LAND WEST OF CHESTERTON

FLOOD RISK ASSESSMENT

FOR

TAYLOR WIMPEY UK LTD

July 2015

Our Ref: RCEF29420-002R

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This report has been prepared in the RPS Group Quality Management System to British Standard EN ISO 9001:2008

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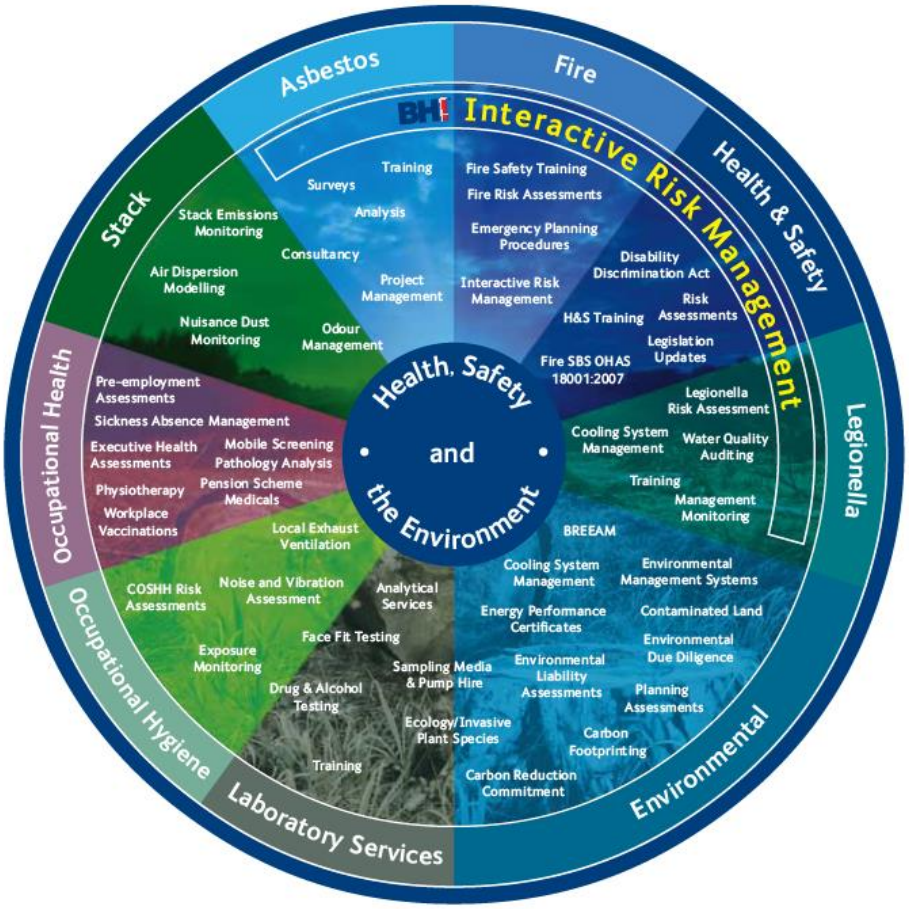

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General Notes

1. The following notes should be read in conjunction with the report:

2. This report contains only that available factual data for the site, which was obtained from the sources, described in the text. These data were related to the site on the basis of the location information made available to RPS by the client.

3. The assessment of the site is based on information supplied by the client. Relevant information was also obtained from other sources.

4. The report reflects both the information provided to RPS in documents made available for review and the results of observations and consultations by RPS staff.

5. Where data have been supplied by the client or other sources, including that from previous site audits or investigations, it has been assumed that the information is correct but no warranty is given to that effect. While reasonable care and skill has been applied in review of this data no responsibility can be accepted by RPS for inaccuracies in the data supplied.

6. This report is prepared and written in the context of the proposals stated in the introduction to this report and its contents should not be used out of context. Furthermore new information, changed practices and changes in legislation may necessitate revised interpretation of the report after its original submission.

7. The copyright in the written materials shall remain the property of the RPS Company but with a royalty-free perpetual licence to the client deemed to be granted on payment in full to the RPS Company by the client of the outstanding amounts.

CONTENTS

1 INTRODUCTION

1.1 RPS was commissioned to undertake a Flood Risk Assessment of land situated North of Green Lane, Chesterton in relation to the proposed residential development. The site has been granted outline planning permission (ref: 14/01737/OUT) and therefore this report is intended to support the full planning application.

1.2 The aim of the Flood Risk Assessment is to outline the potential for the site to be impacted by flooding, the impacts of the proposed development on flooding in the vicinity of the site, and the proposed measures which could be incorporated into the development to mitigate the identified risk. The report has been produced in accordance with the guidance detailed in the National Planning Policy Framework (NPPF). Reference has also been made to the CIRIA SUDS manual (C697), BRE Digest 365 Soakaway Design, the Cherwell and West Oxfordshire Strategic Flood Risk Assessment (SFRA).

1.3 This report has been produced in consultation with the Sustainable Places Team at the Environment Agency. The site is not located within an Internal Drainage Board (IDB) District.

1.4 This report is not intended to provide formal details of the final drainage design for the development. It provides information regarding the capabilities of the conceptual surface water drainage strategy to meet the requirements of the NPPF.

1.5 The desk study was undertaken by reference to information provided / published by the following bodies:

- Environment Agency;
- Centre for Ecology and Hydrology;
- British Geological Survey;
- Ordnance Survey; and
- Thames Water.

1.6 A site visit was conducted on 25th March 2014.

2 PLANNING POLICY CONTEXT

National Planning Policy

2.1 The National Planning Policy Framework (NPPF) released in March 2012, advises of the requirements for a site specific Flood Risk Assessment (FRA) for any of the following cases:

- All proposals (including minor development and change of use) located within the Environmental Agency designated floodplain, recognised as either Flood Zone 2 (medium probability) or Flood Zone 3 (high probability);
- All proposals greater than 1ha in area located in Flood Zone 1 (low probability);
- All proposals within an area which has critical drainage problems (as notified to the Local Planning Authority by the Environment Agency); and
- Where proposed development may be subject to other sources of flooding.

Local Planning Policy

The Cherwell Local Plan (2011 – 2031) was formally adopted by Cherwell District Council on 20th July 2015. The plan contains the following policies relating to flood risk and drainage:

Policy ESD 6 - Sustainable Flood Risk Management

The Council will manage and reduce flood risk in the district through using a sequential approach to development; locating vulnerable developments in areas at lower risk of flooding. Development proposals will be assessed according to the sequential approach and where necessary the exceptions test as set out in the NPPF. Development will only be permitted in areas of flood risk when there are no reasonably available sites in areas of lower flood risk and the benefits of the development outweigh the risks from flooding.

In addition to safeguarding floodplains from development, opportunities will be sought to restore natural river flows and floodplains, increasing their amenity and biodiversity value. Building over or culverting of watercourses should be avoided and the removal of existing culverts will be encouraged.

Existing flood defences will be protected from damaging development and where development is considered appropriate in areas protected by such defences it must allow for the maintenance and management of the defences and be designed to be resilient to flooding.

Site specific flood risk assessments will be required to accompany development proposals in the following situations:

- *All development proposals located in flood zones 2 or 3*
- *Development proposals of 1 hectare or more located in flood zone 1*
- *Development sites located in an area known to have experienced flooding problems*
- *Development sites located within 9m of any watercourses.*

Flood risk assessments should assess all sources of flood risk and demonstrate that:

- *There will be no increase in surface water discharge rates or volumes during storm events up to and including the 1 in 100 year storm event with an allowance for climate change (the design storm event)*
- *Developments will not flood from surface water up to and including the design storm event or any surface water flooding beyond the 1 in 30 year storm event, up to and including the design storm event will be safely contained on site.*

Development should be safe and remain operational (where necessary) and proposals should demonstrate that surface water will be managed effectively on site and that the development will not increase flood risk elsewhere, including sewer flooding.

Policy ESD 7 - Sustainable Drainage Systems (SuDS)

All development will be required to use sustainable drainage systems (SuDS) for the management of surface water run-off.

Where site specific Flood Risk Assessments are required in association with development proposals, they should be used to determine how SuDS can be used on particular sites and to design appropriate systems.

In considering SuDS solutions, the need to protect ground water quality must be taken into account, especially where infiltration techniques are proposed. Where possible, SuDS should seek to reduce flood risk, reduce pollution and provide landscape and wildlife benefits. SuDS will require the approval of Oxfordshire County Council as LLFA and SuDS Approval Body, and proposals must include an agreement on the future management, maintenance and replacement of the SuDS features.

Policy ESD 8: Water Resources

The council will seek to maintain water quality, ensure adequate water resources and promote sustainability in water use.

Water quality will be maintained and enhanced by avoiding adverse effects of development on the water environment. Development proposals which would adversely affect the water quality of

surface or underground water bodies, including rivers, canals, lakes and reservoirs, as a result of directly attributable factors, will not be permitted.

Development will only be permitted where adequate water resources exist, or can be provided without detriment to existing uses. Where appropriate, phasing of development will be used to enable the relevant water infrastructure to be put in place in advance of development commencing.

Policy ESD 9 - Protection of the Oxford Meadows SAC

Developers will be required to demonstrate that:

- *During construction of the development there will be no adverse effects on the water quality or quantity of any adjacent or nearby watercourse*
- *During operation of the development any run-off of water into adjacent or surrounding watercourses will meet Environmental Quality Standards (and where necessary oil interceptors, silt traps and Sustainable Drainage Systems will be included)*
- *New development will not significantly alter groundwater flows and that the hydrological regime of the Oxford Meadows SAC is maintained in terms of water quantity and quality*
- *Run-off rates of surface water from the development will be maintained at Greenfield rates.*

2.2 The Cherwell and West Oxfordshire Strategic Flood Risk Assessment (SFRA) identifies and maps flood risk from all sources at a borough-wide scale as well as providing guidance on producing site specific FRAs. Relevant information from the SFRA has been referenced throughout this Flood Risk Assessment report.

3 CONSULTATION

3.1 The Flood Risk Assessment has been produced in consultation with the Sustainable Places Team at the Environment Agency. The Environment Agency advised that for sites located within Flood Zone 1 greenfield run-off rates need to be maintained post development. Where possible, greenfield rates should be improved (i.e. through the use of soakaways).

3.2 The site is not located within an Internal Drainage Board (IDB) District.

3.3 The public sewer network within the vicinity of the site is operated by Thames Water. The sewer network within the vicinity of the site is discussed within Section 8 of this report.

3.4 A pre-development enquiry has been undertaken as part of the preparation of the Flood Risk Assessment. Thames Water have provided a Sewer Impact Study which is included as Appendix A and is described as follows:

- The hydraulic model indicates that the foul network does not have available capacity downstream of the proposed connection manhole to accept the proposed development flows.
- Improvements to the existing foul network are required to enable the proposed connection to sewer network. The proposed indicative option resolves the modelled increase in flooding and surcharge on the sewer network.
- The hydraulic model indicates that there would be an insignificant increase in network surcharge and flooding during wet weather events in inclusion of the additional development flows. Therefore, improvements to the surface water network system are not required.
- An updated foul water impact study is currently being undertaken.

3.5 The site is within the administrative boundary of Cherwell District Council. The Lead Local Flood Authority is Oxfordshire County Council. Oxfordshire County Council's Draft Local Flood Risk Management Strategy is currently open for consultation between 30th June 2014 and 19th September 2014.

4 SITE DESCRIPTION

Site Description

4.1 The site is located off Green Lane, Chesterton approximately 2.5 km to the southwest of Bicester town centre at National Grid Reference SP 55761 21449. It is rectangular in shape, occupying an area of approximately 2.79 hectares. A site location plan is provided in Figure 1.

4.2 The majority of the site is currently utilised as arable farm land, however, there are several sheds and a gravel area to the north of the site.

4.3 Vehicular and pedestrian access to the site is currently gained via the single track road which forms the north western boundary.

Surrounding Land Uses

4.4 The site is situated within an area dominated by agricultural and residential land uses. The site is bound to the north by allotments to the northeast by residential properties to the south west by agricultural land and to the north west by a single track road beyond which lies Bicester Hotel, Golf and Spa.

4.5 The site is not situated within or in close proximity to either a Special Area of Conservation (SAC) or Special Protection Area (SPA).

Topography

4.6 A topographic survey has been undertaken by RPS (Drainage Ref. JKK8123_1, Dated 21st March 2014) on the site and is included in Appendix B. The site generally slopes gently downwards in a south easterly direction from a topographic high point of approximately 78.38 m AOD in the northern corner to a topographic low point of approximately 75.00 m AOD in the southern corner.

4.7 The topographic survey identifies that levels along the single track road which form the north western boundary of generally fall from north to south with levels at the northern end of the site at approximately 78.83 m AOD and levels at the southern end at approximately 78.03 m AOD. The levels on the part of the single track road close to the northern boundary of the site are generally up to 0.5 m higher than on the site.

4.8 Reference to OS Mapping contours identifies that site is located within a wider area where levels are generally sloping downwards in a south easterly direction. Ground to the north west of the site is generally higher than the site and ground to the south east of the site is generally lower.

5 PROPOSED DEVELOPMENT

5.1 This planning application seeks outline planning approval with means of access for consideration (layout, scale, appearance and landscaping reserved for subsequent approval) for the erection of up to 45 dwellings served via a new vehicular and pedestrian access; public open space and associated earthworks to facilitate surface water drainage; and all other ancillary and enabling works.

5.2 The proposed layout is included at Appendix C.

5.3 Vehicular and pedestrian access will be provided via a newly constructed access road which will lead off the single track road located to the north west of the site.

5.4 Finished floor levels for the proposed buildings will be raised slightly above existing site levels.

5.5 The proposed area of hardstanding following development of the site will comprise approximately 1.03 Ha and the remaining area will be soft landscaping and public open space.

5.6 The proposed use of the site is classified as ôMore Vulnerableôwithin the NPPF.

5.7 An indicative drainage layout has been designed for the site. It is anticipated that surface water runoff will pass to a surface water drain situated within The Woodlands to the south of the site. The acceptable discharge rate to the existing mains sewer will need to be agreed with Thames Water in consultation with the Environment Agency. However, based on the existing greenfield nature of the site, greenfield rates will need to be maintained post development.

5.8 The potential to provide surface water attenuation, including the use of SuDS, has been considered as part of the preliminary design process (see Section 10 ï Surface Water Management).

6 HYDROLOGICAL SETTING

Nearby Watercourses

6.1 Reference to Ordnance Survey Mapping indicates that the nearest surface water feature is Gagle Brook which is situated approximately 350 m to the east, beyond Chesterton town centre. The brook is indicated to flow to the south, ultimately discharging to the River Ray approximately 4.6 km from the site.

6.2 A total of thirteen ponds are shown to be located within the grounds of the Bicester Hotel, Golf and Spa to the north west of the site.

6.3 No artificial watercourses / features (e.g. canals, reservoirs) have been identified within 1km of the site.

Flood Risk Classification

6.4 The Environment Agency's indicative floodplain map indicates that the site is located wholly within Flood Zone 1 which is classified as being at a low risk of fluvial flooding (less than 1 in 1000 annual probability). The Environment Agency indicative floodplain map is included as Figure 2.

6.5 The Environment Agency's indicative floodplain map indicates that the nearest floodplain to the site is located approximately 350 m to the east and is associated with Gagle Brook. Reference to Ordnance Survey Mapping indicates that the site is situated at least 75 m AOD whilst Gagle Brook is situated at approximately 70 m AOD, therefore the site is at least 5 m above the identified floodplain.

6.6 Reference to the Environment Agency's online risk of flooding from surface water map indicates that the proposed site is not at risk of surface water flooding.

6.7 The Environment Agency's reservoir flooding map indicates that the site is not in an area at risk of inundation from reservoir flooding.

6.8 No other sources of flooding have been identified within close proximity to the site.

7 HYDROGEOLOGICAL SETTING

7.1 Reference to the British Geological Survey online mapping (1:50,000 scale) indicates that no superficial deposits underlie the site. The underlying bedrock is indicated to consist of the Cornbrash Formation a member of the Great Oolite Group. This is described as poorly bedded, medium- to fine-grained limestone.

7.2 A site investigation was undertaken by RSK between 19th and 20th May during which 8 trial pits, 3 soakaway tests and 6 window sample boreholes were undertaken. The geology within the site is identified as follows:

- The site is generally underlain by topsoil which is directly underlain by limestone of the Cornbrash Formation;
- The limestone was identified to extend to depths of between 0.40 m bgl and 1.40 m bgl, achieving a thickness of between 0.30 m and 1.20 m.
- This was further underlain by an orange brown, clayey, gravelly sand, with subangular to subgrounded gravel, also thought to be part of the Cornbrash Formation. The sand extended to depths of between 0.60 m and 2,29 m bgl.
- A light grey mottled orange slightly gravelly friable clay was encountered below the sand, from depths of between 0.60 m and 1.50 m bgl, extending to depths of between 1.50 m to 2.80 m bgl.
- This was further underlain by a stiff grey clay that possibly represents the Forest Marble Formation. This was encountered to the base of all exploratory holes.

Soakaway Testing

7.3 The results of the soakaway testing indicate variable infiltration rates. Two soakaways were undertaken in the clays of the Forest Marble Formation at depths of 3.50 m bgl in TP01, located in the south western corner of the site and 2.66 m bgl in TP03, located in the northern area of the site, both of which indicated rising water levels and as such no infiltration was calculated. This is likely to have been caused by groundwater within the Cornbrash Formation emptying into the trial pit during the soakaway test at higher rate than infiltration was occurring. One soakaway undertaken within the limestone of the Cornbrash Formation at 1.08 m bgl in TP06, located in the eastern area of the site, gave an infiltration rate of 1.71×10^{-5} m/s.

7.4 According to the Environment Agency's online Groundwater Vulnerability Mapping, the bedrock consisting of the Cornbrash Formation is classified as a Secondary A Aquifer. Secondary A

Aquifers are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

7.5 Soilscapes online mapping describes the underlying soil on the site as, ôFreely draining lime-rich loamy soilsô

7.6 Reference to the Environment Agencyôs online groundwater Source Protection Zone maps indicates that the site is not located within a groundwater Source Protection Zone.

8 EXISTING DRAINAGE / WATER MAINS

8.1 At present the site is currently undeveloped and therefore there is no formal surface water system draining the site.

8.2 Reference to Thames Water plans of public sewers (shown in Appendix D) indicates that a 225 mm diameter surface water sewer and a 150 mm diameter foul water sewer are situated within the Woodlands to the south of the site. Both sewers are indicated to flow southward before diverting eastward along Green Lane.

8.3 Reference to water network plans provided by Thames Water indicates that there is a 90mm distribution main located in The Woodlands to the south of the site.

9 FLOOD RISK AND MITIGATION

9.1 The key sources of flooding that could potentially impact the site are discussed below:

Fluvial / Tidal Flooding

9.2 The Environment Agencyôs indicative floodplain map indicates that the site is located wholly within Flood Zone 1 which is classified as being at a low risk of fluvial flooding (less than 1 in 1000 annual probability). The Environment Agency indicative floodplain map is included as Figure 2.

9.3 Given the distance of the nearest floodplain to the site (350 m) and the elevation of the site above the watercourse (approximately 5 m) the risk of fluvial flooding to the site is considered to be low.

9.4 The access road included in the proposed development which leads off the single track road, is located within Flood Zone 1 therefore safe access/egress is available for the site.

9.5 Given that the site and immediate surrounding area is within Flood Zone 1, the proposed development will not result in any modification to fluvial flood flows nor is there any loss in floodplain storage; therefore floodplain compensation is not required for the proposed development.

Proposed Mitigation

9.6 No mitigation measures are required.

Flooding from sewers

9.7 Sewer flooding can occur during periods of heavy rainfall when a sewer becomes blocked or is of inadequate capacity. At present the site is currently undeveloped and therefore there is no formal surface water system draining the site, however there are sewers situated to the south of the site serving the neighbouring residential properties which are detailed in Section 8.

9.8 Given the topography of the site and the surrounding area it is likely that in the event of sewer surcharging it is water would be retained within the road by the roadside kerbs, and would flow along the Woodlands to the south and east and away from the site.

9.9 The SFRA has taken historical sewer flooding records provided from Thames Water and Anglian Water Services DG5 databases detailing the total number of flood events recorded to have affected both internal and external property over a 10 year period. The number of recorded sewer flooding events provided from the DG5 register is provided on a 5 figure grid reference basis and does not pin-point specific areas. The site is not identified as being within an area where sewer flooding has been recorded.

9.10 The discharge rate to the existing sewer will be agreed with Thames Water to ensure that there is capacity to receive discharge from the site without significantly increasing flood risk.

Proposed Mitigation

9.11 The residential dwellings on site will need to be raised above the road network in order to mitigate the potential for flooding from the onsite drainage network.

Surface water flooding (overland flow)

9.12 This can occur during intense rainfall events, when water cannot soak into the ground or enter drainage systems.

9.13 Reference to the Environment Agencyôs online risk of flooding from surface water map indicates that the site is not at risk from surface water flooding.

9.14 Reference to OS Mapping contours identifies that the site is located within a wider area where levels are generally sloping downwards in a southerly easterly direction. Ground to the north west of the site is generally higher than the site and ground to the south east of the site is generally lower. There is therefore potential for surface water overland flow to migrate onto the site from off-site areas to the north and north west of the site. In such instances, flows would migrate across the site in a south easterly direction following the topographic gradient towards Hazelhurst Road.

9.15 Surface water flooding from on-site sources is considered in Section 10 of this report.

Proposed Mitigation

9.16 Floor levels of the buildings on site will be raised a minimum of 150 mm above surrounding ground levels thereby preventing ingress of any overland flows from off-site sources into the buildings on the site.

Groundwater flooding

9.17 This can occur in low-lying areas when groundwater levels rise above surface levels, or within underground structures. BGS mapping indicates that the site is underlain by bedrock consisting of the Cornbrash Formation a member of the Great Oolite Group. There is potential for shallow groundwater to exist beneath the site, although it is unlikely to be present in significant quantities. At this stage no site specific information is available for groundwater levels beneath the site.

9.18 The SFRA states that, ô*No historical flooding records or information were identified for the SW quadrant of Bicester*.ô

9.19 Soilscapes online mapping describes the underlying soil on the site as, ôFreely draining lime-rich loamy soilsô

9.20 The proposed buildings on the site do not include basement levels.

9.21 The risk of groundwater flooding is considered to be low.

Proposed Mitigation

9.22 No mitigation required

Other Sources

9.23 The risk of flooding associated with reservoirs, canals and other artificial structures is considered to be low given the absence of any such features within close proximity of the site.

9.24 The Environment Agencyôs indicative Reservoir Flooding map indicates that the site is not in an area at risk of inundation from reservoir flooding.

9.25 There will be no increase in flood risk from sources such as water mains, canals or other artificial water bodies as a result of the development.

Proposed Mitigation

9.26 Raising floor levels of the buildings on site a minimum of 150 mm above surrounding ground levels will reduce the risk of ingress of any sewer flows into the buildings on the site.

Event Exceedence and Residual Risk

9.27 The mitigation measures proposed as part of the development scheme are considered appropriate to mitigate against any residual risks or event exceedence scenarios.

10 SURFACE WATER MANAGEMENT

Introduction

10.1 At present, the site is undeveloped and therefore, there will be an increase in the amount of hardstanding in the form of roads, residential buildings and driveways. Consultation with the Environment Agency has determined that greenfield run-off rates need to be maintained post development.

10.2 The IoH 124 Method has been used to calculate the greenfield run-off rate for the site. The calculation sheet is included at Appendix E. The QBAR greenfield run-off rate has been calculated as 2.14 l/s which is approximately 6.0 l/s/ha for the site.

10.3 The proposed development comprises the construction of residential properties. Generally, this type of development is considered to have a design life of 100 years. Therefore, for the purposes of this assessment, taking into account the recommended national precautionary sensitivity ranges for peak rainfall intensity (Table 5 in the NPPF), a 30% increase in peak rainfall intensity has been included as climate change allowance, which caters up to the year 2115.

Consideration of Sustainable Drainage Systems

10.4 The potential for the use of Sustainable Drainage Systems (SuDS) has been considered at this stage.

Swales, detention basins and ponds

10.5 The use of detention basins or ponds within the site is a potential method for surface water attenuation due to the availability of open areas within the proposed development. The conceptual surface water and foul water drainage plan, included in Appendix F, identifies that Attenuation basin 1 (North Pond) will provide a storage volume of 363 m^3 with a freeboard of approximately 0.76 m for the 1 in 100 year plus 30% climate change event. Detention basin 2 (South Pond) will provide a storage volume of 232 m^3 with a freeboard of approximately 0.56 m for the 1 in 100 year plus 30% climate change event. The ponds have the potential to be used as infiltration basins subject to soakaway tests prior to the detailed drainage design. Micro drainage WinDes calculations are included at Appendix G.

Soakaways

10.6 Reference to BGS mapping indicates that the site is underlain by no superficial deposits. The underlying bedrock is indicated to consist of the Cornbrash Formation which is likely to be of a relatively high permeability. The soils are described as ôFreely draining lime-rich loamy soilsô

10.7 Given the reported geological conditions beneath the site it is considered that soakaways are feasible within the south eastern corner of the site. In-situ testing has determined an infiltration rate of 1.71 x 10^{-5} m/s within this area of the site. It should be noted that infiltration features are preliminary only and are subject to further localised intrusive ground investigations.

Rainwater Harvesting

10.8 The attenuation benefits provided through the use of rainwater harvesting are considered to be limited, and would only be realised when the tanks were not full.

Green Roofs

10.9 Green roofs are considered unsuitable given the nature of the development.

Porous / Permeable Paving

10.10 The use of porous / permeable paving would be suitable for within the south eastern corner of the site.

Conceptual Surface Water Attenuation Scheme

10.11 The proposed surface water attenuation scheme comprises drainage of surface water from the site into surface water attenuation basins. The conceptual surface and foul water drainage scheme is shown in Appendix F. Micro drainage calculation sheets are provided at Appendix G. Final drainage design will be required at the detailed design stage.

10.12 The proposed development will be drained via a series of attenuation basins and soakaways.

10.13 The western corner of the site will discharge via surface water sewers into an attenuation basin located upon the eastern boundary of the site. The attenuation basin will provide a storage volume of 363 m^3 for the 1 in 100 year plus 30 % climate change event. The basin will have a bed level of 74.930 m AOD and a depth of water of 0.5 m. The basin will also include a freeboard of approximately 0.76 m.

10.14 Water within the basin will outfall into a further attenuation basin located in the southern corner of the site via a surface water sewer at a rate of 3 l/s determined by a flow control.

10.15 The attenuation basin within the southern corner of the site will provide 232 m^2 of volume for the 1 in 100 year plus 30% climate change event for properties within the south western corner of the site. the basin will have a bed level of 74.25 m AOD and a depth of water of 0.35 m. The basin will also include a freeboard of approximately 0.56 m.

10.16 The outflow from the attenuation basin is to be controlled by a hydrobrake. The outflow will be restricted to 5 l/s, therefore providing betterment over the existing greenfield runoff rate (6.0 l/s) and will discharge into Woodlands via a gravity sewer.

10.17 Residential dwellings within the south eastern corner of the site are shown to discharge into a series of soakaways. Further soakaway testing will be required within this area of the site at the detailed design stage in order to determine the rate at which discharge will infiltrate into the surrounding strata. The soakaways are described as follows:

- LAP : 2.4 x 4.0 m x 0.66 m deep;
- 35/36: 2.4 m x 3.2 m x 0.66 m deep;
- 37-43: 1.6 m x 3.2 m x 0.66 m deep;
- 44: 2.4 x 3.6 m x 0.66 m deep; and
- 45: 2.4 m x 3.6 m x 0.66 m deep.

10.18 It should be noted that infiltration features are preliminary only and are subject to further localised intrusive ground investigations.

10.19 The road network within the south eastern corner of the site comprises a 400 mm minimum open graded crushed rock permeable sub base.

10.20 Car parking areas within the proposed development will feature permeable parking that comprises 80 mm permeable block paving, over a 50 mm laying course which is underlain by a layer of open graded crushed rock.

10.21 This provides significant betterment than the existing situation as all events above the QBAR rate will be maintained on site up to the 1 in 100 year plus 30 % allowance for climate change event.

Foul Drainage

10.22 The foul water drainage is likely to comprise one of two options:

Either,

- Gravity drainage to a foul water pumping station at the southern end of the site. Following which foul water is pumped by a rising main into the existing Thames Water foul sewer beneath the A4095 (manhole node 7601). As shown on the drainage layout plan at Appendix F; or
- Gravity drainage into The Woodlands (this water require requisition through an adjacent property).

Event Exceedence

10.23 The proposed indicative surface water drainage concept provides storage up to the 1 in 100 year plus 30% climate change event. In an event exceeding this magnitude, detailed drainage design

will identify mitigation measures to ensure that the resulting above-ground flooding will be confined to temporary shallow flooding of the on-site road network and will not affect the buildings on site or significantly increase flood risk to off-site locations.

10.24 Event exceedence planning will be undertaken as part of the final design process. Suitable mitigation measures will be incorporated into the development to ensure water is retained on-site should surcharging of on-site drains occur during extreme rainfall events.

11 SEQUENTIAL TEST AND EXCEPTION TEST

Sequential Test

11.1 The NPPF requires the Local Authority to apply the Sequential Test in consideration of new development. The aim of the Test is to steer new development to areas at the lowest probability of flooding. The proposed use of the site is classified as ómore vulnerableôwithin the NPPF.

11.2 More vulnerable developments are deemed appropriate for Flood Zone 1 and therefore the proposed development of the site meets the requirements of the Sequential Test.

The Exception Test

11.3 According to Table 3 of the NPPF, ómore vulnerableôdevelopments are considered appropriate within Flood Zone 1 without the requirement to apply the Exception Test. Therefore, application of the Exception Test is not required for the proposed development.

12 SUMMARY AND CONCLUSIONS

12.1 The aim of the Flood Risk Assessment is to outline the potential for the site to be impacted by flooding, the potential impacts of the development on flooding both onsite and in the vicinity, and the proposed measures which can be incorporated into the development to mitigate the identified risks. The report has been produced in accordance with the guidance detailed in the NPPF. Reference has also been made to the CIRIA SuDS manual (C697), the Strategic Flood Risk Assessment and following consultation with the Environment Agency's Sustainable Places Team.

12.2 The potential flood risks to the site, and the measures proposed to mitigate the identified risks, are summarised in the table below:

Source of flooding	Identified Risk			Mitigation proposed	Residual risk		
	L	M	H		L	M	H
Fluvial	✓			No mitigation required.	✓		
Tidal	✓			No mitigation required.	✓		
Sewers	✓			Residential dwellings raised above road network.	✓		
Surface Water		✓		Floor levels of the buildings raised a minimum of 150mm above surrounding ground levels.	✓		
Groundwater	✓			No mitigation required	✓		
Other Sources (e.g. reservoirs, water mains)	✓			Raise floor levels of the buildings onsite a minimum of 150mm above surrounding ground levels.	✓		

12.3 The site is located with the Environment Agency's Flood Zone 1, therefore is considered to have a low risk of fluvial flooding.

12.4 Based on the site's location within Flood Zone 1, the site meets the requirements of the Sequential Test incorporated within the NPPF.

12.5 The conceptual foul and surface water drainage plan, described in Section 10, will restrict surface water run-off from the site to 5 l/s before discharging into an existing Thames Water surface water sewer. Attenuation is provided in the form of attenuation basins and soakaways. maintain

greenfield run-of rates for the site through a series of gravity sewers. Attenuation is provided in the form of 2 No. Attenuation basins and soakaways.

12.6 Overall, it has been demonstrated that the development would be safe, without increasing flood risk elsewhere, and that a positive reduction in flood risk would be achieved through the proposed surface water management.

Figure 1

SITE LOCATION PLAN

RPS
Unit 12, Watersedge Business Park, Modwen Road, Salford Quays, M5 3EZ
T +44 (0)161 874 3737 F +44 (0)161 877 3959 W rpsgroup.com

Client: Taylor Wimpey Oxfordshire	Date: 27/08/2014 Scale: NTS
Project: Green Lane, Chesterton	Figure: 01 Rev: 00
Title: Site Location Plan	Job Ref: RCEF29420

Figure 2

ENVIRONMENT AGENCY FLOOD MAP

RPS
Unit 12, Watersedge Business Park, Modwen Road, Salford Quays, M5 3EZ
T +44 (0)161 874 3737 F +44 (0)161 877 3959 W rpsgroup.com

Client: Taylor Wimpey Oxfordshire | Date: 27/08/2014 | Scale: NTS

Project: Green Lane, Chesterton | Figure: 02 | Rev: 00

Title: Environment Agency Flood Map | Job Ref: RCEF29420

Appendix A

THAMES WATER SEWER IMPACT STUDY

SEWER IMPACT STUDY

X4503 – 793

SMG 1651

PROPOSED CONNECTION AT GREEN LANE, BICESTER

FOUL AND SURFACE WATER SYSTEM

V2.0 April 2015

Prepared by:	Prashanth Krishnamoorthy
Checked by:	Umesha Halekote
Reviewed by:	Graham Moralee
Approved by:	Mike Carroll

Network & Process Modelling Group
Thames Water Utilities Ltd
Power House, Island Road
Reading, Berkshire
RG2 0RP

Asset Management

Contents

Appendices

1.0 Introduction

The following report was commissioned by Thames Water's Developer Services to investigate the capacity within the existing foul and surface water network and to ascertain the impact of a proposed new connection on the foul and surface water network at Green Lane, Bicester.

The scope of the study is to undertake a preliminary desktop study based upon an existing hydraulic model.

The scope of the study includes:

- Carry out a manhole survey, pumping station survey and a short-term flow survey
- Build a new hydraulic model of the surface water network
- Model enhancement with manhole and pumping station survey data
- Verify the model using flow survey data
- Check the current performance of the existing network during both dry and wet weather events
- Add development flows to the model and check the impact of additional flow to the sewer network during both dry and wet weather events
- Suggest possible options to allow flows to be accepted into the existing network with no detriment to existing levels of service. It should be noted that these options are indicative and are likely to be subject to change based on site conditions, other utilities and requirements of third parties. However, the options indicate the feasibility of connecting the site to the sewerage system and the ability of the sewerage system to accept the development.

2.0 Background

The proposed new development is on a Greenfield site and the Developer proposes to accommodate 45 new housing units. The development area is situated in the village of Chesterton, locatd to the southwest of Bicester.

The development area is bounded by Green Lane to the south and the A4095 to the west.

The foul flow from the development area has been calculated, using the latest Thames Water guidelines, as an average gravity flow of 2.06l/s. The surface water flow from the development area has been provided by the Developer as a peak flow of 6l/s.

The preferred connection manholes have been identified as SP55218205 for the foul flows and SP55218203 for the surface water flows, both located located to the south of the development site. A plan showing the location of the development and connection point is provided in Appendix A.

3.0 Existing Sewerage System and Treatment Works

The area in the vicinity of the development site is served by a separate foul and surface water sewer network.

From the development site, foul flows in the development area gravitate in a south-easterly direction towards Audley House Sewage Pumping Station (SPS), from where they are pumped to the gravity network draining to Fire Station (Chesterton) SPS.

From here, flows are lifted directly to Bicester Sewage Treatment Works (STW), located approximately 2km downstream of the development site.

Foul flows travel through sewers ranging from 150mm diameter to 250mm diameter sewer from the development area towards Bicester STW.

Surface water flows in the development area gravitate in a south-easterly direction along Green Lane before discharging to Gagle Brook.

Surface water flows travel through sewers ranging from 150mm diameter to 600mm diameter sewer from the development area towards Gagle Brook.

The local foul and surface water sewers are shown in the plan provided in Appendix B.

4.0 Thames Water Drainage Requirements

It is necessary to provide separate foul and surface water drainage systems and to ensure that each system is connected to an appropriate drainage system.

This study considers the impact of both foul and surface water flows discharging from the new development.

As the Developer proposes to connect both foul and surface water flows into the existing network, this report covers the impact of both the foul and surface water flows from the proposed development on the existing sewer networks adjacent to and downstream of the proposed development.

Additional development flows should not cause new or additional flood risk to the existing system in either dry or wet weather.

5.0 Sewer Impact Assessment

Assessment of the hydraulic loading of the foul and surface water network was carried out by means of an existing hydraulic model of the foul network and a newly built hydraulic model of the surface water network.

The model was enhanced with the results of a manhole and pumping station survey carried out in the study area. A flow survey was also completed to enable a verification exercise to be completed, and to confirm the current flows in the sewer network.

The proposed new development area and connection point details were added to the model and the assessment completed to identify the impact of the proposed new development.

The analysis of the catchment indicates that the foul and surface water networks are responsive to rainfall, with flooding being a risk in the catchment for extreme events.

The impact of the proposed foul and surface water connection was assessed based on the design flows detailed in Section 2.0.

5.1 Foul Sewers

5.1.1 Assessment of Existing Catchment

The hydraulic model indicates that the existing foul network does not have available capacity downstream of the proposed connection manhole. The hydraulic model has been used to assess wet weather scenarios of various durations. During these wet weather events, the hydraulic model predicts network surcharge and flooding to occur.

5.1.2 Assessment of Development Catchment

An analysis has been completed to assess the impact of connecting the flows from the development into the public sewer. An allowance of 2.06l/s average gravity flow was used to represent the development.

Table 1: Proposed Development Connection Details

Connection	Manhole	Diameter of Outgoing Sewer
Development Site	SP55218205	150mm

5.1.3 Foul Water System Improvement Works

The hydraulic model indicates that the foul network does not have available capacity downstream of the proposed connection manhole to accept the proposed development flows. On inclusion of the additional flows from the development site, an increase in the predicted volume of flooding and surcharge on the downstream sewer network is predicted to occur.

One indicative option has been developed to prevent the detrimental impact on the existing system, and allow the development site to connect to the existing sewer network. This option has been developed during a preliminary desktop investigation, using the hydraulic model only. The solution identified is intended to indicate the likely extent and magnitude and the network enhancement required to mitigate the predicted detriment and thus inform negotiations between the Developer and Thames Water over the feasibility and likely cost of the connection. A detailed design is required to confirm the size, location and performance of the indicative option before proceeding with any construction. Detailed design may also indicate alternative options.

Option – On-line Storage (See Appendix C1 for Plan)

- Connect development flows to manhole SP55218205.
- Provide approximately 93m^3 on-line storage between manholes SP56210205 and SP56211202 in Green Lane by upsizing three lengths of existing 150mm diameter pipe to 900mm diameter, for a total length of 147m.

5.2 Surface Water Sewers

5.2.1 Assessment of Existing Catchment

The hydraulic model indicates that the existing surface water network does not have available capacity downstream of the proposed connection manhole. The hydraulic model has been used to assess wet weather scenarios of various durations. During these wet weather events, the hydraulic model predicts network surcharge and flooding to occur.

5.2.2 Assessment of Development Catchment

An analysis has been completed to assess the impact of connecting the surface water flows from the development into the surface water sewer. An allowance of 6l/s gravity flow was used to represent the development.

Table 2: Proposed Development Connection Details

Connection	Manhole	Diameter of Outgoing Sewer
Development Site	SP55218203	225mm

5.2.3 Surface Water System Improvement Works

The hydraulic model indicates that the surface water network does not have available capacity downstream of the proposed connection manhole to accept the proposed development flows. However, the hydraulic model predicts an insignificant increase in network surcharge and flooding on inclusion of the additional development flows.

Therefore, improvements to the surface water network system are not required.

6.0 Risks and Issues

Current understanding of the hydrology of urban environments recognises that the effective pervious area (the pervious proportion of the catchment that produces surface runoff and generates flow in the sewer) is likely to exhibit a dynamic nature in relation to increasing volumes of rainfall, i.e. the more rainfall the greater the resulting effective pervious area is likely to be.

Whilst the hydrological models deployed attempt to simulate this dynamic behaviour, there is a risk that the model, when extrapolated to storm events, will not accurately predict the flows in the system. Therefore, any potential error is multiplied when the system is tested against a large design storm.

7.0 Conclusions

The desktop study has successfully investigated and identified the implications of the proposed new development on a Greenfield site at Green Lane, Bicester to the existing foul and surface water networks.

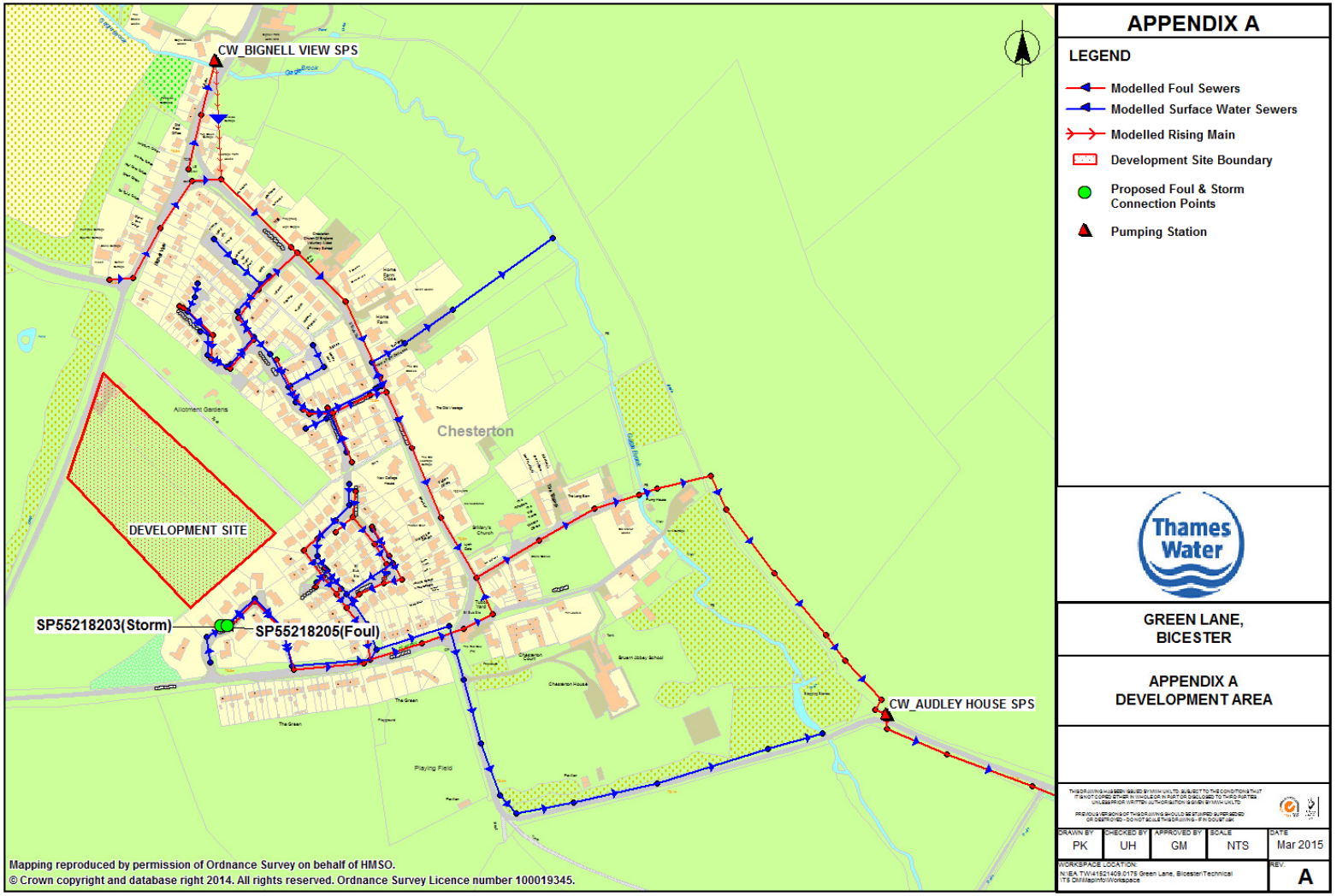
The hydraulic model indicates that the foul network does not have available capacity downstream of the proposed connection manhole to accept the proposed development flows.

Improvements to the existing foul network are required to enable the proposed connection to the sewer network, without causing any detriment to the level of service provided. The proposed indicative option resolves the modelled increase in flooding and surcharge on the sewer network.

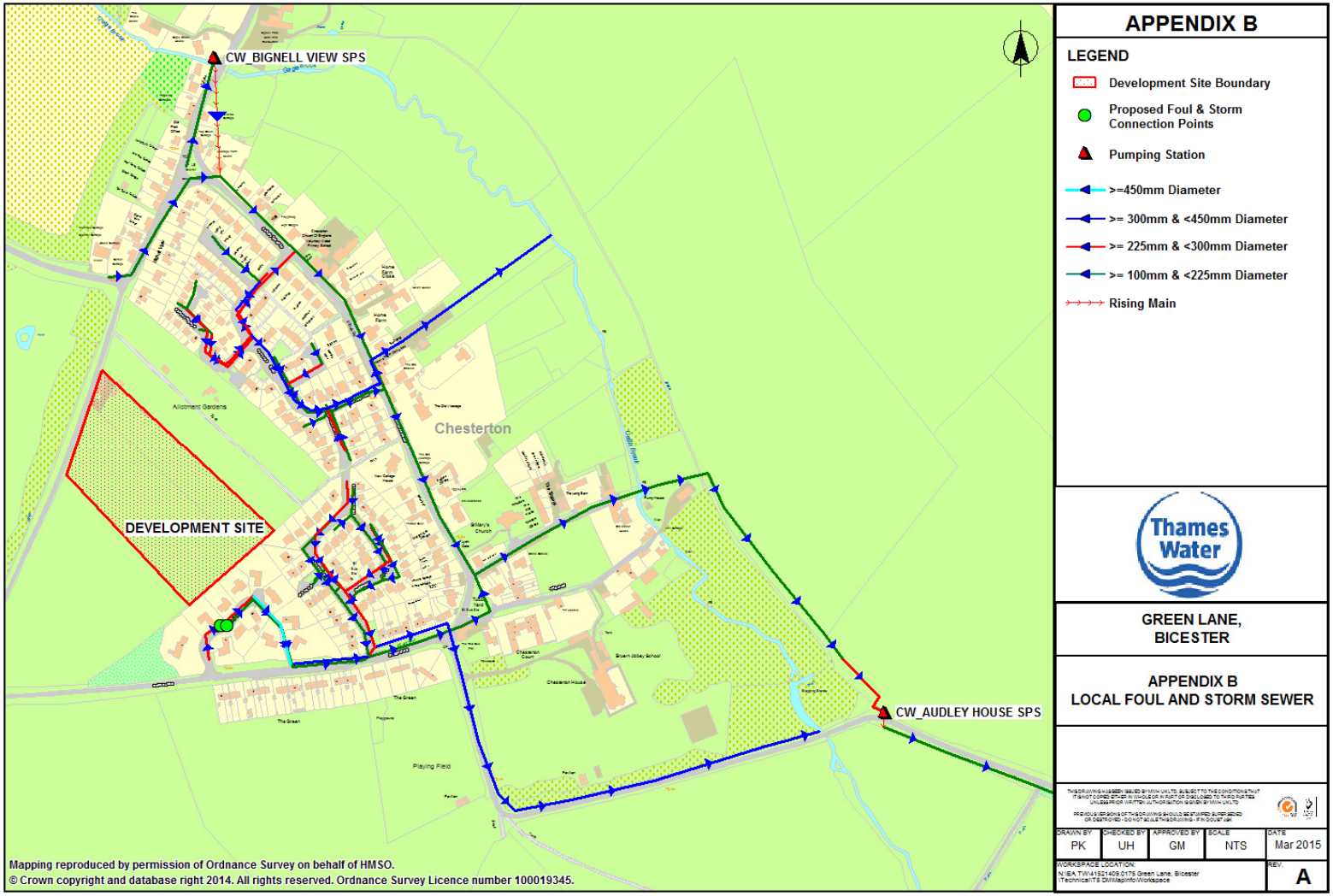
The hydraulic model indicates that there would be an insignificant increase in network surcharge and flooding during wet weather events in inclusion of the additional development flows. Therefore, improvements to the surface water network system are not required.

The issues highlighted and discussed throughout this report are recommendations to Thames Water Utilities and may be altered/added to based upon local operational knowledge of the system.

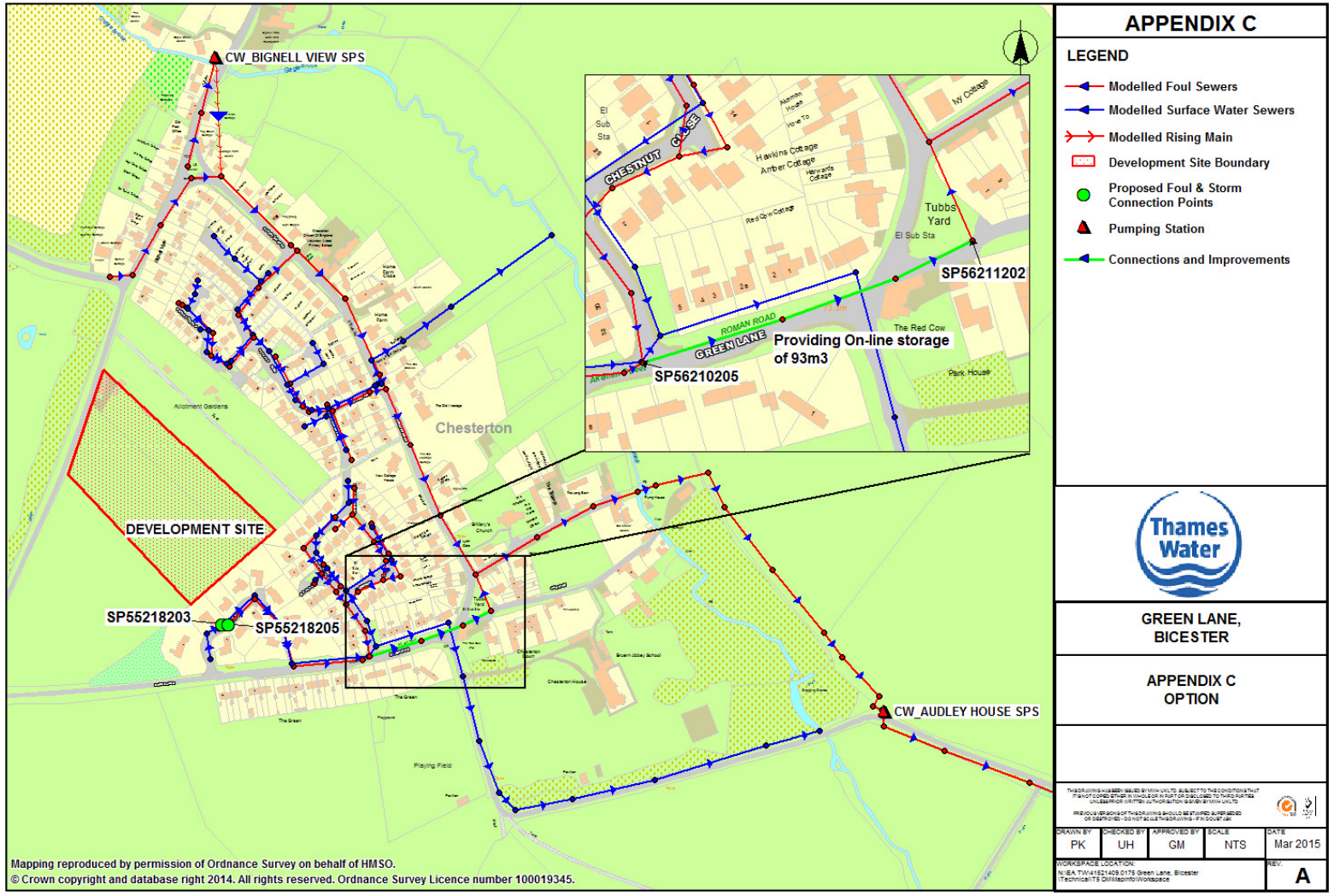
Appendix A – Site Plan



Appendix B – Local Sewers

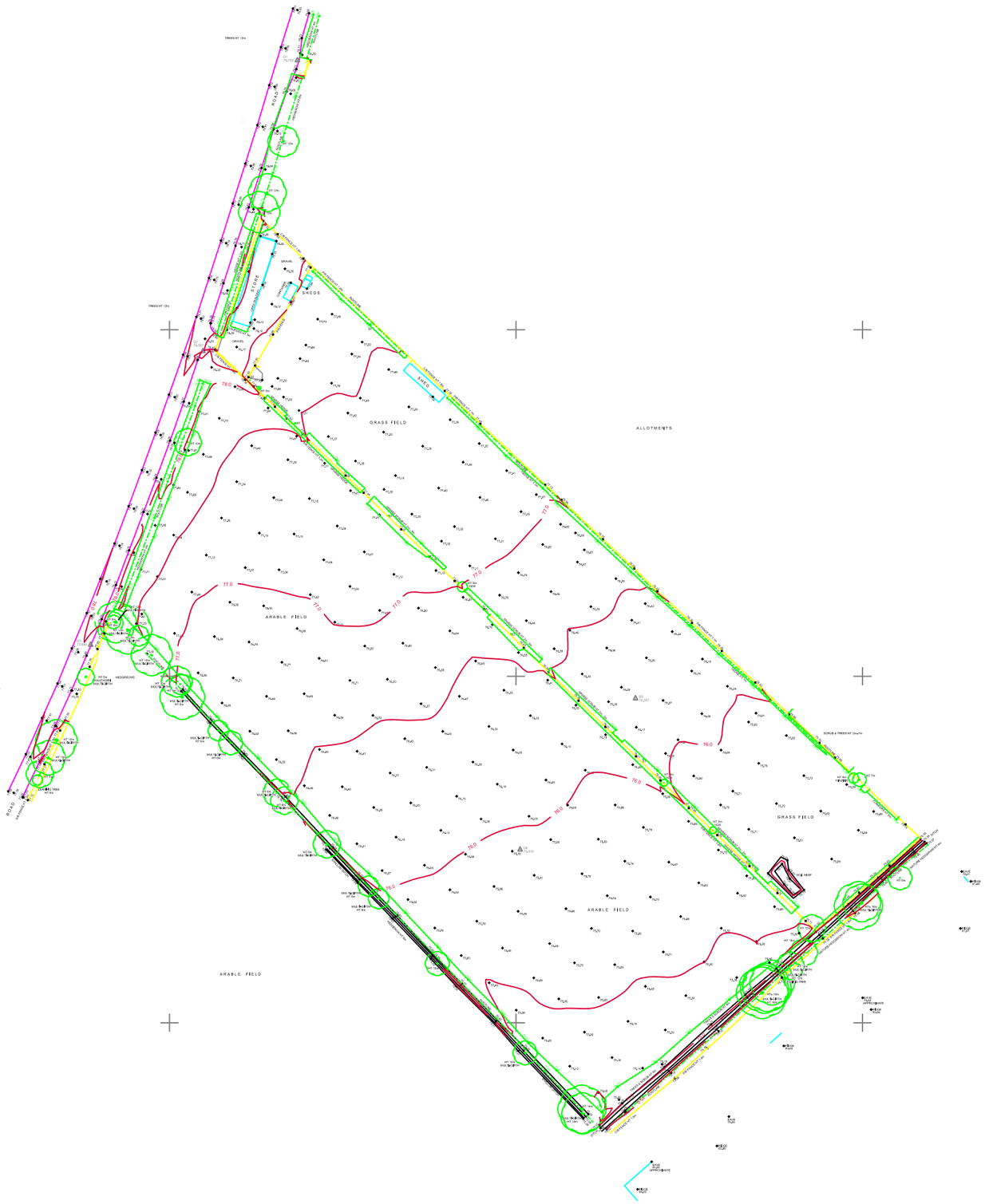


Appendix C – Connections and Improvements – Option



Appendix B

TOPOGRAPHIC SURVEY



Notes

1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.
3. This drawing should be read in conjunction with all other relevant drawings and specifications.

SURVEY KEY

AV	AIR VALVE	MH	IRON MAIL
BL	BOLLARD	MO	MINE OUTLET
BM	BENCH MARK	LO	LETTER BOX
BS	BEACON	LP	LAMP POST
BS	BUS STOP SIGN	LA	LANDS LAY
BT	BRITISH TELECOM COVER	MH	MANHOLE
B/W	BARBED WIRE	MC	MARKER POST
CB	CONTROL BOX	MW	MONITORING WELL
CCTV	CLOSED CIRCUIT TV	NP	NAME PLATE
CL	COVER LEVEL	P	POST
C/I	CORRUGATED IRON	PH	PARKING METER
C/L	CHAIN LINK	P/R	POST AND RAIL
CONC	CONCRETE	P/W	POST AND WIRE
CPS	CONCRETE PAVING SLABS	RE	RODDING EYE
CR	COLUMN	RS	ROAD SIGN
C/B	CLOSE BOARDED	RWP	RAIN WATER PIPE
C/NP	CHESTNUT PALING	SC	STOP COCK
C/P	CONCRETE PANEL	SF	SOFFIT LEVEL
CTV	CABLE TV	SP	SIGN POST
D	TRUNK DIAMETER	S/R	STEEL RAILING
DP	DOWN PIPE	ST	STUMP
EBS	ELECTRICITY BOX - DOUBLE	SW	SOFFIT WIDE
EC	ELECTRICITY BOX	TW	TRAFFIC LIGHT METER
EC	ELECTRICITY COVER	TC	TACKLE POINT
EP	ELECTRICITY POLE	TCB	TELEPHONE CALL BOX
ER	EARTH ROD	TL	TRAFFIC LIGHT
EU	EUCALYPTUS	TLC	TRAFFIC LIGHT SERVICE COVER
FL	FINISHED FLOOR LEVEL	TP	TELEPHONE POLE
FH	FIRE HYDRANT	TW	TOP OF WALL LEVEL
FV	FOUL WATER	UL	UNABLE TO LIFT
GL	GROUND LIGHT	VC	UNDERGROUND VALVE COVER
GM	GAS METER	VP	VENT PIPE
GP	GATE POST	WCL	WINDOW CILL LEVEL
GV	GAS VALVE	WHL	WINDOW HEAD LEVEL
GY	GULLY	WL	WATER LEVEL
HCH	HORSE CHESTNUT	WM	WATER METER
IC	INSPECTION COVER	WM	WIRE MESH
IL	INVERT LEVEL	WO	WATER OUT VALVE
IW	IRON INVERT LEVEL	WV	WATER VALVE

1. UNDERGROUND DRAINAGE INFORMATION HAS BEEN MEASURED FROM SURFACE INSPECTION ONLY AND SHOULD BE CONFIRMED BY SPECIALISTS IF CRITICAL.
2. TREE AND HEDGE SPECIES HAVE BEEN IDENTIFIED AS ACCURATELY AS POSSIBLE BUT SHOULD BE CONFIRMED BY SPECIALISTS IF CRITICAL.
3. SURVEY GRID & LEVELS RELATED TO ORDNANCE SURVEY NATIONAL GRID, OBTAINED THROUGH RTK TIE GPS OBSERVATIONS. BASED ON STATION D4 (455801.189E, 221349.983N). NO SCALE FACTOR HAS BEEN USED.
4. NORTH ARROW APPROXIMATE ONLY

Station	Easting	Northing	Level
D1	455736.915	221577.756	78.753
D2	455709.661	221493.829	78.587
D3	455677.244	221409.074	77.984
D4	455801.189	221349.983	75.910
D5	455834.508	221393.631	76.357

Rev	Description	By	Ckd	Date

For guidance only. Do not scale off this drawing

Noble House
Capital Drive, Linford Wood, Milton Keynes MK14 6QP
T:+44 (0)1908 665888 E:: rpsmk@rpsgroup.com F:+44 (0)1908 669899

Client

Project LAND AT GREEN LANE, CHESTERTON, OXFORDSHIRE.

Title TOPOGRAPHICAL SURVEY

Status	Scale	Date Created
Final	1:500 @A0	21st March 2014
Project Leader	Drawn By	Checked by
AP	DJR	ST

Drawing Number JKK8123 _1

Rev A

rpsgroup.com

Appendix C

PROPOSED LAYOUT

Appendix D

THAMES WATER SEWER PLANS

Asset Location Search

Thames Water Property Searches
12Vastern Road
READING
RG1 8DB

Search address supplied

1
Banks Furlong
Chesterton
Bicester
OX26 1UG

Your reference RCEF29420

Our reference ALS/ALS Standard/2014_2726117

Search date 28 March 2014

You are now able to order your Asset Location Search requests online by visiting
www.thameswater-propertysearches.co.uk

searchcode

Asset Location Search

Search address supplied: 1, Banks Furlong, Chesterton, Bicester, OX26 1UG

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

This searchprovides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0845 070 9148, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

Asset Location Search

Waste Water Services

Please provide a copy extract from the public sewer map.

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an ‘as constructed’ record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0845 920 0800. The Customer Centre can also arrange for a full flow and

pressure test to be carried out for a fee.

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Payment for this Search

A charge will be added to your suppliers account.

Asset Location Search

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, budget estimates, diversions, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0845 850 2777
Email: developer.services@thameswater.co.uk

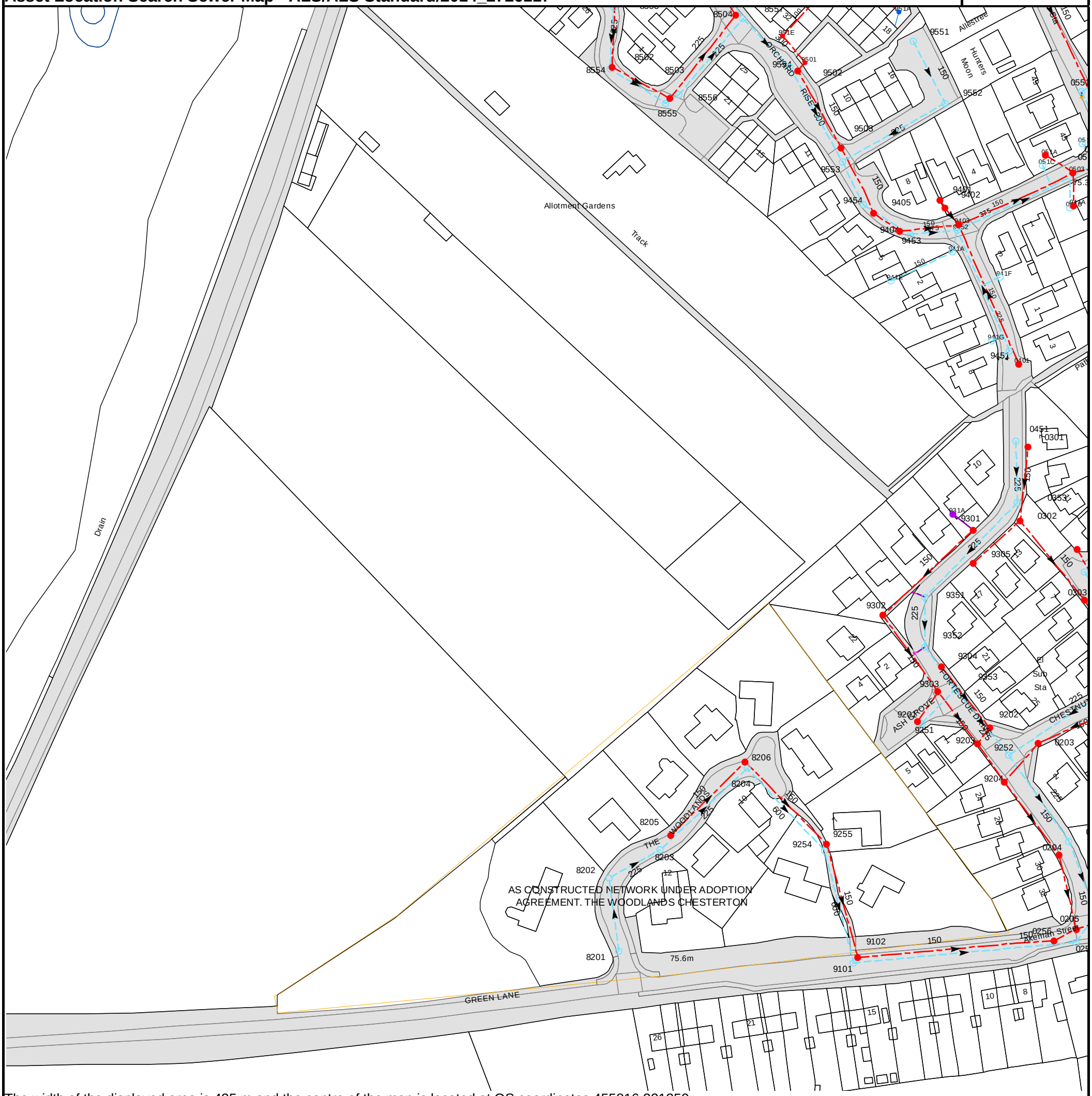
Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0845 850 2777
Email: developer.services@thameswater.co.uk

Asset Location Search Sewer Map - ALS/ALS Standard/2014_2726117



The width of the displayed area is 425 m and the centre of the map is located at OS coordinates 455816,221359

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
8204	74.73	73.16
8206	74.73	73.55

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

Control Valve

Drop Pipe

Ancillary

Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

Outfall

Undefined End

Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.

2) All measurements on the plans are metric.

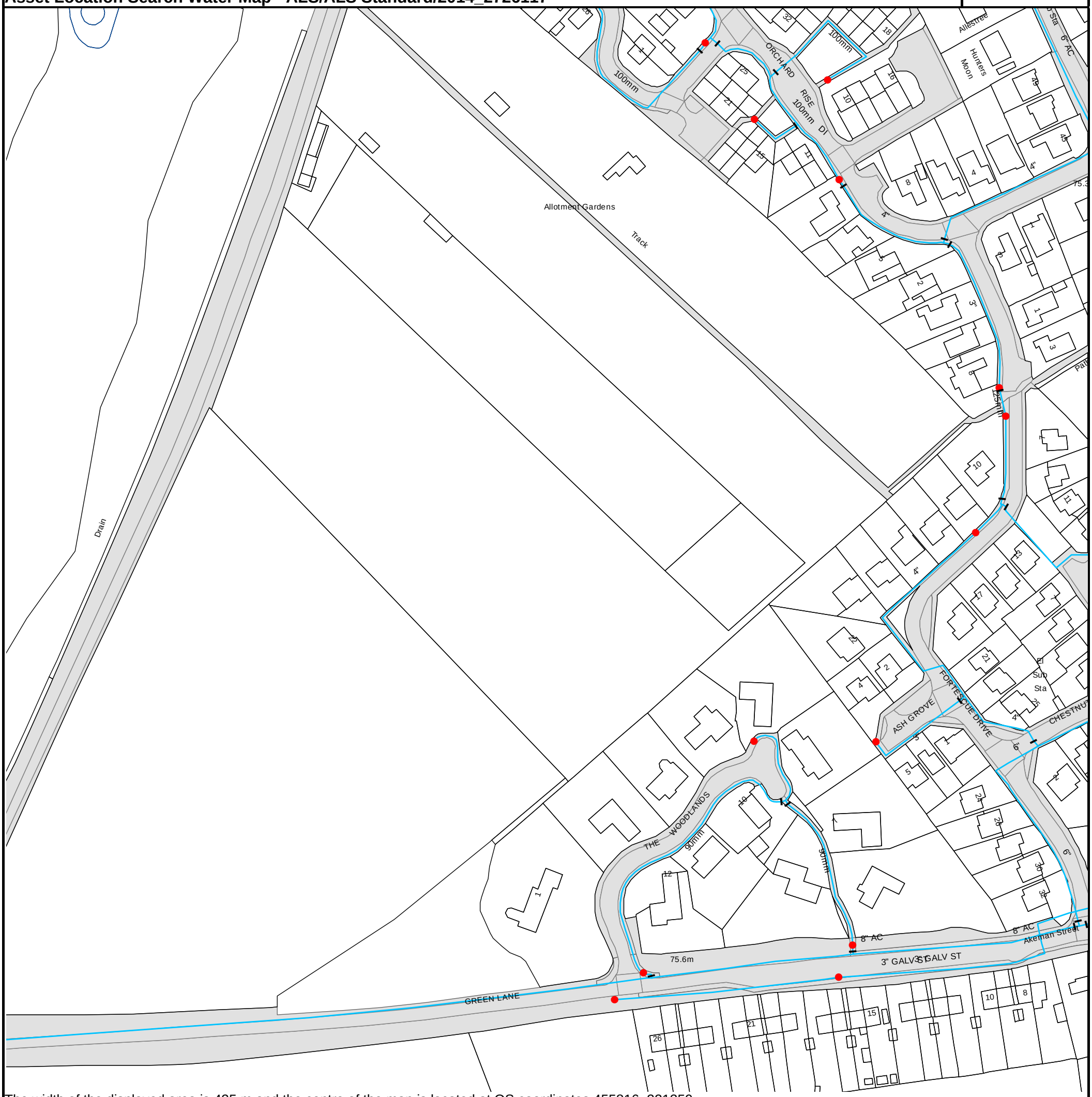
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.

4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.

5) 'na' or '0' on a manhole level indicates that data is unavailable.

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.

Asset Location Search Water Map - ALS/ALS Standard/2014_2726117



The width of the displayed area is 425 m and the centre of the map is located at OS coordinates 455816, 221359.

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

16"

Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

3" SUPPLY

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

3" FIRE

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

3" METERED

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Other Water Pipes (Not Operated or Maintained by Thames Water)

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

Terms and Conditions

All sales are made in accordance with Thames Water Utilities Limited (TWUL) standard terms and conditions unless previously agreed in writing.

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment 14 days from due date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service, or will be held to be invalid.
4. Thames Water does not accept post-dated cheques-any cheques received will be processed for payment on date of receipt.
5. In case of dispute TWUL`s terms and conditions shall apply.
6. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
7. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
8. A charge may be made at the discretion of the company for increased administration costs.

A copy of Thames Water's standard terms and conditions are available from the Commercial Billing Team (cashoperations@thameswater.co.uk).

We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0845 9200 800.

If you are unhappy with our service you can speak to your original goods or customer service provider. If you are not satisfied with the response, your complaint will be reviewed by the Customer Services Director. You can write to him at: Thames Water Utilities Ltd. PO Box 492, Swindon, SN38 8TU.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to Consumer Council for Water on 0121 345 1000 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.

Ways to pay your bill

Credit Card	**BACS Payment**	**Telephone Banking**	**Cheque**
Call **0845 070 9148** quoting your invoice number starting CBA or ADS.	Account number **90478703** Sort code **60-00-01** A remittance advice must be sent to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.** or email **ps.billing@thameswater.co.uk**	By calling your bank and quoting: Account number **90478703** Sort code **60-00-01** and your invoice number	Made payable to '**Thames Water Utilities Ltd**' Write your Thames Water account number on the back. Send to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW** or by DX to **151280 Slough 13**

Thames Water Utilities Ltd Registered in England & Wales No. 2366661 Registered Office Clearwater Court, Vastern Rd, Reading, Berks, RG1 8DB.

Search Code

IMPORTANT CONSUMER PROTECTION INFORMATION

This search has been produced by Thames Water Property Searches, Clearwater Court, Vastern Road, Reading RG1 8DB, which is registered with the Property Codes Compliance Board (PCCB) as a subscriber to the Search Code. The PCCB independently monitors how registered search firms maintain compliance with the Code.

The Search Code:

- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in property search reports undertaken by subscribers on residential and commercial property within the United Kingdom
- sets out minimum standards which firms compiling and selling search reports have to meet
- promotes the best practise and quality standards within the industry for the benefit of consumers and property professionals
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.

By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

The Code's core principles

Firms which subscribe to the Search Code will:

- display the Search Code logo prominently on their search reports
- act with integrity and carry out work with due skill, care and diligence
- at all times maintain adequate and appropriate insurance to protect consumers
- conduct business in an honest, fair and professional manner
- handle complaints speedily and fairly
- ensure that products and services comply with industry registration rules and standards and relevant laws
- monitor their compliance with the Code

Complaints

If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm's final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). The Ombudsman can award compensation of up to £5,000 to you if he finds that you have suffered actual loss as a result of your search provider failing to keep to the Code.

Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

TPOs Contact Details

The Property Ombudsman scheme
Milford House
43-55 Milford Street
Salisbury
Wiltshire SP1 2BP
Tel: 01722 333306
Fax: 01722 332296
Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk

PLEASE ASK YOUR SEARCH PROVIDER IF YOU WOULD LIKE A COPY OF THE SEARCH CODE

Appendix E

IOH 124 METHOD GREENFIELD CALCULATIONS

CALCULATIONS

Sheet No: 1 of 1

Project: Green Lane **Ref:** RCEF29420

Calc Details: IOH124, Greenfield Run-off Calculation

Prepared by: MB **Date:** 01/04/2014

Unit 12, Watersedge Business Park,
Modwen Road, Salford Quays,
M5 3EZ
T +44 (0)161 874 3737
F +44 (0)161 877 3959

The IOH124 method is the preferred approach for calculating Greenfield run-off. This should however be compared to the ADAS method on steep sites.

Calculation

NB This spreadsheet considers the run-off from small rural catchments
where the catchment area is less than 50Ha, the QBAR calc is completed for 50Ha and scaled down accordingly

AREA 0.01 km^2
1 Ha

SAAR 656 mm
Take from FEH CD

SOIL 0.335

Winter Rain Acceptance Potential (FSR, Fig I.4.18) or refer to: http://www.landis.org.uk/soilscapes/

Soil Class		% of catchment
Very High	S1	
High	S2	50%
Moderate	S3	50%
Low	S4	
Very Low	S5	

QBAR 0.002 m^3/s
2.15 l/s

QBAR $0.00108\ AREA^{0.89}\ SAAR^{1.17}\ SOIL^{2.17}$

Region 6

Hydrological areas

Peak Run-off

Return Period	Flow (m^3/s)	Flow (l/s)
2yr	0.002	1.9
5yr	0.003	2.7
10yr	0.003	3.5
30yr	0.005	4.9
50yr	0.006	5.6
100yr	0.007	6.8
100yr + 20%	0.008	8.2
100yr + 30%	0.009	8.9
500yr	0.010	9.6
1000yr	0.011	11.1

Growth Factors

Hydrometric Area	Return Period							
	2	5	10	30	50	100	500	1000
1	0.9	1.2	1.45	1.88	2.12	2.48	3.25	3.63
2	0.91	1.11	1.42	1.9	2.17	2.63	3.45	3.85
3	0.94	1.25	1.45	1.75	1.9	2.08	2.73	3.04
4	0.89	1.23	1.49	1.95	2.2	2.57	3.62	4.16
5	0.89	1.29	1.65	2.39	2.83	3.56	5.02	5.76
6	0.88	1.28	1.62	2.26	2.62	3.19	4.49	5.16
7	0.88	1.28	1.62	2.26	2.62	3.19	4.49	5.16
8	0.88	1.23	1.49	1.91	2.12	2.42	3.41	3.91
9	0.93	1.21	1.42	1.77	1.94	2.18	2.86	3.19
10	0.93	1.19	1.38	1.7	1.85	2.08	2.73	3.04
Ireland	0.95	1.2	1.37	1.64	1.77	1.96	2.4	2.6

Appendix F

CONCEPTUAL SURFACE WATER ATTENUATION PLAN

Refer to Inset 1 for continuation

Refer to Inset 2 for continuation

Wooded edge forming part of Bicester Country Club & Golf Course

THE HALE

Wildflower meadow and native shrub planting Wildlife Enhancement

Surface Water Attenuation Basin No. 1
Storage Volume of 363m³
for 1 in 100 yr + 30% event.
Water Depth 0.5m
Freeboard Approx 0.76 m

Bed Level
74.930m

IL 74.930

IL 74.88

Flow Control
3.0 litres/sec
IL74.865

Planning Application Boundary

TURNING AREA

Proposed FW rising

IL 74.25

Bed Level
74.25m

IL 74.20

Surface Water Attenuation Basin No. 2
Storage Volume of 232 m³
for 1 in 100 yr + 30% event.
Water Depth 0.35m
Freeboard Approx 0.56m

Foul water pumping station

Flow Control
5.0 litres/sec
IL74.180

2.5m easement from existing plot (2 The Woodlands) required. Outfall subject to agreement with land owner and Thames Water confirmation of connection and sewer requisition.

Existing Thames Water
FW manhole No. 8206
CL 74.79
IL 73.63

Existing Thames Water
SW manhole No. 8204
CL 74.78
IL 73.20

THE WOODLANDS

ARABLE FIELD

Allotment Gardens

ALLOTMENTS

DRAINAGE NOTES

1. All material used in the construction of drains and manholes shall comply to the relevant British standard and be kite marked where appropriate.
2. All adoptable drainage works shall be carried out in accordance with Sewers for Adoption 6th or 7th Edition.
3. All private drains shall be constructed in accordance with the relevant sections of the building regulations approved documents and BS EN 754-part 4:1998.
4. All private foul drainage access chambers shall be set minimum 450mm below finished levels, unless otherwise shown.
5. All private drains shall be 100mm Ø UPVC (unless otherwise stated) to BS EN 1401 and have a minimum of 350mm cover at any point.
6. Private surface water sewers shall be laid at a minimum gradient of 1:100 or to the invert levels shown.
7. Private foul sewers shall be laid at a minimum gradient of 1:80 or to the invert levels shown.
8. Falls from SVP, SS, DC & RWP to access or inspection chambers shall be laid at a minimum gradient of 1:40.
9. All SVPs and stack pipes shall have rodding access plates fitted at their bases (ground floor level).
10. Pipe bed and surround:
    Verge: class B,
    Private road/drive (cover > 900): class S,
    Private road/drive (cover < 900): class A unless stated otherwise.
11. All drains shall be flexibly jointed and where pipes pass through footings, retaining walls or screen walls, lintels shall be provided over pipes.
12. Where drains are close to buildings refer to clause 2.25 of the building regulations approved document H.

TYPE, SIZE AND DEPTH OF ALL INFILTRATION SUDS FEATURES ARE PRELIMINARY ONLY AND ARE SUBJECT TO FURTHER LOCALISED INTRUSIVE GROUND INVESTIGATIONS

13. Covers and frames shall be set to finished ground levels and falls. Cover levels shown are indicative only.
14. Inspection & access chamber covers and frames shall be provided by the proprietary manufacturer.
15. Locations of rainwater pipes & soil pipes are indicative only, refer to the relevant architects drawings.
16. All chamber covers located within the access road or parking bays shall be D400 heavy duty.
17. Contractor to verify manhole locations, pipe diameters and levels prior to making any connections to existing sewers and drains and confirm findings to the engineer
18. The contractor shall maintain all existing foul water flows at all times during construction.
19. Yard gullies to be sealed during construction to prevent blockages and system jetted clean upon completion (maximum jetting pressure of 180bar or 2600psi).
20. For typical construction details, see RPS drawing series JNY8140-500.
21. Refer to architects drawings for clarification of SVP's that vent to atmosphere.
22. Drainage connections are subject to terms & conditions of Thames Water and shall be undertaken in accordance with Section 106 of the Water Industry Act.
23. Contractor is to liaise directly with Thames Water to arrange all necessary inspections of adoptable works & connections to public sewers, & shall allow attendance to site as required.
24. All ground investigation and infiltration results shall be reported to the Engineer.
25. SuDS design is based on initial investigations undertaken by RSK in May 2015 Contact Ref: 313035.
26. This drawing is to be read in accordance with the FRA

INSET 1

Existing Thames Water
FW manhole No. 7601
CL 78.74
IL 77.54

78.6m

Rising main discharge to outlet manhole

Proposed FW rising

INSET 2

2.5m easement from existing plot (2 The Woodlands) required. Outfall subject to agreement with land owner and Thames Water confirmation of connection and sewer requisition.

THE WOODLANDS

Existing Thames Water
FW manhole No. 8205
CL 75.09
IL 74.10

Connect into new manhole on line of existing Thames Water Sewer at 5l/s Approx. IL 73.615

Existing Thames Water
SW manhole No. 8203
CL 75.07
IL 73.70

GENERAL NOTES

1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.
3. All dimensions are in metres unless otherwise stated.
4. This drawing is based on a topographical survey undertaken by:- RPS Planning and Development, Milton Keynes.
5. Proposed Layout is based on Site Plan, drawing number LSD129.03.01 undertaken by Life Space Design.
6. This drawing should be read in accordance with all relevant scheme drawings and specification.
7. All works to be carried out in strict accordance with with 'Specification of Highway Works - Modified and Extended including Oxfordshire County Council's (OCC) supplementary clauses.
8. All works with the public highway to be carried out and comply with requirements of DTP "Traffic signs Manual Chapter 8 - Traffic Safety Measures and Signs for Road Works and Temporary Situations".
9. Any discrepancies between project specification & OCC requirements to be reported to immediately to the Engineer.

KEY

- Proposed Foul Water Drain (private)
- Proposed Foul Water Sewer (adoptable)
- Proposed Foul Water Rising Main (adoptable)
- Proposed Foul Water Manhole
- Proposed Surface Water Drain (private)
- Proposed Surface Water Sewer (adoptable)
- Proposed Surface Water Manhole
- Proposed Perforated Pipe
- Trench Soakaway Infiltration
- Porous Subbase Infiltration (Private)
- Porous Subbase Attenuation (Private)
- Porous Subbase Infiltration (Public)

PRELIMINARY NOT FOR CONSTRUCTION

Rev	Description	Date	Initial	Checked

RPS

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Abingdon, Oxfordshire, OX14 4SH.
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Client Taylor Wimpey

Project Land North Of Green Lane, Chesterton

Title Drainage Layout

Status	Drawn By	Checked by
PRELIMINARY	HSS	JR
Project Number	**Scale @ A1**	**Date Created**
JNY8140	1:500	30/07/2015

Drawing Number JNY8140-500

Rev

rpsgroup.com

Drawing Ref: P:\JNY8140 - GREEN LANE, CHESTERTON\DWGS\DRAWINGS\JNY8140-500.REV - DRAINAGE LAYOUT.DWG Plotted Date: 7/30/2015 12:39 PM

Appendix G

MICRO DRAINAGE WINDES MODELLING ASSESSMENT

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 95 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	75.559	0.259	0.1	0.9	O K
30 min Summer	75.622	0.322	0.1	1.1	O K
60 min Summer	75.660	0.360	0.1	1.2	O K
120 min Summer	75.664	0.364	0.1	1.2	O K
180 min Summer	75.651	0.351	0.1	1.2	O K
240 min Summer	75.633	0.333	0.1	1.1	O K
360 min Summer	75.598	0.298	0.1	1.0	O K
480 min Summer	75.565	0.265	0.1	0.9	O K
600 min Summer	75.536	0.236	0.1	0.8	O K
720 min Summer	75.509	0.209	0.1	0.7	O K
960 min Summer	75.463	0.163	0.1	0.5	O K
1440 min Summer	75.397	0.097	0.1	0.3	O K
2160 min Summer	75.351	0.051	0.1	0.2	O K
2880 min Summer	75.341	0.041	0.1	0.1	O K
4320 min Summer	75.330	0.030	0.1	0.1	O K
5760 min Summer	75.324	0.024	0.0	0.1	O K
7200 min Summer	75.320	0.020	0.0	0.1	O K
8640 min Summer	75.317	0.017	0.0	0.0	O K
10080 min Summer	75.315	0.015	0.0	0.0	O K
15 min Winter	75.593	0.293	0.1	1.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	128.285	0.0	18
30 min Summer	84.226	0.0	32
60 min Summer	52.662	0.0	60
120 min Summer	31.800	0.0	92
180 min Summer	23.353	0.0	126
240 min Summer	18.644	0.0	160
360 min Summer	13.543	0.0	228
480 min Summer	10.792	0.0	296
600 min Summer	9.043	0.0	362
720 min Summer	7.823	0.0	426
960 min Summer	6.219	0.0	548
1440 min Summer	4.493	0.0	780
2160 min Summer	3.241	0.0	1104
2880 min Summer	2.568	0.0	1468
4320 min Summer	1.847	0.0	2200
5760 min Summer	1.461	0.0	2920
7200 min Summer	1.217	0.0	3648
8640 min Summer	1.048	0.0	4384
10080 min Summer	0.923	0.0	5112
15 min Winter	128.285	0.0	18

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	75.665	0.365	0.1	1.2	O K
60 min Winter	75.714	0.414	0.1	1.4	O K
120 min Winter	75.718	0.418	0.1	1.4	O K
180 min Winter	75.700	0.400	0.1	1.3	O K
240 min Winter	75.675	0.375	0.1	1.3	O K
360 min Winter	75.623	0.323	0.1	1.1	O K
480 min Winter	75.575	0.275	0.1	0.9	O K
600 min Winter	75.532	0.232	0.1	0.8	O K
720 min Winter	75.493	0.193	0.1	0.6	O K
960 min Winter	75.430	0.130	0.1	0.4	O K
1440 min Winter	75.353	0.053	0.1	0.2	O K
2160 min Winter	75.338	0.038	0.1	0.1	O K
2880 min Winter	75.330	0.030	0.1	0.1	O K
4320 min Winter	75.322	0.022	0.0	0.1	O K
5760 min Winter	75.317	0.017	0.0	0.0	O K
7200 min Winter	75.314	0.014	0.0	0.0	O K
8640 min Winter	75.312	0.012	0.0	0.0	O K
10080 min Winter	75.311	0.011	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	84.226	0.0	31
60 min Winter	52.662	0.0	60
120 min Winter	31.800	0.0	98
180 min Winter	23.353	0.0	136
240 min Winter	18.644	0.0	174
360 min Winter	13.543	0.0	248
480 min Winter	10.792	0.0	318
600 min Winter	9.043	0.0	386
720 min Winter	7.823	0.0	448
960 min Winter	6.219	0.0	570
1440 min Winter	4.493	0.0	764
2160 min Winter	3.241	0.0	1100
2880 min Winter	2.568	0.0	1472
4320 min Winter	1.847	0.0	2204
5760 min Winter	1.461	0.0	2880
7200 min Winter	1.217	0.0	3672
8640 min Winter	1.048	0.0	4408
10080 min Winter	0.923	0.0	5152

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.004

Time (mins) From:	To:	Area (ha)
0	4	0.004

Model Details

Storage is Online Cover Level (m) 76.250

Trench Soakaway Structure

Infiltration Coefficient Base (m/hr)	0.06120	Trench Width (m)	2.5
Infiltration Coefficient Side (m/hr)	0.06120	Trench Length (m)	4.5
Safety Factor	2.0	Slope (1:X)	1000.0
Porosity	0.30	Cap Volume Depth (m)	0.450
Invert Level (m)	75.300	Cap Infiltration Depth (m)	0.450

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 78 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	75.376	0.276	4.1	20.0	O K
30 min Summer	75.413	0.313	4.1	25.4	Flood Risk
60 min Summer	75.437	0.337	4.1	28.8	Flood Risk
120 min Summer	75.444	0.344	4.1	29.8	Flood Risk
180 min Summer	75.438	0.338	4.1	28.9	Flood Risk
240 min Summer	75.427	0.327	4.1	27.3	Flood Risk
360 min Summer	75.404	0.304	4.1	24.0	Flood Risk
480 min Summer	75.383	0.283	4.1	21.1	O K
600 min Summer	75.367	0.267	4.0	18.7	O K
720 min Summer	75.353	0.253	3.8	16.8	O K
960 min Summer	75.329	0.229	3.4	13.8	O K
1440 min Summer	75.293	0.193	2.9	9.8	O K
2160 min Summer	75.256	0.156	2.3	6.4	O K
2880 min Summer	75.231	0.131	2.0	4.5	O K
4320 min Summer	75.200	0.100	1.5	2.6	O K
5760 min Summer	75.181	0.081	1.2	1.7	O K
7200 min Summer	75.167	0.067	1.0	1.2	O K
8640 min Summer	75.158	0.058	0.9	0.9	O K
10080 min Summer	75.151	0.051	0.8	0.7	O K
15 min Winter	75.396	0.296	4.1	22.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	128.285	0.0	17
30 min Summer	84.226	0.0	31
60 min Summer	52.662	0.0	56
120 min Summer	31.800	0.0	88
180 min Summer	23.353	0.0	122
240 min Summer	18.644	0.0	156
360 min Summer	13.543	0.0	222
480 min Summer	10.792	0.0	286
600 min Summer	9.043	0.0	348
720 min Summer	7.823	0.0	410
960 min Summer	6.219	0.0	530
1440 min Summer	4.493	0.0	768
2160 min Summer	3.241	0.0	1128
2880 min Summer	2.568	0.0	1496
4320 min Summer	1.847	0.0	2204
5760 min Summer	1.461	0.0	2936
7200 min Summer	1.217	0.0	3672
8640 min Summer	1.048	0.0	4376
10080 min Summer	0.923	0.0	5120
15 min Winter	128.285	0.0	17

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	75.440	0.340	4.1	29.2	Flood Risk
60 min Winter	75.469	0.369	4.1	33.5	Flood Risk
120 min Winter	75.474	0.374	4.1	34.1	Flood Risk
180 min Winter	75.463	0.363	4.1	32.6	Flood Risk
240 min Winter	75.446	0.346	4.1	30.2	Flood Risk
360 min Winter	75.412	0.312	4.1	25.1	Flood Risk
480 min Winter	75.381	0.281	4.1	20.8	O K
600 min Winter	75.360	0.260	3.9	17.7	O K
720 min Winter	75.341	0.241	3.6	15.3	O K
960 min Winter	75.311	0.211	3.1	11.7	O K
1440 min Winter	75.267	0.167	2.5	7.3	O K
2160 min Winter	75.226	0.126	1.9	4.2	O K
2880 min Winter	75.202	0.102	1.5	2.7	O K
4320 min Winter	75.174	0.074	1.1	1.4	O K
5760 min Winter	75.159	0.059	0.9	0.9	O K
7200 min Winter	75.149	0.049	0.7	0.6	O K
8640 min Winter	75.146	0.046	0.6	0.5	O K
10080 min Winter	75.143	0.043	0.5	0.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	84.226	0.0	31
60 min Winter	52.662	0.0	58
120 min Winter	31.800	0.0	96
180 min Winter	23.353	0.0	134
240 min Winter	18.644	0.0	170
360 min Winter	13.543	0.0	240
480 min Winter	10.792	0.0	302
600 min Winter	9.043	0.0	364
720 min Winter	7.823	0.0	428
960 min Winter	6.219	0.0	550
1440 min Winter	4.493	0.0	792
2160 min Winter	3.241	0.0	1144
2880 min Winter	2.568	0.0	1496
4320 min Winter	1.847	0.0	2200
5760 min Winter	1.461	0.0	2936
7200 min Winter	1.217	0.0	3672
8640 min Winter	1.048	0.0	4304
10080 min Winter	0.923	0.0	5136

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.103

Time (mins) From:	To:	Area (ha)
0	4	0.103

Model Details

Storage is Online Cover Level (m) 75.700

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.06120	Width (m)	21.9
Membrane Percolation (mm/hr)	1000	Length (m)	21.9
Max Percolation (l/s)	133.2	Slope (1:X)	80.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	75.100	Cap Volume Depth (m)	0.400

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 1188 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	75.642	0.142	0.0	2.2	2.2	118.0	Flood Risk
30 min Summer	75.684	0.184	0.0	2.2	2.2	153.7	Flood Risk
60 min Summer	75.724	0.224	0.0	2.2	2.2	189.5	Flood Risk
120 min Summer	75.761	0.261	0.0	2.2	2.2	222.9	Flood Risk
180 min Summer	75.779	0.279	0.0	2.2	2.2	239.3	Flood Risk
240 min Summer	75.789	0.289	0.0	2.2	2.2	248.6	Flood Risk
360 min Summer	75.800	0.300	0.0	2.2	2.2	258.3	Flood Risk
480 min Summer	75.804	0.304	0.0	2.2	2.2	261.9	Flood Risk
600 min Summer	75.803	0.303	0.0	2.2	2.2	261.7	Flood Risk
720 min Summer	75.801	0.301	0.0	2.2	2.2	259.1	Flood Risk
960 min Summer	75.790	0.290	0.0	2.2	2.2	249.4	Flood Risk
1440 min Summer	75.772	0.272	0.0	2.2	2.2	233.1	Flood Risk
2160 min Summer	75.753	0.253	0.0	2.2	2.2	215.2	Flood Risk
2880 min Summer	75.735	0.235	0.0	2.2	2.2	199.4	Flood Risk
4320 min Summer	75.702	0.202	0.0	2.2	2.2	169.8	Flood Risk
5760 min Summer	75.671	0.171	0.0	2.2	2.2	142.3	Flood Risk
7200 min Summer	75.641	0.141	0.0	2.2	2.2	117.0	Flood Risk
8640 min Summer	75.614	0.114	0.0	2.2	2.2	93.9	Flood Risk
10080 min Summer	75.588	0.088	0.0	2.2	2.2	72.2	O K
15 min Winter	75.659	0.159	0.0	2.2	2.2	132.4	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	128.285	0.0	119.9	19
30 min Summer	84.226	0.0	157.6	34
60 min Summer	52.662	0.0	197.0	64
120 min Summer	31.800	0.0	238.1	124
180 min Summer	23.353	0.0	262.2	182
240 min Summer	18.644	0.0	279.1	242
360 min Summer	13.543	0.0	304.4	362
480 min Summer	10.792	0.0	323.4	482
600 min Summer	9.043	0.0	338.6	602
720 min Summer	7.823	0.0	351.5	720
960 min Summer	6.219	0.0	361.7	932
1440 min Summer	4.493	0.0	355.0	1140
2160 min Summer	3.241	0.0	437.4	1532
2880 min Summer	2.568	0.0	461.8	1932
4320 min Summer	1.847	0.0	498.3	2764
5760 min Summer	1.461	0.0	525.1	3568
7200 min Summer	1.217	0.0	547.3	4328
8640 min Summer	1.048	0.0	565.2	5096
10080 min Summer	0.923	0.0	581.4	5848
15 min Winter	128.285	0.0	134.3	19

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	75.705	0.205	0.0	2.2	2.2	172.7	Flood Risk
60 min Winter	75.750	0.250	0.0	2.2	2.2	213.1	Flood Risk
120 min Winter	75.793	0.293	0.0	2.2	2.2	251.7	Flood Risk
180 min Winter	75.814	0.314	0.0	2.2	2.2	271.3	Flood Risk
240 min Winter	75.826	0.326	0.0	2.2	2.2	282.7	Flood Risk
360 min Winter	75.840	0.340	0.0	2.3	2.3	295.6	Flood Risk
480 min Winter	75.846	0.346	0.0	2.3	2.3	301.9	Flood Risk
600 min Winter	75.849	0.349	0.0	2.3	2.3	304.1	Flood Risk
720 min Winter	75.848	0.348	0.0	2.3	2.3	303.7	Flood Risk
960 min Winter	75.843	0.343	0.0	2.3	2.3	298.2	Flood Risk
1440 min Winter	75.820	0.320	0.0	2.2	2.2	277.3	Flood Risk
2160 min Winter	75.794	0.294	0.0	2.2	2.2	253.2	Flood Risk
2880 min Winter	75.770	0.270	0.0	2.2	2.2	230.8	Flood Risk
4320 min Winter	75.721	0.221	0.0	2.2	2.2	186.4	Flood Risk
5760 min Winter	75.674	0.174	0.0	2.2	2.2	144.9	Flood Risk
7200 min Winter	75.630	0.130	0.0	2.2	2.2	107.0	Flood Risk
8640 min Winter	75.587	0.087	0.0	2.2	2.2	71.0	O K
10080 min Winter	75.545	0.045	0.0	2.2	2.2	36.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	84.226	0.0	176.3	33
60 min Winter	52.662	0.0	220.6	62
120 min Winter	31.800	0.0	266.8	122
180 min Winter	23.353	0.0	293.8	180
240 min Winter	18.644	0.0	312.7	240
360 min Winter	13.543	0.0	340.8	356
480 min Winter	10.792	0.0	362.1	472
600 min Winter	9.043	0.0	363.0	586
720 min Winter	7.823	0.0	362.9	700
960 min Winter	6.219	0.0	363.0	922
1440 min Winter	4.493	0.0	362.7	1326
2160 min Winter	3.241	0.0	489.7	1644
2880 min Winter	2.568	0.0	517.5	2104
4320 min Winter	1.847	0.0	558.3	2984
5760 min Winter	1.461	0.0	589.1	3816
7200 min Winter	1.217	0.0	613.1	4616
8640 min Winter	1.048	0.0	633.0	5368
10080 min Winter	0.923	0.0	650.7	5952

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.500

Time (mins) From:	To:	Area (ha)
0	4	0.500

Model Details

Storage is Online Cover Level (m) 75.900

Infiltration Basin Structure

Invert Level (m) 75.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	800.0	0.400	968.0

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0073-3000-1700-3000
Design Head (m)	1.700
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	73
Invert Level (m)	74.930
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.700	3.0
Flush-Flo™	0.322	2.4
Kick-Flo®	0.653	1.9
Mean Flow over Head Range	-	2.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.9	1.200	2.6	3.000	3.9	7.000	5.8
0.200	2.3	1.400	2.7	3.500	4.2	7.500	6.0
0.300	2.4	1.600	2.9	4.000	4.5	8.000	6.2
0.400	2.4	1.800	3.1	4.500	4.7	8.500	6.4
0.500	2.3	2.000	3.2	5.000	5.0	9.000	6.5
0.600	2.1	2.200	3.4	5.500	5.2	9.500	6.7
0.800	2.1	2.400	3.5	6.000	5.4		
1.000	2.4	2.600	3.6	6.500	5.6		

Cascade Summary of Results for Pond 2.srcx

Upstream Structures	Outflow To	Overflow To
Pond 1 Hydrobrake.srcx	(None)	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	74.362	0.112	2.9	73.0	Flood Risk
30 min Summer	74.395	0.145	3.7	95.4	Flood Risk
60 min Summer	74.430	0.180	3.8	118.6	Flood Risk
120 min Summer	74.465	0.215	3.8	142.9	Flood Risk
180 min Summer	74.485	0.235	3.8	157.3	Flood Risk
240 min Summer	74.499	0.249	3.8	167.2	Flood Risk
360 min Summer	74.519	0.269	3.8	181.3	Flood Risk
480 min Summer	74.533	0.283	3.8	191.0	Flood Risk
600 min Summer	74.542	0.292	3.8	197.8	Flood Risk
720 min Summer	74.549	0.299	3.8	202.6	Flood Risk
960 min Summer	74.556	0.306	3.8	207.8	Flood Risk
1440 min Summer	74.554	0.304	3.8	206.3	Flood Risk
2160 min Summer	74.540	0.290	3.8	196.3	Flood Risk
2880 min Summer	74.523	0.273	3.8	184.2	Flood Risk
4320 min Summer	74.486	0.236	3.8	157.8	Flood Risk
5760 min Summer	74.452	0.202	3.8	134.3	Flood Risk
7200 min Summer	74.429	0.179	3.8	118.2	Flood Risk
8640 min Summer	74.414	0.164	3.8	108.3	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	128.285	0.0	164.1	19
30 min Summer	84.226	0.0	209.0	34
60 min Summer	52.662	0.0	300.7	64
120 min Summer	31.800	0.0	363.2	124
180 min Summer	23.353	0.0	399.1	182
240 min Summer	18.644	0.0	423.8	242
360 min Summer	13.543	0.0	458.8	362
480 min Summer	10.792	0.0	483.0	482
600 min Summer	9.043	0.0	500.1	602
720 min Summer	7.823	0.0	511.5	722
960 min Summer	6.219	0.0	521.4	960
1440 min Summer	4.493	0.0	513.9	1342
2160 min Summer	3.241	0.0	689.1	1656
2880 min Summer	2.568	0.0	726.6	1992
4320 min Summer	1.847	0.0	778.4	2724
5760 min Summer	1.461	0.0	835.6	3400
7200 min Summer	1.217	0.0	870.0	4032
8640 min Summer	1.048	0.0	897.1	4672

Cascade Summary of Results for Pond 2.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	74.406	0.156	3.8	102.2	Flood Risk
15 min Winter	74.375	0.125	3.3	81.4	Flood Risk
30 min Winter	74.412	0.162	3.8	106.5	Flood Risk
60 min Winter	74.450	0.200	3.8	132.6	Flood Risk
120 min Winter	74.489	0.239	3.8	159.8	Flood Risk
180 min Winter	74.511	0.261	3.8	175.7	Flood Risk
240 min Winter	74.526	0.276	3.8	186.6	Flood Risk
360 min Winter	74.548	0.298	3.8	201.8	Flood Risk
480 min Winter	74.562	0.312	3.8	212.2	Flood Risk
600 min Winter	74.572	0.322	3.8	219.5	Flood Risk
720 min Winter	74.579	0.329	3.8	224.7	Flood Risk
960 min Winter	74.587	0.337	3.8	230.6	Flood Risk
1440 min Winter	74.589	0.339	3.8	232.0	Flood Risk
2160 min Winter	74.572	0.322	3.8	219.2	Flood Risk
2880 min Winter	74.549	0.299	3.8	202.9	Flood Risk
4320 min Winter	74.491	0.241	3.8	161.2	Flood Risk
5760 min Winter	74.437	0.187	3.8	124.0	Flood Risk
7200 min Winter	74.411	0.161	3.8	106.2	Flood Risk
8640 min Winter	74.400	0.150	3.7	98.4	Flood Risk
10080 min Winter	74.392	0.142	3.6	93.2	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.923	0.0	919.1	5352
15 min Winter	128.285	0.0	182.7	19
30 min Winter	84.226	0.0	224.2	33
60 min Winter	52.662	0.0	336.8	62
120 min Winter	31.800	0.0	405.8	122
180 min Winter	23.353	0.0	444.5	180
240 min Winter	18.644	0.0	470.1	240
360 min Winter	13.543	0.0	503.3	358
480 min Winter	10.792	0.0	520.8	476
600 min Winter	9.043	0.0	529.2	592
720 min Winter	7.823	0.0	534.2	708
960 min Winter	6.219	0.0	533.8	936
1440 min Winter	4.493	0.0	508.5	1384
2160 min Winter	3.241	0.0	771.3	1968
2880 min Winter	2.568	0.0	813.3	2220
4320 min Winter	1.847	0.0	869.0	2984
5760 min Winter	1.461	0.0	937.3	3520
7200 min Winter	1.217	0.0	975.2	4040
8640 min Winter	1.048	0.0	1005.9	4680
10080 min Winter	0.923	0.0	1030.8	5448

Cascade Rainfall Details for Pond 2.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.300

Time (mins) From:	To:	Area (ha)
0	4	0.300

Cascade Model Details for Pond 2.srcx

Storage is Online Cover Level (m) 74.600

Tank or Pond Structure

Invert Level (m) 74.250

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	635.0	0.350	738.0

Hydro-Brake® Outflow Control

Design Head (m) 0.900 Hydro-Brake® Type Md4 Invert Level (m) 74.250
Design Flow (l/s) 5.0 Diameter (mm) 82

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.5	1.200	5.7	3.000	9.1	7.000	13.9
0.200	3.7	1.400	6.2	3.500	9.8	7.500	14.3
0.300	3.2	1.600	6.6	4.000	10.5	8.000	14.8
0.400	3.4	1.800	7.0	4.500	11.1	8.500	15.3
0.500	3.7	2.000	7.4	5.000	11.7	9.000	15.7
0.600	4.1	2.200	7.8	5.500	12.3	9.500	16.2
0.800	4.7	2.400	8.1	6.000	12.8		
1.000	5.2	2.600	8.4	6.500	13.4		

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 133 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	75.497	0.397	0.1	1.1	O K
30 min Summer	75.599	0.499	0.1	1.4	O K
60 min Summer	75.672	0.572	0.1	1.6	O K
120 min Summer	75.691	0.591	0.1	1.7	O K
180 min Summer	75.680	0.580	0.1	1.6	O K
240 min Summer	75.660	0.560	0.1	1.6	O K
360 min Summer	75.618	0.518	0.1	1.5	O K
480 min Summer	75.579	0.479	0.1	1.3	O K
600 min Summer	75.543	0.443	0.1	1.2	O K
720 min Summer	75.509	0.409	0.1	1.1	O K
960 min Summer	75.448	0.348	0.1	1.0	O K
1440 min Summer	75.350	0.250	0.1	0.7	O K
2160 min Summer	75.247	0.147	0.1	0.4	O K
2880 min Summer	75.184	0.084	0.1	0.2	O K
4320 min Summer	75.144	0.044	0.1	0.1	O K
5760 min Summer	75.135	0.035	0.1	0.1	O K
7200 min Summer	75.130	0.030	0.1	0.1	O K
8640 min Summer	75.125	0.025	0.0	0.1	O K
10080 min Summer	75.122	0.022	0.0	0.1	O K
15 min Winter	75.548	0.448	0.1	1.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	128.285	0.0	18
30 min Summer	84.226	0.0	32
60 min Summer	52.662	0.0	60
120 min Summer	31.800	0.0	102
180 min Summer	23.353	0.0	132
240 min Summer	18.644	0.0	168
360 min Summer	13.543	0.0	236
480 min Summer	10.792	0.0	304
600 min Summer	9.043	0.0	372
720 min Summer	7.823	0.0	440
960 min Summer	6.219	0.0	568
1440 min Summer	4.493	0.0	820
2160 min Summer	3.241	0.0	1172
2880 min Summer	2.568	0.0	1504
4320 min Summer	1.847	0.0	2200
5760 min Summer	1.461	0.0	2936
7200 min Summer	1.217	0.0	3664
8640 min Summer	1.048	0.0	4400
10080 min Summer	0.923	0.0	5136
15 min Winter	128.285	0.0	18

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	75.665	0.565	0.1	1.6	O K
60 min Winter	75.755	0.655	0.1	1.8	O K
120 min Winter	75.837	0.737	0.1	1.9	O K
180 min Winter	75.791	0.691	0.1	1.9	O K
240 min Winter	75.740	0.640	0.1	1.8	O K
360 min Winter	75.680	0.580	0.1	1.6	O K
480 min Winter	75.623	0.523	0.1	1.5	O K
600 min Winter	75.569	0.469	0.1	1.3	O K
720 min Winter	75.520	0.420	0.1	1.2	O K
960 min Winter	75.434	0.334	0.1	0.9	O K
1440 min Winter	75.301	0.201	0.1	0.6	O K
2160 min Winter	75.176	0.076	0.1	0.2	O K
2880 min Winter	75.145	0.045	0.1	0.1	O K
4320 min Winter	75.132	0.032	0.1	0.1	O K
5760 min Winter	75.126	0.026	0.0	0.1	O K
7200 min Winter	75.121	0.021	0.0	0.1	O K
8640 min Winter	75.119	0.019	0.0	0.0	O K
10080 min Winter	75.116	0.016	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	84.226	0.0	32
60 min Winter	52.662	0.0	60
120 min Winter	31.800	0.0	114
180 min Winter	23.353	0.0	142
240 min Winter	18.644	0.0	180
360 min Winter	13.543	0.0	256
480 min Winter	10.792	0.0	328
600 min Winter	9.043	0.0	400
720 min Winter	7.823	0.0	470
960 min Winter	6.219	0.0	604
1440 min Winter	4.493	0.0	852
2160 min Winter	3.241	0.0	1188
2880 min Winter	2.568	0.0	1468
4320 min Winter	1.847	0.0	2148
5760 min Winter	1.461	0.0	2912
7200 min Winter	1.217	0.0	3672
8640 min Winter	1.048	0.0	4400
10080 min Winter	0.923	0.0	5120

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.005

Time (mins) From:	To:	Area (ha)
0	4	0.005

Model Details

Storage is Online Cover Level (m) 76.250

Trench Soakaway Structure

Infiltration Coefficient Base (m/hr)	0.06120	Trench Width (m)	2.6
Infiltration Coefficient Side (m/hr)	0.06120	Trench Length (m)	3.6
Safety Factor	2.0	Slope (1:X)	1000.0
Porosity	0.30	Cap Volume Depth (m)	0.650
Invert Level (m)	75.100	Cap Infiltration Depth (m)	0.650