\W521-02.dwg		

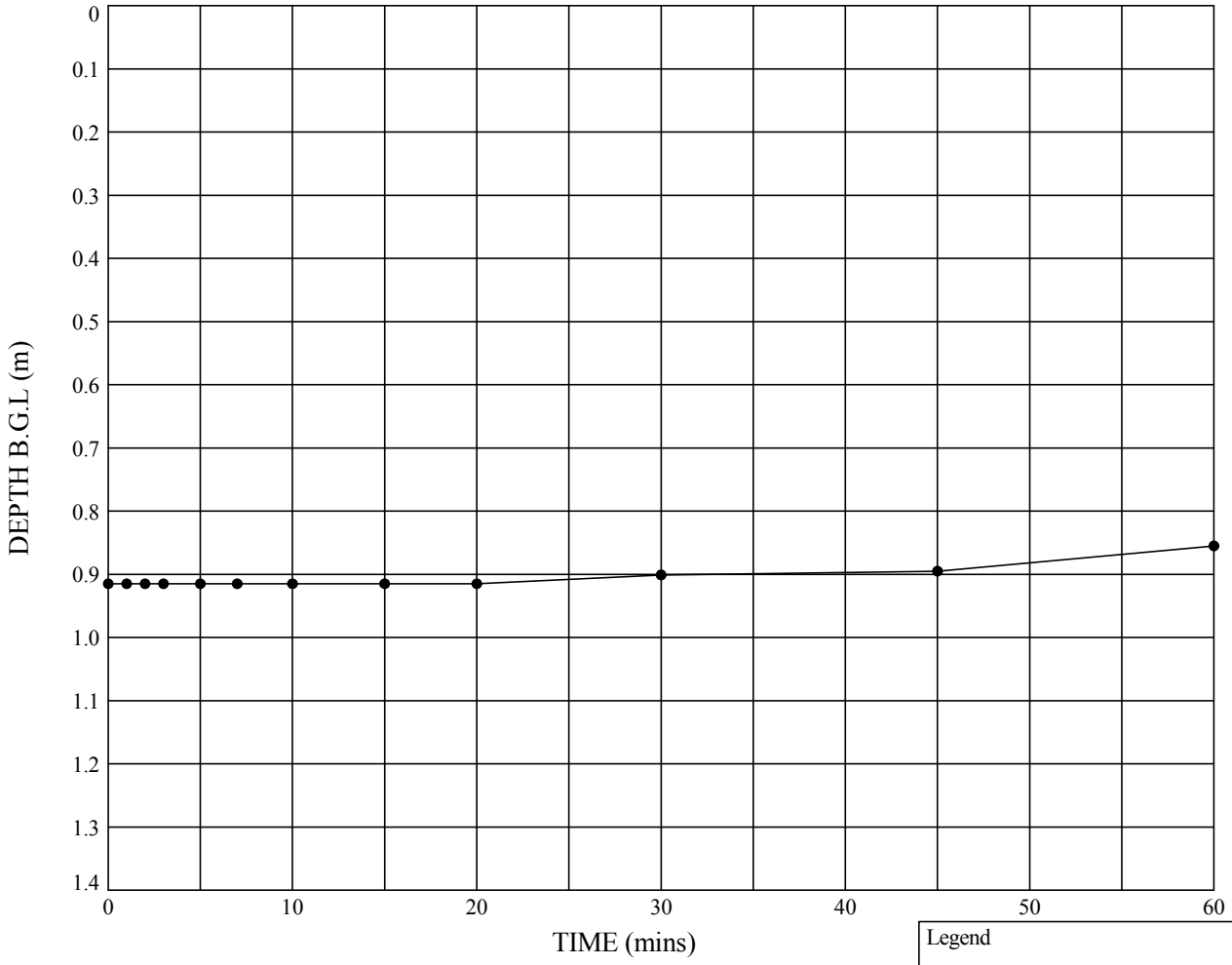
Appendix 5

FULL SCALE SOAKAWAY TEST

Non standard test

Soakaway Test - Position ID : **TP1**

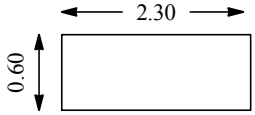
PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME



Legend

● Test 1 (06.02.12)

Plan (Not to scale)



No Bearing Taken

Effective depth, De = 0.46 m

Effective storage volume, V_{p75-25} = 0.3174 m^3

Surface area, a_{p50} = 2.7140 m^2

Time, t_{p75-25} = NA secs

Infiltration rate, f = NA m/s

Notes : Standing water in pit prior to test. Rise in water level. Unable to calculate infiltration rate.

Approved Signatories: D. TROWBRIDGE A. FROST F. HAMILTON M. STOKES

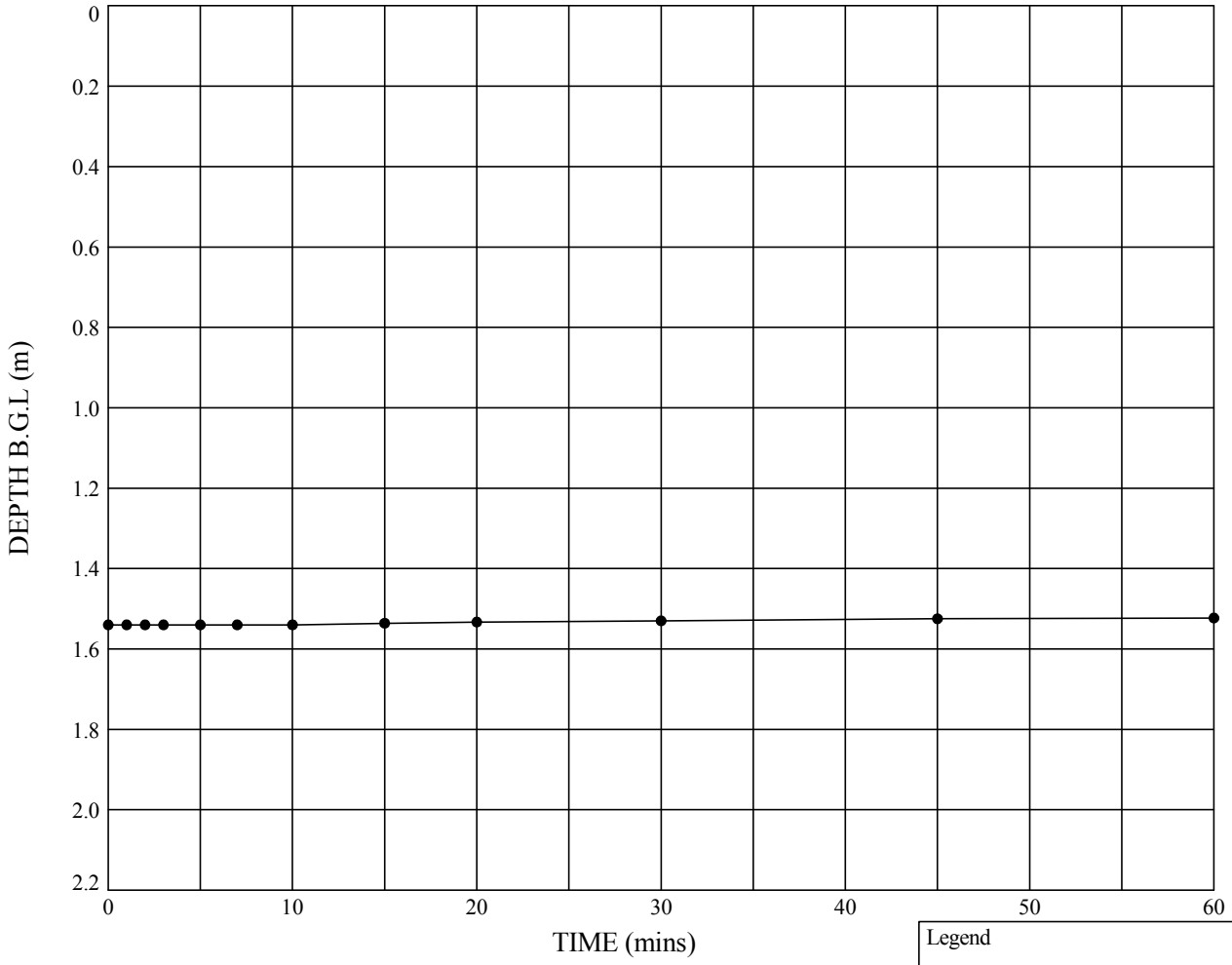
STRUCTURAL SOILS 1a Princess Street Bedminster Bristol BS3 4AG	Compiled By	Date	Checked By	Date
	M. Stokes	07/02/12		
	Contract: **Policemans Lane, Poole**		Contract Ref: **742686**	
			Page: of	

FULL SCALE SOAKAWAY TEST

Non standard test

Soakaway Test - Position ID : **TP2**

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME



Legend

● Test 1 (06.02.12)

Effective depth, De = 0.65 m

Effective storage volume, V_{p75-25} = 0.4485 m^3

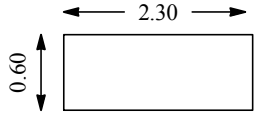
Surface area, a_{p50} = 3.2650 m^2

Time, t_{p75-25} = NA secs

Infiltration rate, f = NA m/s

Notes : Standing water in pit prior to test. Rise in water level. Unable to calculate infiltration rate.

Plan (Not to scale)



No Bearing Taken

Approved Signatories: D. TROWBRIDGE A. FROST F. HAMILTON M. STOKES

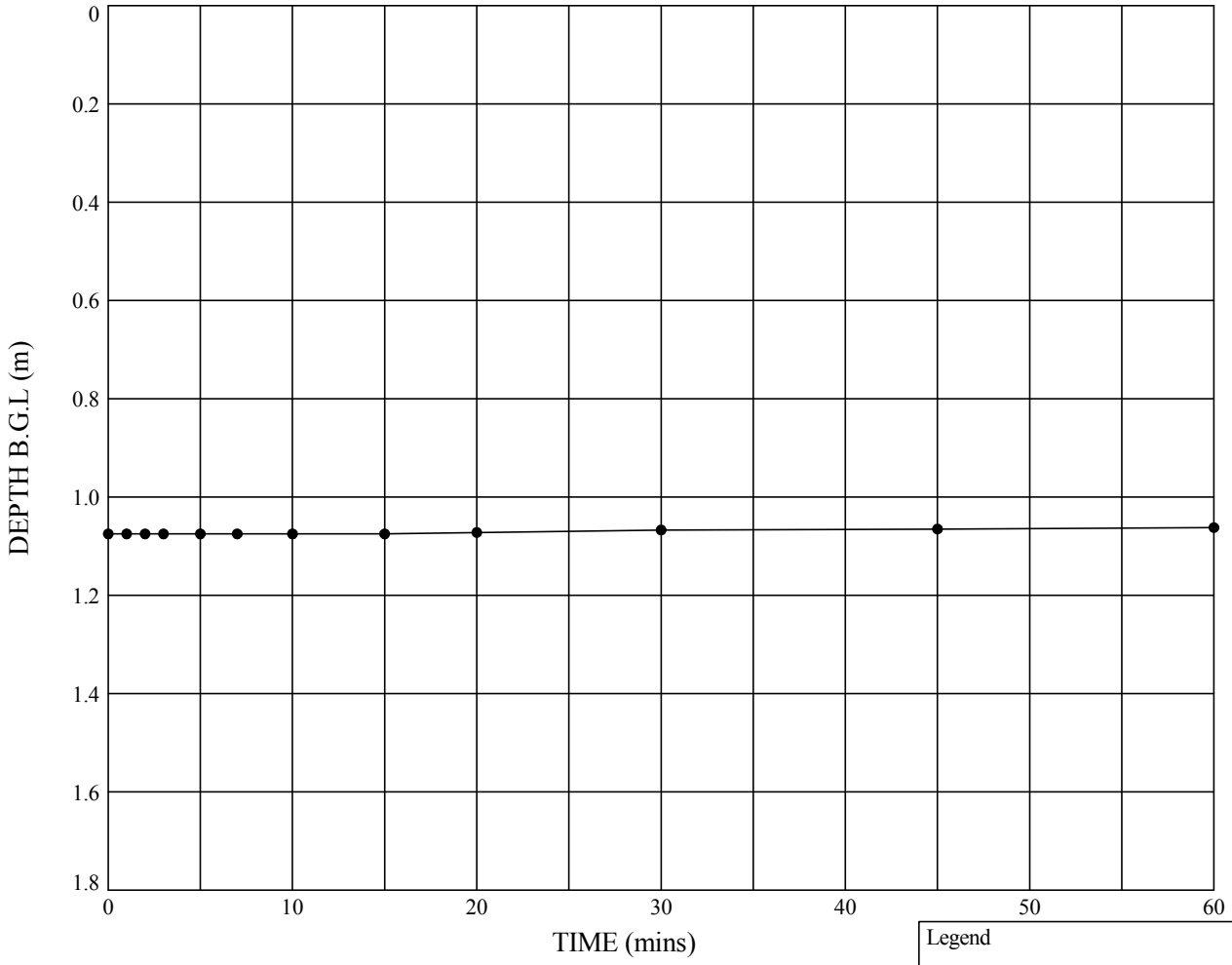
STRUCTURAL SOILS 1a Princess Street Bedminster Bristol BS3 4AG	Compiled By	Date	Checked By	Date
	M. Stokes	07/02/12		
	Contract: **Policemans Lane, Poole**		Contract Ref: **742686**	
			Page: of	

FULL SCALE SOAKAWAY TEST

Non standard test

Soakaway Test - Position ID : **TP3**

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME



Legend

● Test 1 (06.02.12)

Effective depth, De = 0.57 m

Effective storage volume, V_{p75-25} = 0.3420 m^3

Surface area, a_{p50} = 2.6820 m^2

Time, t_{p75-25} = NA secs

Infiltration rate, f = NA m/s

Notes : Rise in water level. Unable to calculate infiltration rate.

Plan (Not to scale)

No Bearing Taken

Approved Signatories: D. TROWBRIDGE A. FROST F. HAMILTON M. STOKES

STRUCTURAL SOILS 1a Princess Street Bedminster Bristol BS3 4AG	Compiled By	Date	Checked By	Date
	M. Stokes	07/02/12		
	Contract: **Policemans Lane, Poole**		Contract Ref: **742686**	
			Page: of	

Appendix 6

PFA consulting

Stratton Park House, Wanborough Road
Swindon, SN3 4HG

Telephone
01793 828000

Website
www.pfaplc.com

Preliminary
These drawings are produced for initial discussion and illustrative purposes only, and should not be relied upon for tender or pricing purposes.

NOTES

1. This drawing is based on topographical survey information supplied by Dorset Land Surveying – Drawing No. 5428/3 Revision C dated 4 October 2011.

2. Proposed Layout based on New masterplanning's Framework Plan, drawing number 098_DI_03.1.

3. Subject to detailed design.

Rev	Date	Description	Drawn	Check
#	20/07/17	First Issue.	RML	CI
A	02/08/17	Amended in line with comments from Planner.	RML	CI
B	09/08/17	Detention basin replaced by swale in eastern part of development.	RML	CI

Status

PRELIMINARY

Client

WYATT HOMES

Project

Land at Policeman's Lane Upton

Drawing Title

Preliminary Surface Water Drainage Strategy

Drawing No. **W521/03** Rev B

Date: July 2017 | Scale: 1:1000 @ A2

E-Mail: rlucas@pfaplc.com

Appendix 7

ICP SUDS Mean Annual Flood

Input

Return Period (years)	2	Soil	0.450
Area (ha)	2.180	Urban	0.000
SAAR (mm)	850	Region Number	Region 8

Results l/s

QBAR Rural	12.0
QBAR Urban	12.0
Q2 years	10.6
Q1 year	9.4
Q30 years	22.9
Q100 years	29.1

ICP SUDS Mean Annual Flood

Input

Return Period (years)	2	Soil	0.450
Area (ha)	3.250	Urban	0.000
SAAR (mm)	850	Region Number	Region 8

Results l/s

QBAR Rural	17.9
QBAR Urban	17.9
Q2 years	15.8
Q1 year	14.0
Q30 years	34.2
Q100 years	43.4

ICP SUDS Mean Annual Flood

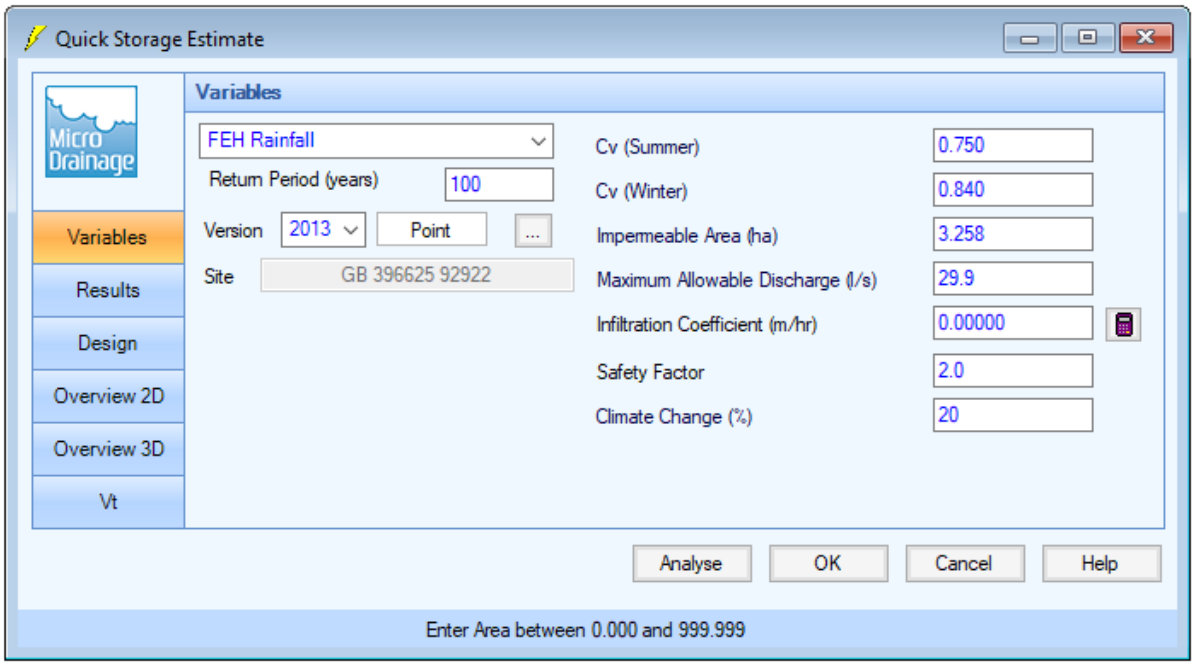
Input

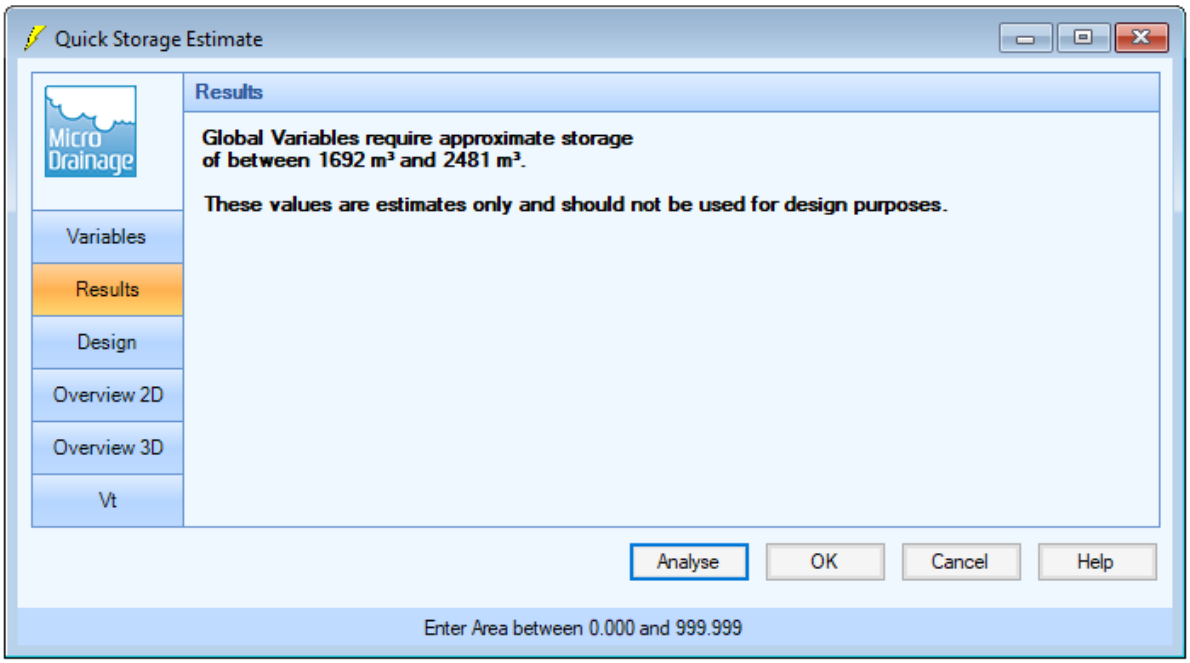
Return Period (years)	2	Soil	0.450
Area (ha)	0.880	Urban	0.000
SAAR (mm)	850	Region Number	Region 8

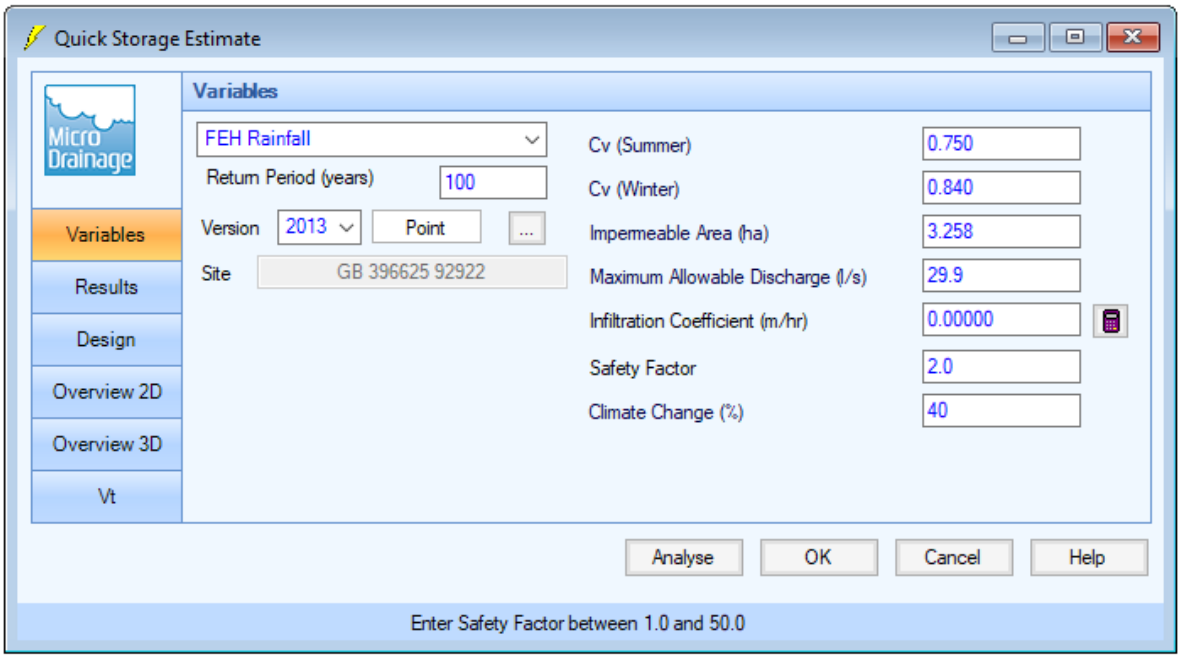
Results l/s

QBAR Rural	4.9
QBAR Urban	4.9
Q2 years	4.3
Q1 year	3.8
Q30 years	9.2
Q100 years	11.7

Appendix 8


Quick Storage Estimate
Micro Drainage
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Variables
FEH Rainfall
Return Period (years) 100
Version 2013 Point ...
Site GB 396625 92922
Cv (Summer) 0.750
Cv (Winter) 0.840
Impermeable Area (ha) 3.258
Maximum Allowable Discharge (l/s) 29.9
Infiltration Coefficient (m/hr) 0.00000
Safety Factor 2.0
Climate Change (%) 20
Analyse
OK
Cancel
Help
Enter Area between 0.000 and 999.999


Quick Storage Estimate
Micro Drainage
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Results
Global Variables require approximate storage of between 1692 m³ and 2481 m³.
These values are estimates only and should not be used for design purposes.
Analyse
OK
Cancel
Help
Enter Area between 0.000 and 999.999


Quick Storage Estimate
Micro Drainage
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Variables
FEH Rainfall
Return Period (years)
100
Version
2013
Point
...
Site
GB 396625 92922
Cv (Summer)
0.750
Cv (Winter)
0.840
Impermeable Area (ha)
3.258
Maximum Allowable Discharge (l/s)
29.9
Infiltration Coefficient (m/hr)
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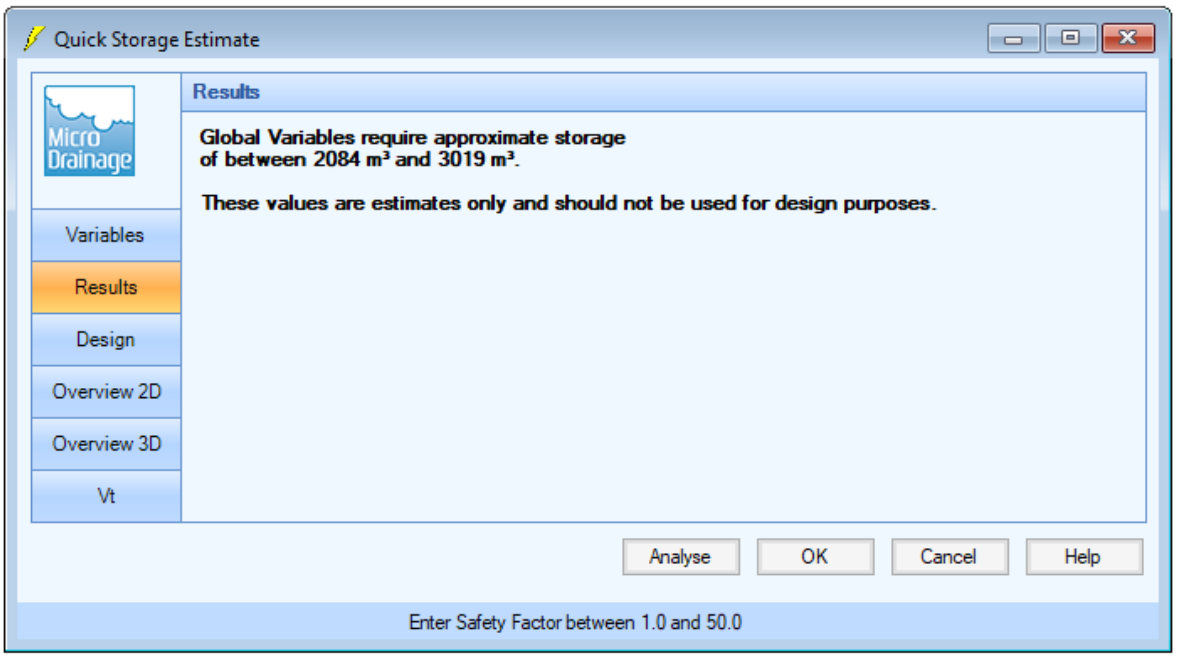
Safety Factor
2.0
Climate Change (%)
40
Analyse
OK
Cancel
Help
Enter Safety Factor between 1.0 and 50.0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Micro Drainage
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Results
Global Variables require approximate storage
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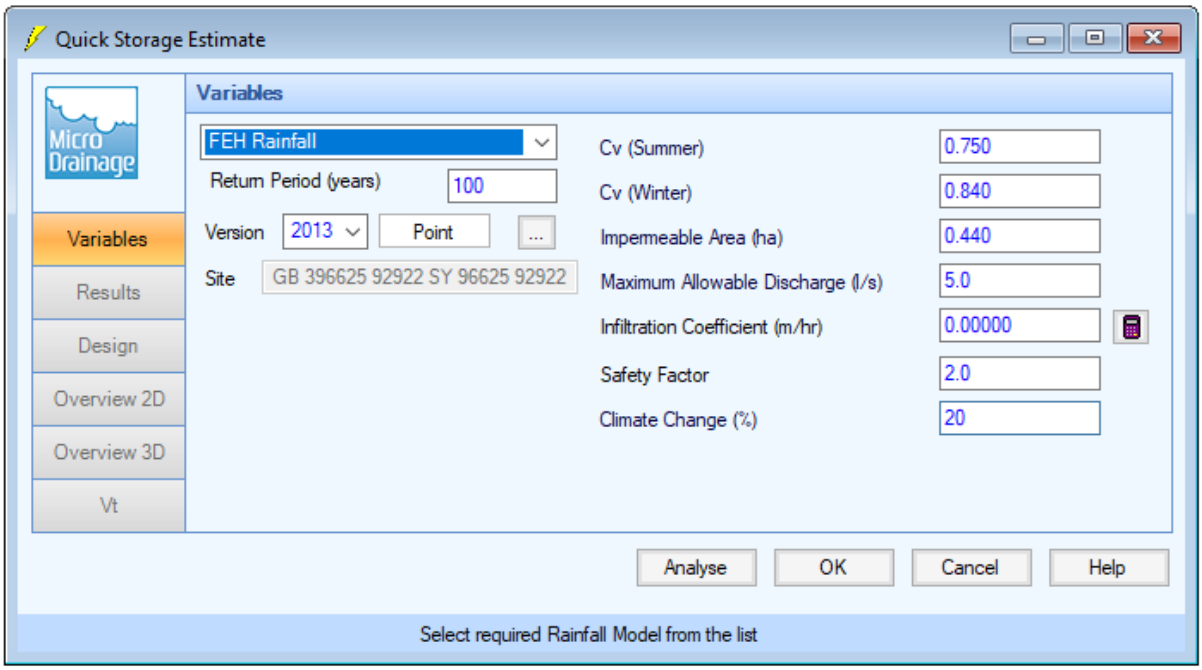
These values are estimates only and should not be used for design purposes.
Analyse
OK
Cancel
Help
Enter Safety Factor between 1.0 and 50.0


Quick Storage Estimate
Micro Drainage
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Variables
FEH Rainfall
Return Period (years)
100
Version
2013
Point
...
Site
GB 396625 92922 SY 96625 92922
Cv (Summer)
0.750
Cv (Winter)
0.840
Impermeable Area (ha)
0.440
Maximum Allowable Discharge (l/s)
5.0
Infiltration Coefficient (m/hr)
0.00000
Safety Factor
2.0
Climate Change (%)
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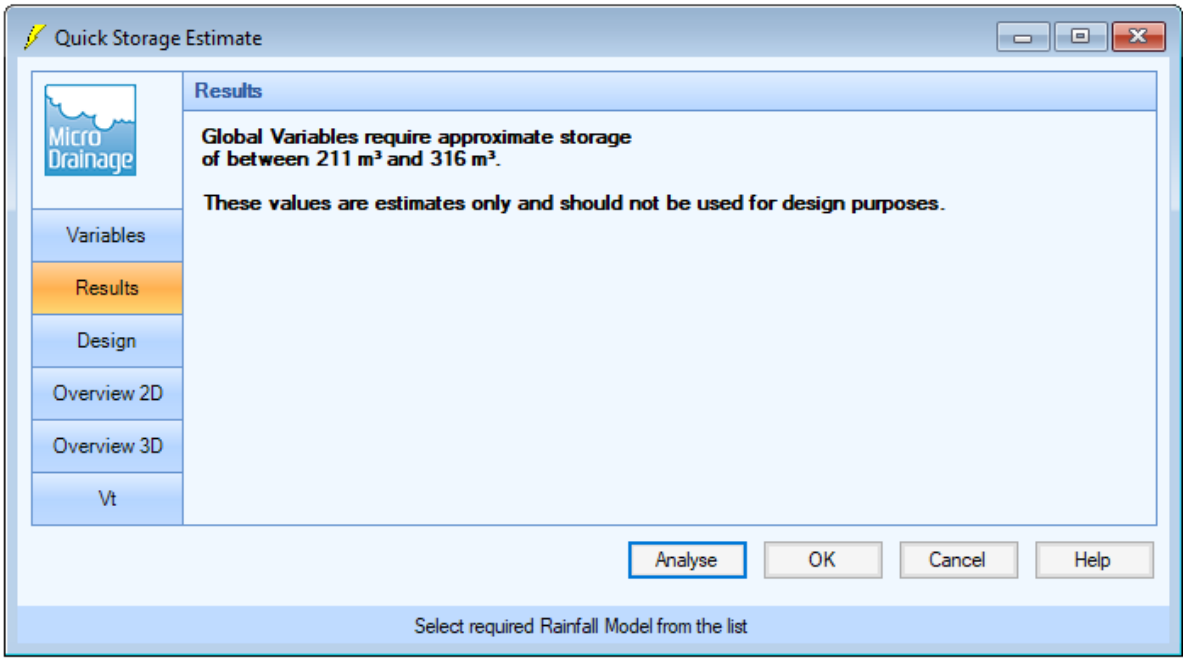
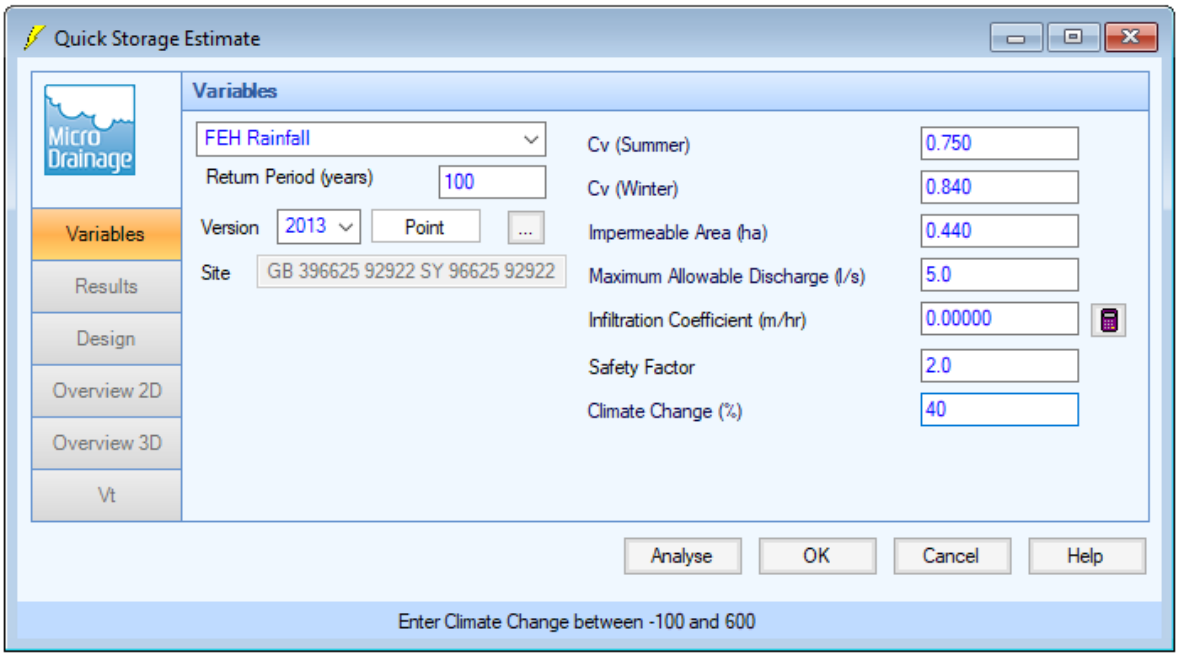
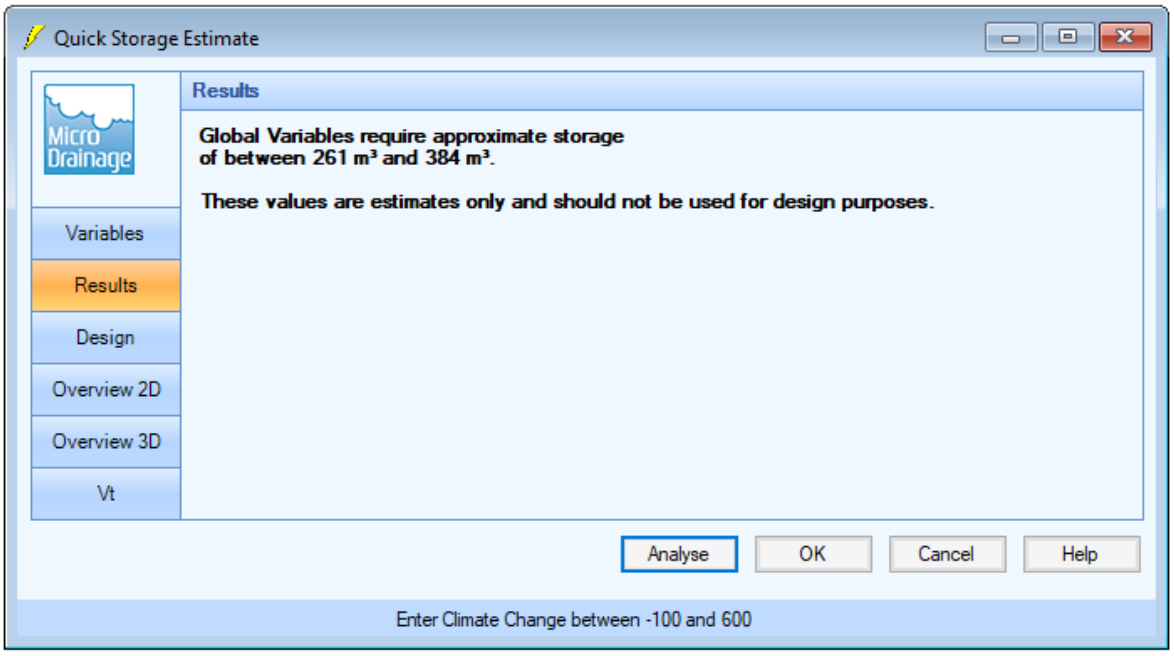
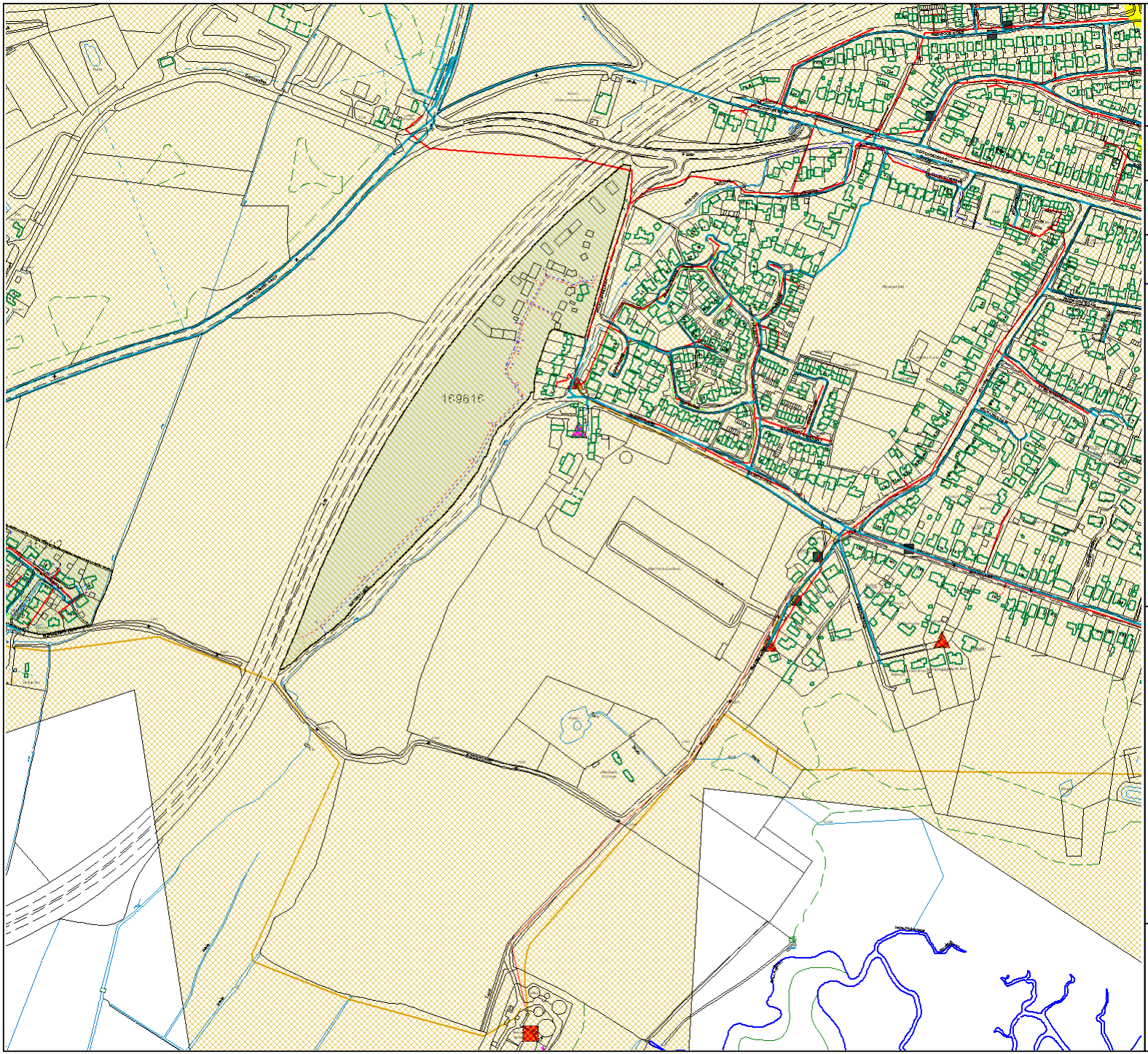
Analyse
OK
Cancel
Help
Select required Rainfall Model from the list


Quick Storage Estimate
Micro Drainage
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Results
Global Variables require approximate storage
of between 211 m³ and 316 m³.
These values are estimates only and should not be used for design purposes.
Analyse
OK
Cancel
Help
Select required Rainfall Model from the list


Quick Storage Estimate
Micro Drainage
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Variables
FEH Rainfall
Return Period (years)
100
Version
2013
Point
...
Site
GB 396625 92922 SY 96625 92922
Cv (Summer)
0.750
Cv (Winter)
0.840
Impermeable Area (ha)
0.440
Maximum Allowable Discharge (l/s)
5.0
Infiltration Coefficient (m/hr)
0.00000
Safety Factor
2.0
Climate Change (%)
40
Analyse
OK
Cancel
Help
Enter Climate Change between -100 and 600


Quick Storage Estimate
Micro Drainage
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Results
Global Variables require approximate storage
of between 261 m³ and 384 m³.
These values are estimates only and should not be used for design purposes.
Analyse
OK
Cancel
Help
Enter Climate Change between -100 and 600

Appendix 9



N
W E
S

Wessex Water
a YTL company

Policeman's Lane

WATER MAINS Public Private

Public
Raw Water
Abandoned
Valve Hydrant PRV Meter

SEWERS Public - Section 104 - Private

Foul
Combined
Surface
Abandoned sewers

OTHER WESSEX PIPES

Rising Mains
Effluent Disposal Main
Overflow

NON-WESSEX PIPES

Private Rising Mains
Culverted Water Course
Highway Drain

Information in this plan is provided for identification purposes only. No warranty as to accuracy is given or implied. The precise route of pipe work may not exactly match that shown. Wessex Water does not accept liability for inaccuracies.
Sewers and lateral drains adopted by Wessex Water under the Water Industry (Schemes for Adoption of Private Sewers) Regulations 2011 are to be plotted over time and may not yet be shown.
In carrying out any works, you accept liability for the cost of any repairs to Wessex Water apparatus damaged as a result of your works. You are advised to commence excavations using hand tools only. Mechanical digging equipment should not be used until pipe work has been precisely located.
If you are considering any form of building works and pipe work is shown within the boundary of your property or a property to be purchased (or very close by) a surveyor should plot its exact position prior to commencing works or purchase. Building over or near Wessex Water's apparatus is not normally permitted.

Printed on: 29/06/2017 10:56

Centre: 396844.00 , 92985.00

Scale = 1:6500

Metres 100 200 300