



NPPF: Flood Risk Assessment

Oak Park, Havant

Ashley House plc

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1.0 Introduction

1.1 Background

- 1.1.1 At the request of Ashley House plc, a Flood Risk Assessment (FRA) has been undertaken, in accordance with the National Planning Policy Framework (NPPF)¹ and Planning Policy Guidance (PPG ID: 7)², for the proposed development of a Health and Well Being Campus on land adjacent to Education Office, River Way, Havant, PO9 2AW (see Drawing 1). This has included an assessment of the surface water drainage requirements of the site.
- 1.1.2 This report details the flood risk at the site and how this could be managed and mitigated to allow the site to be developed. The proposed development may present risks of flooding on-site and/or off-site if flooding is not effectively managed.
- 1.1.3 It is recognised that developments that are designed without regard to flood risk may endanger lives, damage property, cause disruption to the wider community, damage the environment, be difficult to insure and require additional expense on remedial works. Current guidance on development and flood risk³ identifies several key aims for a development to ensure that it is sustainable in flood risk terms. These aims are as follows:
- the development should not be at a significant risk of flooding and should not be susceptible to damage due to flooding;
 - the development should not be exposed to flood risk such that the health, safety and welfare of the users of the development, or the population elsewhere, is threatened;
 - normal operation of the development should not be susceptible to disruption as a result of flooding;
 - safe access to and from the development should be possible during flood events;
 - the development should not increase flood risk elsewhere;
 - the development should not prevent safe maintenance of watercourses or maintenance and operation of flood defences;
 - the development should not be associated with an onerous or difficult operation and maintenance regime to manage flood risk. The responsibility for any operation and maintenance required should be clearly defined;
 - future users of the development should be made aware of any flood risk issues relating to the development;
 - the development design should be such that future users will not have difficulty obtaining insurance or mortgage finance, or in selling all or part of the development, as a result of flood risk issues;
 - the development should not lead to degradation of the environment; and
 - the development should meet all of the above criteria for its entire lifetime, including consideration of the potential effects of climate change.
- 1.1.4 The FRA is undertaken with due consideration of these sustainability aims.

¹ Department for Communities and Local Government (2012) National Planning Policy Framework.

² Department for Communities and Local Government (2014) Planning Practice Guidance; Flood Risk & Coastal Change.

³ CIRIA (2004) Funders report CP/102 Development and Flood Risk – Guidance for the Construction Industry.

1.1.5 The key objectives of the FRA are:

- To assess the flood risk to the proposed development and to demonstrate the feasibility of appropriately designing the development such that any residual flood risk to the development and its users would be acceptable;
- To assess the potential impact of the proposed development on flood risk elsewhere and to demonstrate the feasibility of appropriately designing the development such that the development would not increase flood risk elsewhere; and
- To satisfy the requirements of national planning policy guidance which require FRAs to be submitted in support of planning applications.

1.2 Project Scope

- 1.2.1 In order to achieve the aims outlined above, a staged approach has been adopted in undertaking this FRA, in accordance with current best practice.
- 1.2.2 A screening study has initially been undertaken to identify whether there are any potential sources of flooding at the site, which may warrant further consideration. Any potential flooding issues identified in the screening study have subsequently been considered in a scoping study.
- 1.2.3 The aim of the scoping study is to review all available information and provide a qualitative assessment of the flood risk to the site and the impact of the site on flood risk elsewhere.

1.3 Report Structure

1.3.1 This FRA has the following report structure:

- Section 2 identifies the sources of information that have been consulted during the FRA;
- Section 3 describes the application area including the existing and proposed development;
- Section 4 outlines the flood risk to the existing and proposed development;
- Section 5 assesses the potential impacts of the proposed development on surface water drainage; and
- Section 6 presents a summary and conclusions.

2.0 Sources of Information

2.1 Sources of Information

- 2.1.1 General information regarding the site setting and hydrology of the application site has been obtained from the OS Explorer 120: Chichester
- 2.1.2 Information regarding the current flood risk at the application site, local flood defences and flood water levels have been checked against Environment Agency flood mapping available online.
- 2.1.3 A location plan of the area that forms the development is shown on Drawing 1 and 2.

2.2 Discussion with Regulators

- 2.2.1 A wide range of regulators should be consulted when carrying out an FRA. These include the Environment Agency, the Local Planning Authority (LPA), and Water Regulators. Consultation and discussions with the relevant regulators have been undertaken during this FRA.

2.3 Environment Agency

- 2.3.1 The Flood and Water Management Act 2010 gives the Environment Agency a strategic overview role for all forms of flooding and coastal erosion. They also have direct responsibility for the prevention, mitigation and remediation of flood damage for main rivers and coastal areas. The Environment Agency is the statutory consultee with regards to flood risk and planning.
- 2.3.2 Environment Agency Standing Advice and the NPPF has been consulted and reviewed during this FRA.
- 2.3.3 A data request was submitted to the Environment Agency in relation to flood risk at this site. All correspondences with the Environment Agency have been included within Appendix 3.

2.4 Local Authorities

- 2.4.1 Planning guidance written by Havant Borough Council regarding flood risk was consulted to assess the mitigation policies in place. These documents include the evidence base for the Local Development Framework and the Local Plan.
- 2.4.2 As part of this desktop study, the Hampshire County Council's online PUSH Strategic Flood Risk Assessment (SFRA) was also reviewed.
- 2.4.3 Flood mapping produced as part of the SFRA has been included within Appendix 5.

2.5 Water Utilities

- 2.5.1 Southern Water are responsible for the disposal of waste water in the area, whereas Portsmouth Water are responsible for the supply of clean water to the area.
- 2.5.2 Southern Water have a statutory obligation to maintain a register of properties/areas which are at risk of flooding from the public sewerage system, and this is shown on the DG5 Flood Register. Sewer asset plans were obtained from Southern Water, and have been included within Appendix 4.
- 2.5.3 Information with regards to sewer and water main flooding contained within the SFRA has also been reviewed as part of this FRA.

3.0 Description of Application Area

3.1 Site Location

- 3.1.1 The development site is located on land adjacent to Education Office, River Way, Havant, PO9 2AW (see Drawing 1 and 2).
- 3.1.2 The National Grid Reference of the site is 472054, 107170.

3.2 Existing Development

- 3.2.1 The development site is approximately 1.93 hectares (ha) in area and is currently comprised of mixed grassed areas, demolition material and hardstanding areas attributed to its former use.
- 3.2.2 The site is bounded by Lavant Drive to the south, Lavant Stream (Main River) to the east, Crossland Drive to the north and Leigh Road to the west.
- 3.2.3 The existing site is largely permeable with a small hardstanding area to the north-west of the site. The site is currently accessed by a track at the southern boundary, located off River Way.

3.3 Proposed Development

- 3.3.1 It is understood the proposals is for a Health and Well Being Campus, which will include; 80-bed nursing home, 51 extra care flats, 48 supported living flats, 79 car parking spaces. The proposed development will include access roads, gardens and landscaped areas.
- 3.3.2 The proposed development (see Appendix 1) may present risks of flooding on-site and/or off-site if flooding is not effectively managed.
- 3.3.3 Further details with regard to the proposed development can be found in the information submitted with the planning application.

3.4 Topographic Information

- 3.4.1 A topographic survey was carried out by Pulse Mapping Ltd on December 5th 2014. A copy of the topographic survey has been included within Appendix 2.
- 3.4.2 The site was found to be relatively level, with a gentle slope, falling from north to south. The eastern boundary falls in a southerly direction from 13.46mAOD to 12.53mAOD over a distance of approximately 200m (1:215 slope). The western boundary of the site falls from 14.11mAOD to 12.61mAOD in a southerly direction over a distance of 90m. (1:60 slope).

3.5 Catchment Hydrology

- 3.5.1 Based on a review of the Environment Agency Flood map and Ordnance Survey mapping, Lavant Stream, a 'Main River' (watercourses maintained by the Environment Agency) flows in a southerly direction along the eastern boundary of the site. A Lavant Stream flows along the sites eastern boundary, it passes through a culvert as it approaches the site under Crossland Road, beneath the site entrance along the eastern boundary, and again beneath Lavant Drive to the southern extent of the site.
- 3.5.2 The Environment Agency flood map also shows a second unnamed 'Main River', which flows in a westerly direction, within culvert, along the northern boundary of the site. This unnamed

- Main River appears to convey flow between Lavant Stream and another unnamed Main River located approximately 700m to the west of the site.
- 3.5.2 The Ordnance Survey mapping shows an unnamed land drain (an 'Ordinary Watercourse' maintained by the Local Drainage Authority) located approximately 110m to the south of the site.
- 3.5.3 Based on a site walkover during September 2014, Lavant Stream was observed as being dry, and overgrown with vegetation (see Figure 3.1 below).
- 3.5.4 As noted below in Section 5.5, soakaway test were undertaken onsite, which found that the lowest rate of infiltration from three trial pits being 0.213m/hr, which indicated high infiltration capacity. It is therefore likely that Lavant Stream is often dry, becoming active during heavy/prolonged storm events when baseflows are high.
- 3.5.5 There is an retention basin located in the south-eastern corner of the site which was associated with the sites surface water drainage arrangement (see Section 3.6 below).

Figure 3.1: Photograph of Lavant Stream



3.6 Southern Water Assets

- 3.6.1 Southern Water asset plans show that there is an Ø675mm public foul sewer which flows across/within the north-west corner of the site.
- 3.6.2 Foul water discharges from the existing education office into the Ø150mm Southern Water sewer before connecting into an Ø225 foul sewer in Leigh Road. Surface water discharges into Lavant Stream via a retention basin.
- 3.6.3 All correspondence with Southern Water, including asset plans, have been included within Appendix 4.

3.7 Soils and Geology

- 3.7.1 Soils mapping produced by the National Soils Resources Institute (Cranfield University) show that the site is underlain by freely draining slightly acid loamy soils.
- 3.7.2 The British Geological Survey (BGS) online mapping (Geology of Britain Viewer) shows that the superficial deposits to the east of the site is Head (clayey gravel, with areas to the west of the site shown as being River Terrace Deposits (sand silt and clay). The bedrock geology beneath the site is London Clay Formation (Sand, Silt, and Clay).
- 3.7.3 Based on the above, the permeability of the soil is potentially high, whereas the geology is potentially low.

4.0 Flood Risk

4.1 Potential Sources of Flooding – Level 1 Screening Study

- 4.1.1 All potential sources of flooding must be considered for any proposed development. A summary of the potential sources of flooding and a review of the potential risk posed by each source at the application site is presented in Table 4.1.

Table 4.1: Potential Risk Posed by Flooding Sources

Flooding Source	Potential Flood Risk at Application Site?	Potential Source	Data Sources
Fluvial flooding	Yes	Lavant Stream (Main River)	Environment Agency, SFRA
Tidal flooding	No	None Identified	Environment Agency
Flooding from rising / high groundwater	Yes	Secondary Aquifer	BGS Map, SFRA
Overland flow flooding	Yes	Poor permeability	JBA Map. SFRA
Flooding from artificial drainage systems	Yes	Sewers	Southern Water, SFRA
Flooding due to infrastructure failure	No	None Identified	Environment Agency. OS Map

Fluvial Flooding Sources

i. Environment Agency Flood Map

- 4.1.2 As noted above in Section 3.5, Lavant Stream flows south along the eastern boundary of the site. There is also an unnamed Main River flowing within culvert along the northern boundary. This unnamed Main River appears to convey flow between Lavant Stream and another Main River located approximately 700m to the west of the site. An unnamed land drain is located 110m to the south of the site.
- 4.1.3 The Environment Agency flood map shows that the site is located largely within Flood Zone 1; outside the 1 in 1000 year return period (<0.1% AEP) (see Drawing 5). It is noted that there are negligible areas of Flood Zones 2 and 3 associated with Lavant Stream along the eastern boundary of the site.
- 4.1.4 It is noted that the Environment Agency flood maps do not differential Flood Zone 3a from 3b ('Functional Floodplain') which is located within the extent of the 1 in 20 year return period (5% AEP).

ii. Modelled Flood Levels

- 4.1.5 As part of the consultation process, the Environment Agency provided modelled flood levels for Lavant Stream, which flows south along the sites eastern boundary. The flood levels show that the level falls from 13.16mAOD at the northern extent of the site, to 11.46mAOD at the southern extent of the site.
- 4.1.6 All correspondences with the Environment Agency, including the point location map, have been included within Appendix 3.

- 4.1.7 It is noted that the modelled flood levels provided by the Environment Agency were extracted from a 2004 JFlow model. JFlow modelling is considered a 'broad-brushed' modelling technique, designed to derive flood zones at a national scale.
- 4.1.8 Models were run using a Digital Terrain Model (DTM) with a 5m x 5m grid, however the DTM grids were generalised to between 5m and 100m (depending on the type of model and location, for reasons such as processing speed). Fluvial modelling produced depth data which can be processed using the DTM to provide water level data. However the differing grid sizes means that there is a significant potential for inaccuracy in producing level data, because of the DTM generalisation. Therefore, because of the nature of the model and the DTM, in many cases it will not be possible to confidently assess whether or not a site is above the resulting water level. This is because there are further inherent uncertainties in the depth calculation and within the DTM itself.
- 4.1.9 Based on the above, the flood depths are not considered suitable for use in site specific FRA's. A full copy of the JFlow Information Warning has been included within Appendix 3.
- 4.1.10 However, the JFlow modelling data is the most accurate source of information available regarding fluvial flooding along the eastern boundary of the site. Based on a comparison of flood levels with the site topography, the site is located +400mm above the 1 in 1000 year modelled flood levels.

iii. Historic Flooding

- 4.1.11 There is no information available for historic flooding in the immediate vicinity of the proposed development, based on consultation with the Environment Agency and a review of the SFRA.
- 4.1.12 The British Hydrological Society "Chronology of British Hydrological Event⁴" has no records of flooding in the immediate area. No other historical records of flooding for the site have been recorded.
- 4.1.13 Drawing 7 shows that the site is located outside the mapped extent of historic fluvial flooding events. It is however noted that there is an area of flooding associated with the December 2000 event along Lavant Stream, upstream from the site (upstream from Crossland Drive).

iv. Flood Defences

- 4.1.14 The Environment Agency flood map shows that the site is not protected by flood defence measures. However, consultation with the Environment Agency found that there are flood defences associated with the watercourse to the eastern and northern boundaries.
- 4.1.15 The eastern boundary is protected a natural bank privately maintained with an estimated design standard of 1:50. The northern boundary is protected by a culverted channel maintained by the Environment Agency with an estimated design standard of 1:40.

v. Summary of Fluvial Flooding

- 4.1.16 Based on the above, the site has a low risk of fluvial flooding. Therefore, flooding from this source is considered negligible and has not been considered further within this FRA.

Tidal Flooding Sources

- 4.1.17 The site is not located within the vicinity of tidal flooding sources. Therefore, flooding from this source is considered negligible and has not been considered further within this FRA.

⁴ <http://www.dundee.ac.uk/geography/cbhe/>

Flooding from rising / high groundwater

- 4.1.18 The BGS Groundwater Flooding Susceptibility Map indicates that the entire the site is located within an area considered potential for groundwater flooding to occur at surface (see Drawing 3). This can be explained by the underlying soils and geology (see Section 3.7), whereby the freely draining soils are situated above the clayed/low permeable geology. Based on findings within Section 3.7, the bedrock geology is not likely to be an aquifer.
- 4.1.19 It is however noted that soakaway tests (see Appendix 6 and Section 5.5) showed that groundwater was experienced at depths of 1.9m bgl. The BGS data set is a hazard data set, not a risk data set, meaning that it does not provide any information about the likelihood of a groundwater flooding event occurring. It is noted that the BGS flood map is to be used as a screening tool, and should not be used to inform planning decisions.
- 4.1.20 Groundwater flooding tends to occur sporadically in both location and time. When groundwater flooding does occur, it tends to mostly affect low-lying areas, below surface infrastructure and buildings (for example, tunnels, basements and car parks) underlain by permeable rocks (aquifers).
- 4.1.21 As no below surface infrastructure and buildings are proposed for the site, as such the site is not considered at risk of flooding from rising / high groundwater. This will be further mitigated by the adoption of a surface water management strategy for the site. Based on the above, the risk of groundwater flooding can be mitigated to a low and acceptable level.

Overland flow flooding

- 4.1.22 Overland land flow flooding tends to occur sporadically in both location and time.
- 4.1.23 The JBA Surface Water flood map shows that the majority of the site is located outside the mapped extent of overland flooding (see Drawing 4). A small area of the site, located in the south-east is located within the mapped extents of the 1 in 75 year extent with, 1 in 200 and 1 in 1000 events on the fringes of this extent. There is also a small area of the site located within the mapped extent of the 1 in 75 year flood extent within the western extent of the site.
- 4.1.24 The existing site already has some hardstanding areas, which are impermeable. This explains the mapped surface water flooding described below. It is however noted that these areas of the site are served by an existing drainage system, therefore surface water flooding is managed within the site.
- 4.1.25 Based on the above, the majority of the site is at low risk of overland flow flooding. A small area is at medium to high risk of overland flow flooding. This will be managed by the adoption of a surface water management strategy for the site (see Section 5), which will mitigated overland flow flooding to a low and acceptable level.

Flooding from Artificial Drainage Systems/Infrastructure Failure

i. Artificial Drainage Systems

- 4.1.26 Sewer flooding occurs when urban drainage networks become overwhelmed and maximum capacity is reached. This can occur if there is a blockage in the network causing water to back up behind it or if the sheer volume of water draining into the system is too great to be handled. This type of flooding tends to occur sporadically in both location and time.

- 4.1.27 The majority of sewers are built to the guidelines within Sewers for Adoption⁵. These sewers have a design standard to the 1 in 30 year flood event and therefore it is likely that the majority of sewer systems will surcharge during rainstorm events with a return period greater than 30 years (e.g. 100 years). This was clearly the case during the 2007 national flooding event when drains and sewers were rapidly overwhelmed by the intense and prolonged rainfall, and as such played a considerable role in the flood event.
- 4.1.28 Southern Water is responsible for the disposal of waste water with Portsmouth Water in charge of clean water within the area. Information with regards to sewer and water main flooding contained within the SFRA has been consulted as part of this FRA. Like all Water Companies, Southern Water have a statutory obligation to maintain a register of properties/areas which are at risk of flooding from the public sewerage system, and this is shown on the DG5 Flood Register. This includes records of flooding incidents from public foul sewers, combined sewers and surface water sewers which are maintained by the Water Company. When an incident is reported, a decision chart is used to assess whether the properties/areas are 'at risk' and then the record is added to the appropriate register.
- 4.1.29 Based on a review of Southern Water asset plans, a surface water sewer discharges into the existing retention basin to the south of the Education Office, flows from the retention basin discharge at a restricted rate into the Lavant Stream via a Ø150mm pipe with non-return flap valve.
- 4.1.30 A Ø150mm southern water foul sewer runs west along Lavant Drive before connecting into a Ø225mm foul sewer in Leigh Road.
- 4.1.31 Based on the above, there is a low risk of flooding from sewers. However, the proposed development will increase the impermeable area of the site, and in turn increase surface water runoff. It is proposed that this source of flooding can however be mitigated to a low and acceptable level through the adoption of a surface water management strategy (see Section 5).

ii. Flooding from Reservoirs

- 4.1.32 Based on the Environment Agency Flood Map, the site is located outside the extent of flooding sourced from reservoirs. Therefore, flooding from this source is considered negligible and has not been considered further within this FRA.

4.2 Environment Agency Flood Map and NPPF Guidance

- 4.2.1 A review of the Environment Agency's flood map indicates that the site is located largely within 1 in 1000 annual probability of river flooding in any year (<0.1% AEP). The site is therefore considered to be at low risk of fluvial flooding. It is noted that there are negligible areas of Flood Zone 2 and 3 located along the eastern boundary of the site.
- 4.2.2 Based on a comparison of flood levels with the site topography, the site is located +400mm above the 1 in 1000 year modelled flood levels.
- 4.2.3 The Flood Zones are the current best information on the extent of the extremes of flooding from rivers or the sea that would occur without the presence of flood defences, because these can be breached, overtopped and may not be in existence for the lifetime of the development.
- 4.2.4 The Environment Agency Flood Zones and acceptable development types are explained in Table 4.2. All development types are generally deemed acceptable in terms of flood risk in Flood Zone 1.

⁵ WRC (2010) Sewers for Adoption 6th Edition.

- 4.2.5 In PPG ID: 7 (Table 2) appropriate uses have been identified for the Flood Zones. Applying the Flood Risk Vulnerability Classification in Table 2 and 3 of the PPG ID: 7, the proposed development is classified as 'more vulnerable'. All development is considered suitable within Flood Zone 1.
- 4.2.6 Based on the above, it is recommended that the site is developed sequentially, whereby the developable area is limited to Flood Zone 1 (low risk) and excluded from Flood Zones 2 and 3 (medium to high risk).
- 4.2.7 As noted in Section 4.3 below, an easement should be provided along the reach of the watercourse, which is free from development. As such, the loss of developable area within the site would be considered negligible, based on a sequential approach. It is noted that 'water compatible' uses (i.e. landscaped or recreational areas) are considered appropriate within Flood Zone 2 and 3a/b, provided that ground is not raised, thereby removing the requirement for floodplain compensation.
- 4.2.8 Assuming that the site is developed sequentially, the Sequential Test should be passed and the Exception Test should not be required.

Table 4.2: Environment Agency Flood Zones and Appropriate Land Use

Flood Zone	Probability	Explanation	Appropriate Land use
Zone 1	Low	Less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%)	All development types generally acceptable
Zone 2	Medium	Between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% 0.1%) in any year	Most development type are generally acceptable
Zone 3a	High	A 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year	Some development types not acceptable
Zone 3b	'Functional Floodplain'	Land where water has to be flow or be stored in times of flood. SFRAs should identify this zone (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1% flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes)	Some development types not acceptable

Note: The Flood Zones are the current best information on the extent of the extreme flood from rivers or the sea that would occur without the presence of flood defences, because these can be breached, overtopped and may not be in existence for the lifetime of the development.

Table 4.3: Flood Risk Vulnerability and Flood Zone ‘Compatibility’ as identified in Table 3 of PPG ID: 7

Flood Risk Vulnerability classification (see Table 1 of PPG ID: 7 to the NPPF)	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	Yes	Yes	Yes	Yes	Yes
Zone 2	Yes	Yes	Exception test required	Yes	Yes
Zone 3a	Exception test required	Yes	No	Exception test required	Yes
Zone 3b ‘Functional Floodplain’	Exception test required	Yes	No	No	No

Key: Yes: Development is appropriate, No: Development should not be permitted.

4.3 Flood Risk and Mitigation Measures

Primary Flood Sources

- 4.3.1 Fluvial flooding, sourced from Lavant Stream (which bounds the eastern boundary), is considered the primary source of flooding to the site. It is therefore recommended that the site is developed sequentially, whereby the developable area is limited to Flood Zone 1 (low risk) and excluded from the negligible areas of Flood Zones 2 and 3 (medium to high risk).
- 4.3.2 It is recommended that an appropriate sized easement is provided along the reach of the watercourses, which is free from development. The easement would provide access for inspection and maintenance activities, which may require vehicle access. Access for maintenance is essential to maintain the channel and conveyance of flow (i.e. remove blockages and overgrown vegetation).
- 4.3.3 Based on the sequential approach, and recommended easement along the watercourses, the loss of developable area within the site would be considered negligible. As noted above in Section 4.2, ‘water compatible’ uses could be provided within Flood Zone 2 and 3a/b.
- 4.3.4 As noted in Section 4.1, the flood depths associated with the JFlow modelling are not considered suitable for use in site specific FRA’s. However, the JFlow modelling data is the most accurate source of information available regarding fluvial flooding along the eastern boundary of the site. Based on a comparison of flood levels with the site topography, the site is located +400mm above the 1 in 1000 year modelled flood levels.
- 4.3.5 Based on the proposed layout (see Appendix 1) the main access to the site is located off Old Copse Road, which crosses Lavant Stream. The Environment Agency flood map and historic flooding information indicates that the site access is not compromised by fluvial flooding, and appears to provide safe access by foot or vehicle (including emergency services).

Secondary Flood Sources

- 4.3.6 Secondary flooding sources were identified within the site, including; groundwater flooding and overland flow flooding. These sources of flooding can however be mitigated to a low and acceptable level through the adoption of a surface water management strategy (see Section 5 below). Furthermore, no below ground infrastructure and buildings are proposed for the site.
- 4.3.7 It is however recommended that a precautionary approach is taken whereby finished floor levels are located a minimum of +150mm above external levels to mitigate any residual flooding.

5.0 Site Drainage

5.1 Surface Water Drainage

- 5.1.1 It is recognised that consideration of flood issues should not be confined to the floodplain. The alteration of natural surface water flow patterns through developments can lead to problems elsewhere in the catchment, particularly flooding downstream. For example, replacing vegetated areas with roofs, roads and other paved areas can increase both the total and the peak flow of surface water runoff from the development site. Changes of land use on previously developed land can also have significant downstream impacts where the existing drainage system may not have sufficient capacity for the additional drainage. This section considers the existing drainage system at the application site and potential impacts resulting from the development.
- 5.1.2 A surface water management strategy for the development will be required to manage and reduce the flood risk posed by the surface water runoff from the site. The developer will be required to ensure that any scheme for surface water should build in sufficient capacity for the entire site.
- 5.1.3 There are three possible options to discharge the surface water runoff in accordance with requirement H3 of the Building Regulations 2000⁶. Rainwater shall discharge to one of the following, listed in order of priority:
- i. An adequate soakaway or some other adequate infiltration system; or, where that is not reasonably practicable,
 - ii. a watercourse; or where that is not reasonably practicable,
 - iii. a sewer.
- 5.1.4 An assessment of the surface water runoff rates has been undertaken, in order to determine the surface water options and attenuation requirements for the site. The assessment considers the impact of the site compared to current conditions. Therefore, the surface water attenuation requirement for the developed site can be determined and reviewed against existing arrangements.
- 5.1.5 The surface water drainage arrangements for any development site should be such that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates prior to the proposed development, unless specific off-site arrangements are made and result in the same net effect.

5.2 Existing Drainage System

- 5.2.1 The development site is approximately 1.93 hectares (ha) in area and currently comprises scrubland, mature trees and hardstanding areas.

Foul Drainage

- 5.2.2 The report by Hampshire County Council⁷ (Appendix 7) and Southern Water asset plans (Appendix 3) detail the existing public sewers on and in the vicinity of the site.
- 5.2.3 Asset plans show a large Ø675mm public sewer running from east to west from Old Copse Road to Leigh Road, within the site boundary. It is noted that there is a connecting section of

⁶ Office of the Deputy Prime Minister, The Building Regulations 2000.

⁷ Hampshire County Council – Land at Oak Park, Havant. Preliminary Drainage Strategy 2013.

disused public sewer within the site boundary, thought to have been removed. This is to be investigated further post-planning.

- 5.2.4 A Ø150mm public sewer (confirmed by ALP report⁸) runs from east to west within Lavant Drive and transfers flows from the adjacent developments to the Ø225mm public sewer running north to south down Leigh Road.
- 5.2.5 A sporadic private sewer exists onsite, but due to the staged demolition of the site, full connectivity cannot be established. It is proposed that these connections will be re-utilised as part of the redevelopment.

Surface Water Drainage

- 5.2.6 A Ø225mm public sewer flows within Lavant Drive and discharges flows into an existing attenuation basin within the south-eastern corner before discharging into Lavant Stream.
- 5.2.7 Flows from the attenuation basin to Lavant Stream are restricted by a Ø150mm pipe, fitted with a non-return valve.
- 5.2.8 A sporadic private sewer system exists onsite, due to the staged demolition of the site, full connectivity cannot be established. Some connections into the attenuation basin from within the hardstanding areas of the site have been confirmed visually and through the use of Ground Penetrating Radar (GPR).

5.3 Proposed Development

- 5.3.1 It is understood the proposal is for a Health and well campus inclusive of 179 units, which will include access roads, gardens and landscaped areas.
- 5.3.2 Based on the site layout (see Appendix 1), the proposed development will be approximately 61% (1.17ha) impermeable. Current site layouts show that the development will increase the impermeable area by approximately 0.65 ha as shown in Table 5.1 (refer to Drawing 8)

Table 5.1: Impermeable Area

	Existing Buildings and Hardstanding	Proposed Buildings and Hardstanding	Difference
Area (Ha)	0.52	1.17	+0.65 ha
Percentage of Total Site Area (%)	27	61	+34%

- 5.3.3 Based on the above it has been shown that the proposed development will increase the overall areas of impermeable surfaces. Attenuation of surface runoff for the proposed development will be provided by the existing drainage arrangement (see above).

5.4 Developed Site Drainage

- 5.4.1 Soakaway tests were carried out by Enzygo Ltd during December 2014. Outputs from the soakaway tests have been included within Appendix 6. A summary of the findings is included below:

⁸ A048-003 Havant Health and Wellbeing Campus Drainage Strategy. February 2015.

- Three soakaway pits were located throughout the site:
 - SA1 - Located: north-centre extent of site, Infiltration Rate: 2.22E-03m/s (medium)
 - SA2 - Located: middle of western extent, Infiltration Rate: 3.67E-04m/s (medium)
 - SA3 - Located: middle eastern extent of site, Infiltration Rate: 5.93E-05m/s (medium)
- 5.4.2 Based on the above, the use of soakaways within the site is considered to be feasible. The individual infiltration rates for the respective site locations were used by ALP in the drainage report.
- 5.4.3 Deeper infiltration features would be limited by natural groundwater levels, which were encountered at depths below 1.9m.
- 5.4.4 It is noted that due to the limited size of the site, the use of infiltration based SUDS, beyond the existing attenuation basin, may be limited.

5.5 Proposed Surface Water Management Strategy

- 5.5.1 The surface water management strategy for the proposed development will manage and reduce the flood risk posed by the surface water runoff from the site.
- 5.5.2 It is proposed that the existing surface water drainage arrangement is maintained, whereby surface water is directed to the existing attenuation basin, which then infiltrates/discharged to watercourse. It is noted in the HCC report that the attenuation basin was oversized, therefore the additional hardstanding associated with the proposed development would be accommodated and attenuated.
- 5.5.3 A surface water management strategy for the proposed development has been developed by ALP (Document A048-003, dated February 2015) to manage and reduce the flood risk posed by the surface water runoff from the site.

5.6 Proposed Foul Water Management Strategy

- 5.6.1 It is proposed that the site re-establishes the existing connection to the fowls sewer network, as per Section 5.3 above.
- 5.6.2 A foul water management strategy for the proposed development has been developed by ALP (Document A048-003, dated February 2015) to manage the foul water discharge from the site.

6.0 Summary and Conclusions

6.1 Introduction

- 6.1.1 At the request of Ashley House plc, a Flood Risk Assessment (FRA) has been undertaken, in accordance with the National Planning Policy Framework (NPPF)⁹ and Planning Policy Guidance (PPG ID: 7), for the proposed development of a Health and Wellbeing centre at land adjacent to River Way, Havant, PO9 2AW. This has included an assessment of the surface water drainage requirements of the site.
- 6.1.2 This report details the flood risk at the site and how this could be managed and mitigated to allow the site to be developed in support of the enclosed planning application. The proposed scale of development may present risks of flooding on-site and/or off-site if flooding is not effectively managed.

6.2 Assessment of Flood Risk

- 6.2.1 The FRA has demonstrated the following:
- Lavant Stream 'Main River' flows in a southerly direction along the eastern boundary of the site, with another unnamed 'Main River' flowing within culvert in a westerly direction along the northern boundary of the site.
 - The detailed flood map provided by the Environment Agency show that the site is located largely within Flood Zone 1 (low risk); outside the extent of the 1 in 1000 annual probability of flooding / <0.1% AEP. There is however a negligible areas of Flood Zones 2 and 3 (medium to high risk) located along the eastern boundary of the site.
 - Based on a comparison of flood levels with the site topography, the site is located +400mm above the 1 in 1000 year modelled flood levels.
 - In PPG ID: 7 the appropriate uses have been identified for the Flood Zones. The proposed development is classified as 'more vulnerable'. All development types are generally deemed acceptable in terms of flood risk in Flood Zone 1.
 - It is proposed that the site is developed sequentially, such that all development is limited to Flood Zone 1 (low risk). Any proposed 'water compatible' development (i.e. landscaped or recreational areas) would be considered suitable within Flood Zone 2 and 3a/b. It is recommended that ground levels are not raised within the flood zone to avoid the need for floodplain compensation
 - Assuming that the site is developed sequentially, then the Sequential Test should be passed and the Exception Test should not be required.
 - Secondary flooding sources were identified within the site, including; groundwater flooding and overland flow flooding. These sources of flooding can however be mitigated to a low and acceptable level through the adoption of a surface water management strategy. Furthermore, no below ground infrastructure and buildings are proposed for the site. It is recommended that a precautionary approach is taken whereby finished flood levels are located a minimum of +150mm above external levels to mitigate residual flooding.

⁹ Department for Communities and Local Government (2012) National Planning Policy Framework.

6.2.2 Table 6.1 summarises the probability and consequence of flooding for the site with and without mitigation measures.

Table 6.1: Probability and consequences of all sources of flooding

Flooding Source	Potential Source	Probability	Consequence & Impact Without Mitigation	Consequence & Impact With Mitigation	Comment
Fluvial flooding	Lavant Stream, Unnamed Main River.	Low to High	Low to High	Negligible	Sequential development of site, i.e. limit development to Flood Zone 1.
Tidal flooding	None	Negligible	Negligible	Negligible	None
Flooding from rising / high groundwater	Aquifer	Low	Low	Negligible	No occupation of properties below ground level. Negligible impact with correct management (i.e. appropriated sized drainage system). No groundwater found to a depth of 2m.
Overland flow flooding	Poor Permeability	Low to High	Low to High	Negligible	Negligible impact with correct management (i.e. appropriated sized drainage system).
Flooding from artificial drainage systems	Sewers	Low	Low	Negligible	Will not affect the site area with adequate easement
Flooding due to infrastructure failure	None	Negligible	Negligible	Negligible	None

Key: Green - Negligible, Yellow - Low, Orange - Medium and Red - High; based on consequence and impact with mitigation from each flooding source.

6.3 Site Drainage

6.3.1 In addition, the FRA has considered the potential impact of the development on surface water runoff rates.

Surface Water

- 6.3.2 It is proposed that the existing surface water drainage arrangement are maintained and enhanced, whereby surface water is directed to the existing attenuation basin, which then infiltrates and is discharged to the adjacent watercourse.
- 6.3.3 A surface water management strategy for the proposed development has been developed by ALP (Document A048-003, dated February 2015) to manage and reduce the flood risk posed by the surface water runoff from the site.

Foul Water

- 6.3.4 It is proposed that the site re-establishes the existing connection to the fouls sewer network.
- 6.3.5 A foul water management strategy for the proposed development has been developed by ALP (Document A048-003, dated February 2015) to manage the foul water discharge from the site.

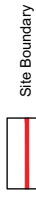
Drainage Summary

- 6.3.6 It has been demonstrated that both surface water and foul flows from the site can be managed such that flood risk to and from the site following the proposed development is not increased.

6.4 Conclusion

- 6.4.1 This FRA demonstrates that the proposed development would be operated with minimal risk from flooding, would not increase flood risk elsewhere and is compliant with the requirements of the NPPF.
- 6.4.2 The development should not therefore be precluded on the grounds of flood risk or drainage.

Key



Site Boundary

Existing Development - Total Site area is 1.93ha

Permeable Area
73% of the site is permeable measuring 1.41ha

Impermeable Area
27% of the site is impermeable measuring 0.52ha



EXISTING DEVELOPMENT

Key



Site Boundary

Proposed Development - Total Site area is 1.93ha

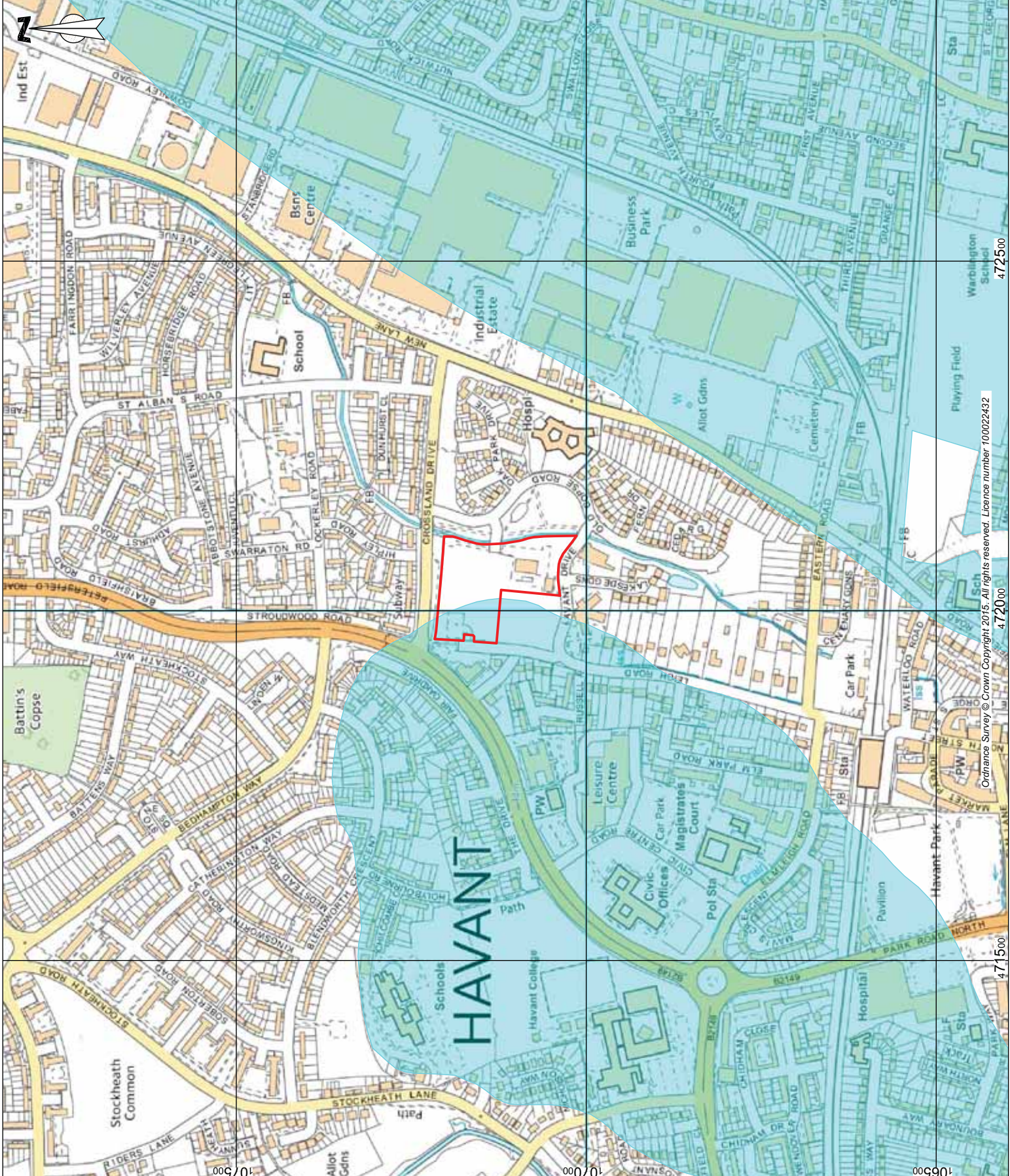
Permeable Area
39% of the site is permeable measuring 0.76ha

Impermeable Area
61% of the site is impermeable measuring 1.17ha



PROPOSED DEVELOPMENT

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DATE	DRAWING NO.	DRAWING TITLE
Jan 2015	8	Permeable and Impermeable Areas
DRAWN	CHECKED	CLIENT
MG	EOC	Ashley House plc



Key



Site Boundary
Geological Indicators of Flooding
from Inland Flooding

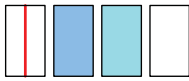


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DRAWN:	MG	CHECKED:	EOC
		DATE:	Jan 2015
		PROJECT:	Oak Park, Havant
		TITLE:	Geological Indicators of Flooding (based on geological deposits)
		DRAWING NO:	6

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Key



Site Boundary

Flood Zone 3

Flood Zone 2

Flood Zone 1



STEP Business Centre, Wortley Rd, Sheffield, S36 2UH

CLIENT:
Ashley House plc

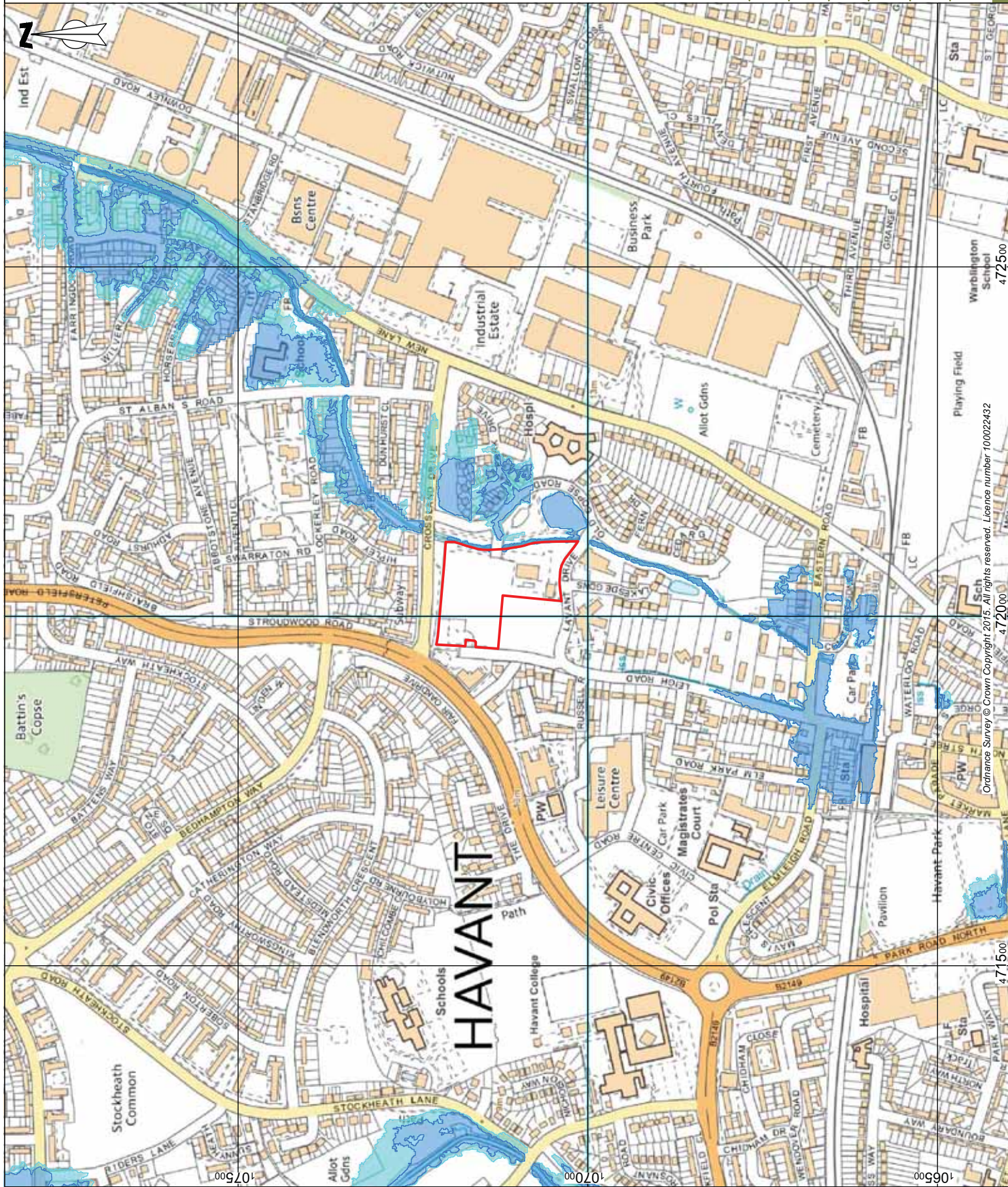
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DATE: Jan 2015

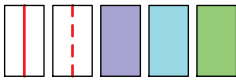
PROJECT:
Oak Park, Havant

TITLE
Environment Agency Flood Zones

DRAWING NO:
5



Key



Site Boundary

Search Extent

1 in 75 Year Surface Water Flooding

1 in 200 Year Surface Water Flooding

1 in 1000 Year Surface Water Flooding



STEP Business Centre, Wortley Rd, Sheffield, S36 2UH

CLIENT:

Ashley House plc

PROJECT REF:

1:5,000@A3 CRM:1112.005.D.004.1

DATE:

MG Jan 2015

CHECKED:

EO'C

PROJECT:

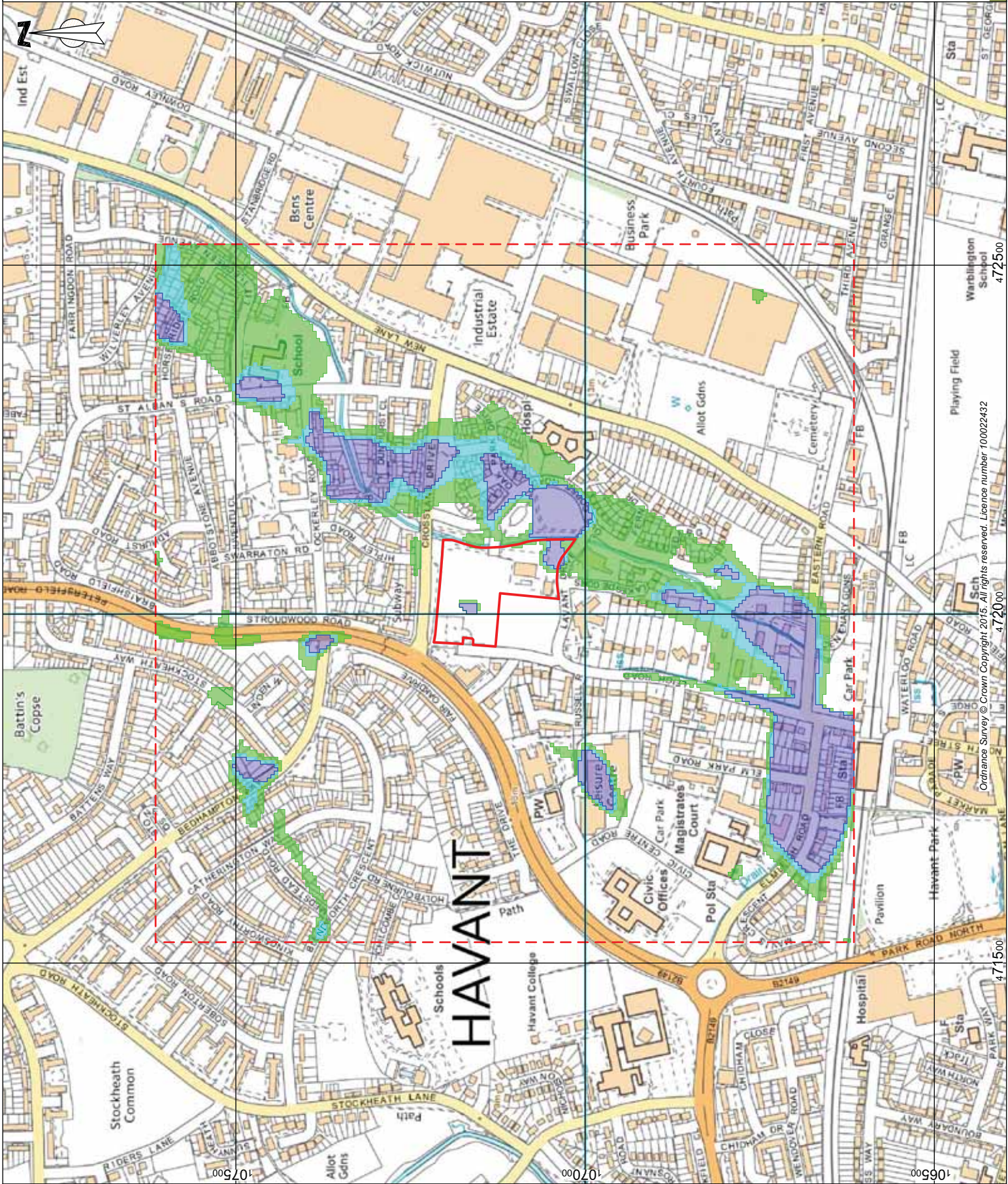
Oak Park, Havant

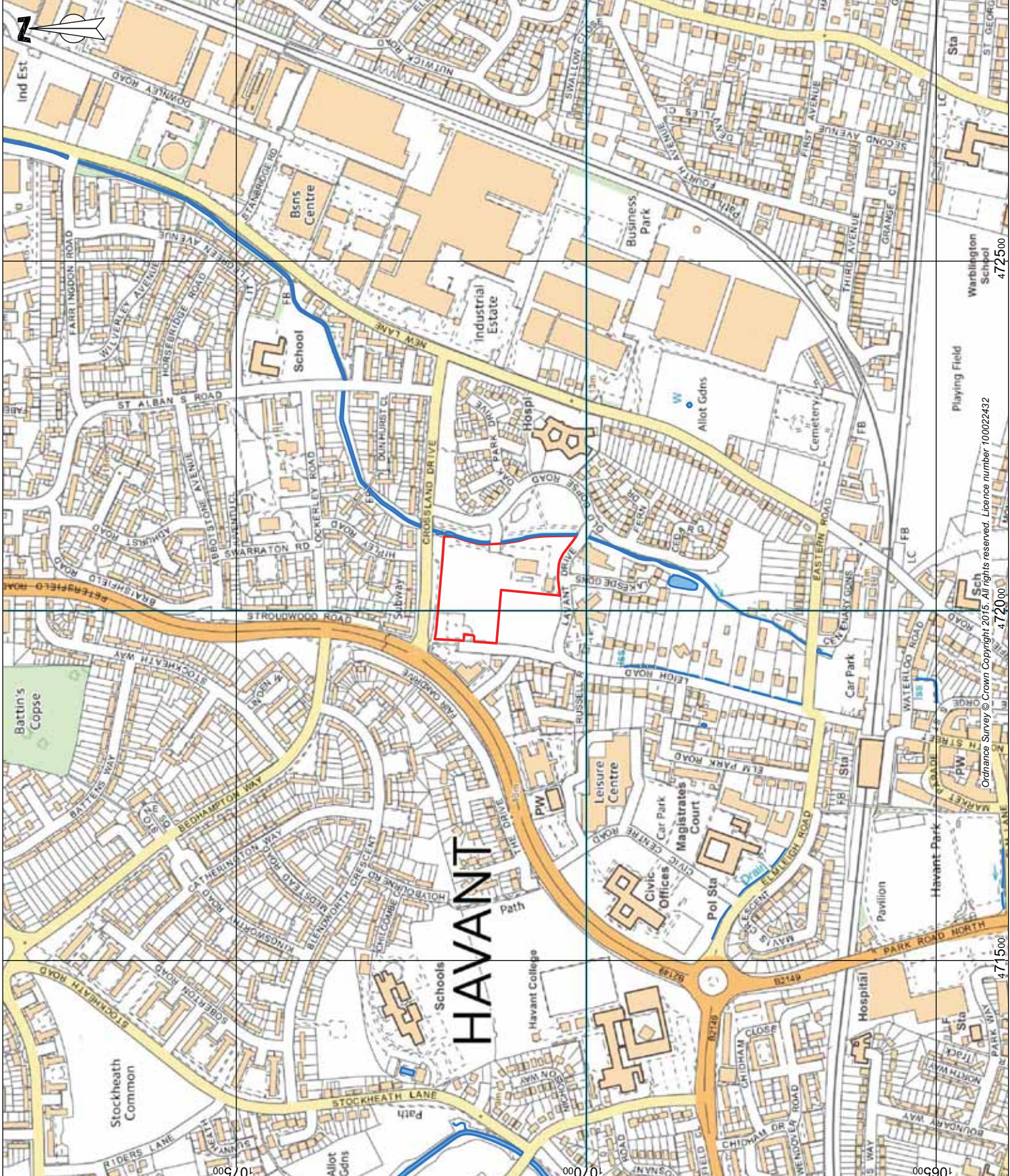
TITLE

JBA Surface Water Flooding

DRAWING NO

4.1





Key



Site Boundary

Surface Water Features

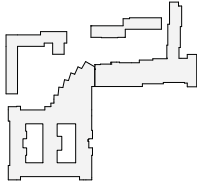
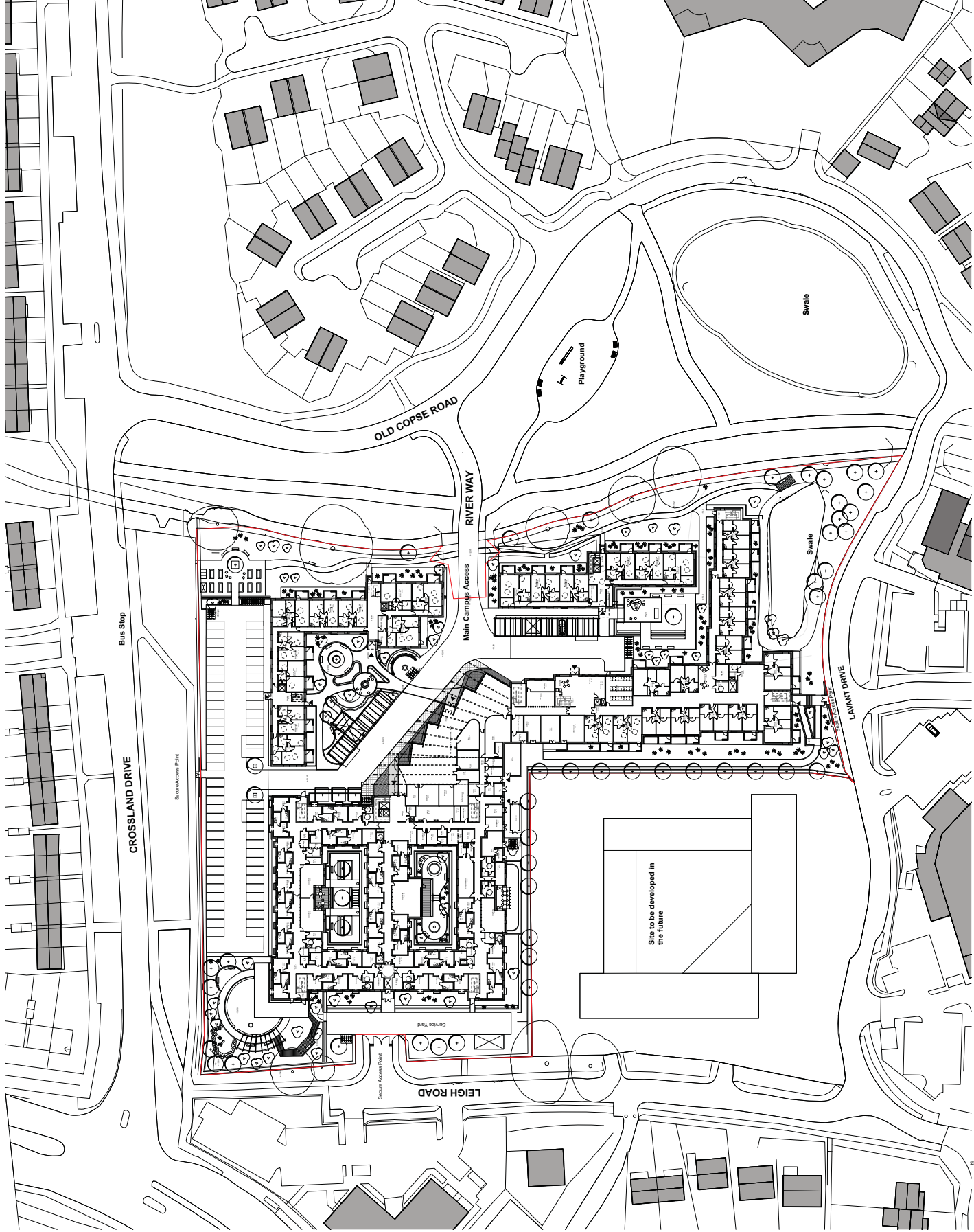


STEP Business Centre, Wortley Rd, Sheffield, S36 2UH

CLIENT:	Ashley House plc		
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DRAWN:	MG	CHECKED:	EO'C
DATE:	Jan 2015	PROJECT:	Oak Park, Havant
TITLE	Surface Water Features		
DRAWING NO.	2		

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Appendix 1 – Proposed Layout



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A 05/01/15 W/015 Planning

Rev Date Proj/Draw Description

Penoyre
pasadgo



28-42 Baner Street
London EC1Y 8QE
020 7250 3477
penoyreasad.com

Client
Hampshire Living Space

Project
Oak Park Health & Wellbeing Campus

Drawing Title
Site Plan as proposed

Project Name
Planning

Date
05.03.2015

Scale
1:500 @ A1 / 1:1000 @ A3

Drawing Number
598-PL-101

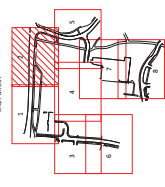
Revision
A

598-G-101

Masterplan Layout

1:500

Appendix 2 – Topographic Survey

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6 Clivedon Office Village
Lancaster Road, Cressex Business Park
High Wycombe, Buckinghamshire
MK9 3 3QZ

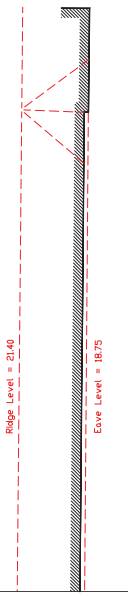
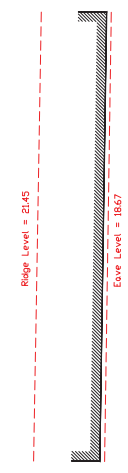
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Officer Way
Hawart
Hampshire
Hampshire, N.H.

PROJECT REF: P180922 - Oak Park	DATE: 05/12/14
DRAWN: RSG	

SCALE: AO 1:500	REV: PO1
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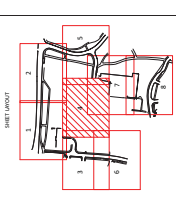
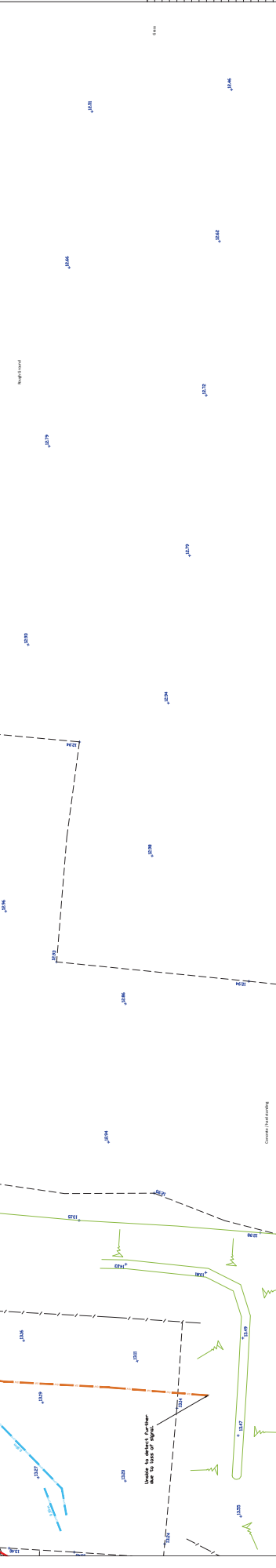
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 THE BOTTY, ALBION PARK
 GUILDFORD, SURREY, GU5 9BH
 T: 01483 527 972
 E: pulse@pulse-mapping.com
 W: www.pulse-mapping.com



NOTES

A series of drawings showing the proposed layout of the site, including the proposed road layout, the proposed parking area, and the proposed building footprint. The drawings are intended to provide a visual representation of the proposed development and to illustrate the proposed layout of the site.

The drawings are intended to provide a visual representation of the proposed development and to illustrate the proposed layout of the site. The drawings are intended to provide a visual representation of the proposed development and to illustrate the proposed layout of the site.



ABBREVIATIONS

1	Proposed Road
2	Proposed Parking
3	Proposed Building Footprint
4	Proposed Fencing
5	Proposed Landscaping
6	Proposed Drainage
7	Proposed Utilities
8	Proposed Other

LEGEND

1	Proposed Road
2	Proposed Parking
3	Proposed Building Footprint
4	Proposed Fencing
5	Proposed Landscaping
6	Proposed Drainage
7	Proposed Utilities
8	Proposed Other

PROJECT REF: P40021 - Oak Park

DATE: 05/12/14

CHECKED: [Signature] SHEET NO: 4 of 8

SCALE: AS SHOWN

PROJECT: Oak Park

SITE: [Signature]

PROJECT REF: P40021 - Oak Park

DATE: 05/12/14

CHECKED: [Signature] SHEET NO: 4 of 8

SCALE: AS SHOWN

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SITE: [Signature]

PROJECT REF: P40021 - Oak Park

DATE: 05/12/14

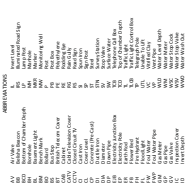
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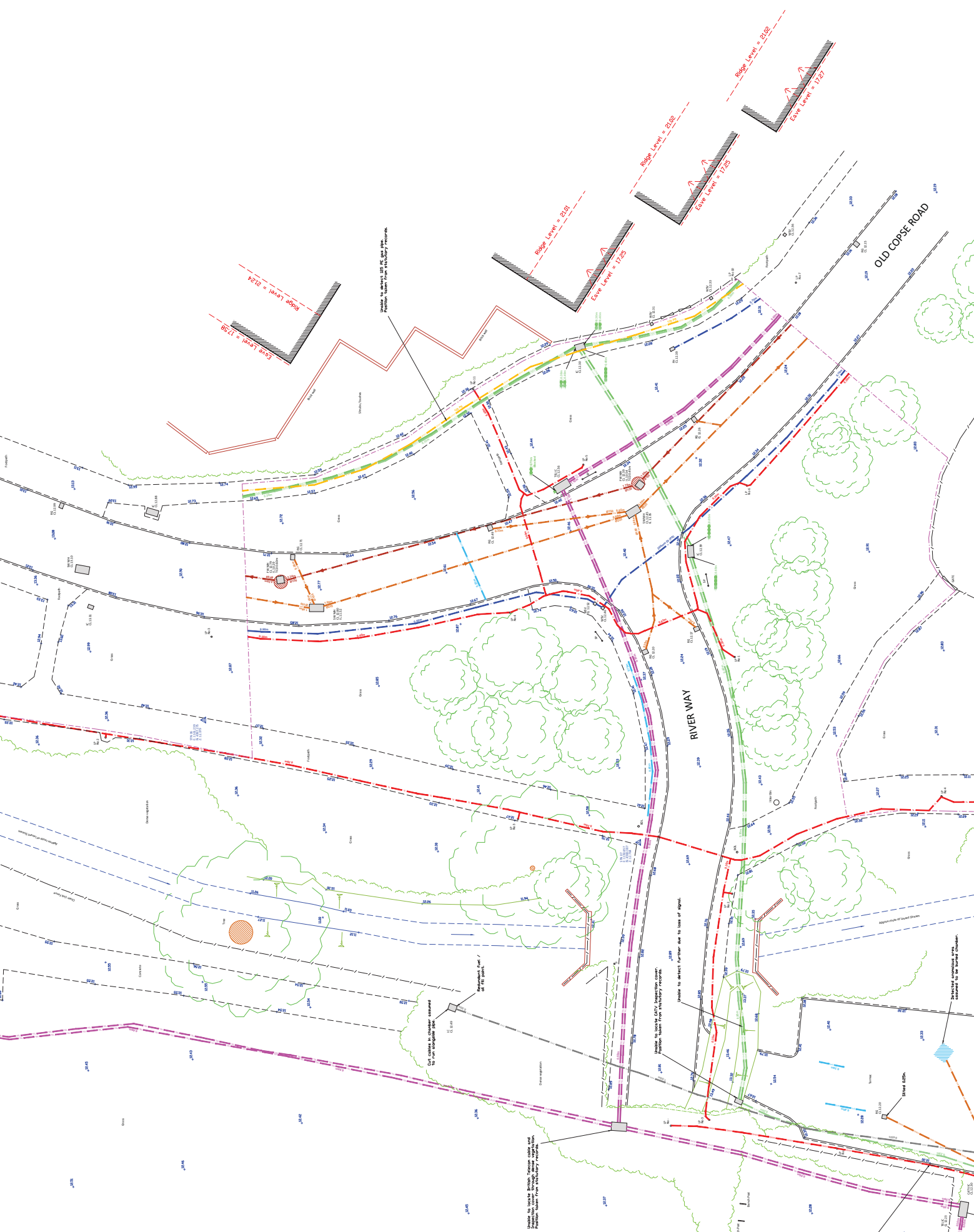
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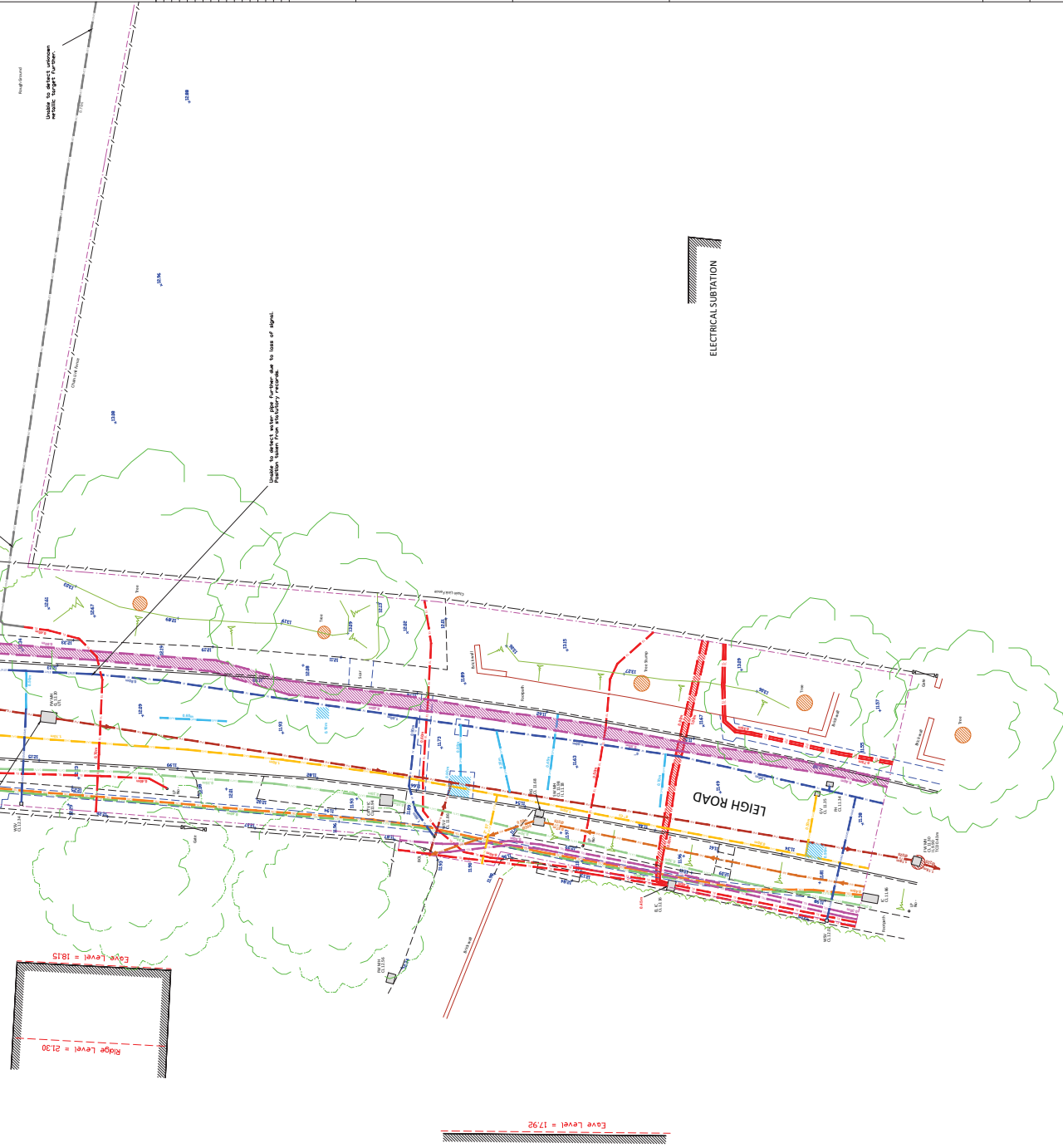
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Pulse mapping

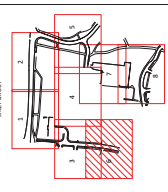
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GUILDFORD, SURREY, GU5 9BH

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E: pulse@pulse-mapping.com
W: www.pulse-mapping.com





Bullseye Core Coordinates (NAD 83)				
Station	Easting	Northing	Depth	Type
01	1985.004	9000.001	13.492	Livecore Ball
02	1985.004	9004.004	14.342	Livecore Ball
03	1985.004	9014.004	13.937	Livecore Ball
04	1985.038	9014.004	13.937	Livecore Ball
05	1985.038	9018.004	13.937	Livecore Ball
06	1985.038	9022.004	13.937	Livecore Ball
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08	1985.038	9030.004	14.342	Livecore Ball
09	1985.038	9034.004	14.342	Livecore Ball
10	1985.038	9038.004	14.342	Livecore Ball
11	1985.038	9042.004	14.342	Livecore Ball
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14	1985.038	9054.004	14.342	Livecore Ball
15	1985.038	9058.004	14.342	Livecore Ball
16	1985.038	9062.004	14.342	Livecore Ball
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18	1985.038	9070.004	14.342	Livecore Ball
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AMERICAN VINTAGE		EUROPEAN VINTAGE	
AV	Age in Years	A	Age in Years
WZ	Wine Zone	W	Wine Zone
WZ1	Wine Zone 1	W1	Wine Zone 1
WZ2	Wine Zone 2	W2	Wine Zone 2
WZ3	Wine Zone 3	W3	Wine Zone 3
WZ4	Wine Zone 4	W4	Wine Zone 4
WZ5	Wine Zone 5	W5	Wine Zone 5
WZ6	Wine Zone 6	W6	Wine Zone 6
WZ7	Wine Zone 7	W7	Wine Zone 7
WZ8	Wine Zone 8	W8	Wine Zone 8
WZ9	Wine Zone 9	W9	Wine Zone 9
WZ10	Wine Zone 10	W10	Wine Zone 10
WZ11	Wine Zone 11	W11	Wine Zone 11
WZ12	Wine Zone 12	W12	Wine Zone 12
WZ13	Wine Zone 13	W13	Wine Zone 13
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WZ15	Wine Zone 15	W15	Wine Zone 15
WZ16	Wine Zone 16	W16	Wine Zone 16
WZ17	Wine Zone 17	W17	Wine Zone 17
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WZ19	Wine Zone 19	W19	Wine Zone 19
WZ20	Wine Zone 20	W20	Wine Zone 20
WZ21	Wine Zone 21	W21	Wine Zone 21
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WZ23	Wine Zone 23	W23	Wine Zone 23
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WZ79	Wine Zone 79	W79	Wine Zone 79
WZ80	Wine Zone 80	W80	Wine Zone 80

[illegible]

CLIENT: Ashley House plc
6 Cliveden Office Village
Lancaster Road, Cressex Business Park
High Wycombe, Buckinghamshire
MK12 3 9QZ

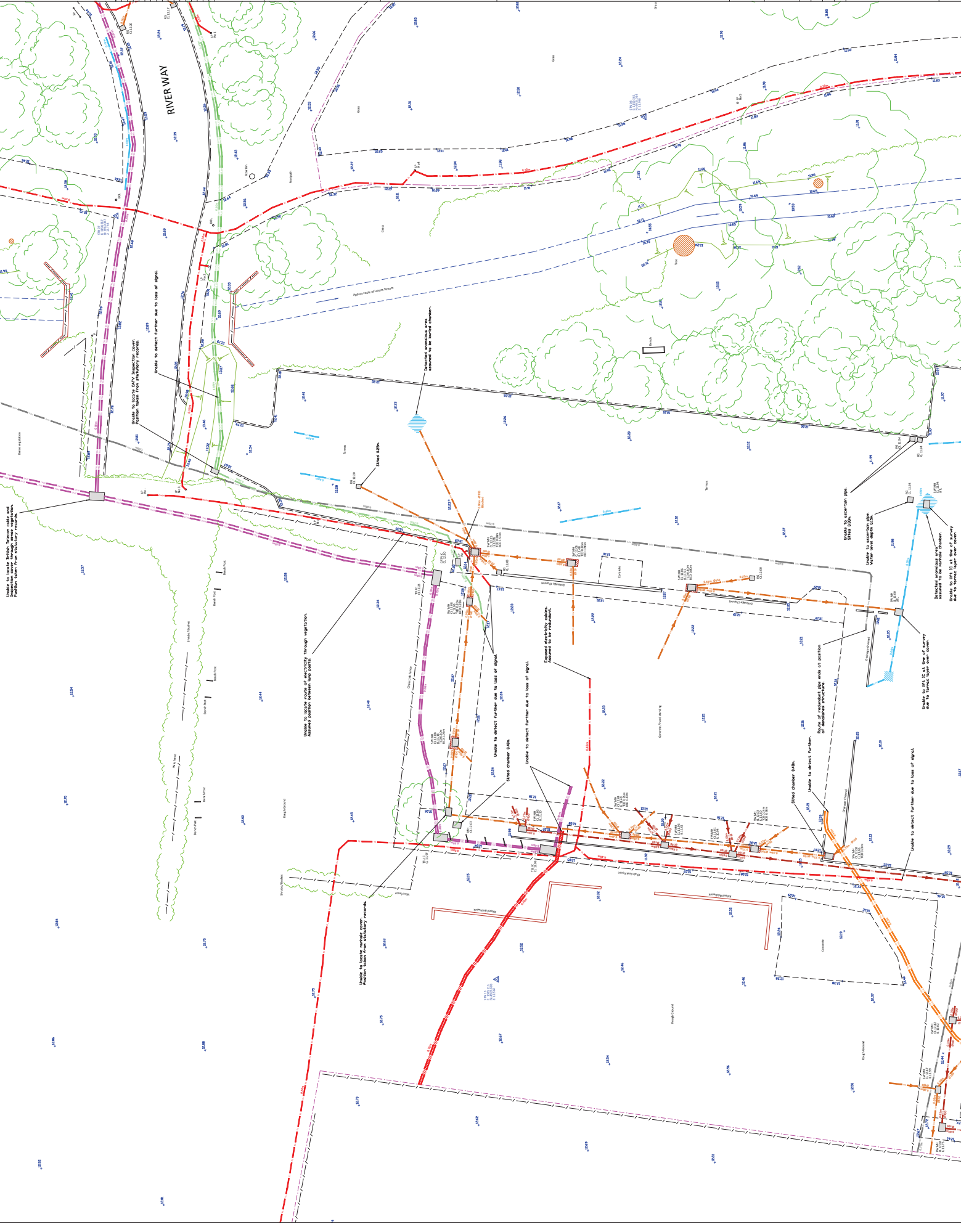
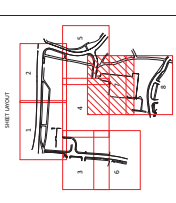
SITE: Oak Park
Off River Way
Havant
Hampshire
PO9 3LH

PROJECT REF: P140921 - Oak Park	
DRAWN: RFG	DATE: 05/12/14
CHECKED: NJS	SHEET NO: 6 of 8
SCALE: AS 1:300	REV: P01

PulseMapping

PULSE MAPPING LTD
THE BOTHY, ALBURY PARK
GUILDFORD, SURREY, GU5 9BH

T: 01483 527 972
E: pulse@pulse-mapping.com
W: www.pulse-mapping.com

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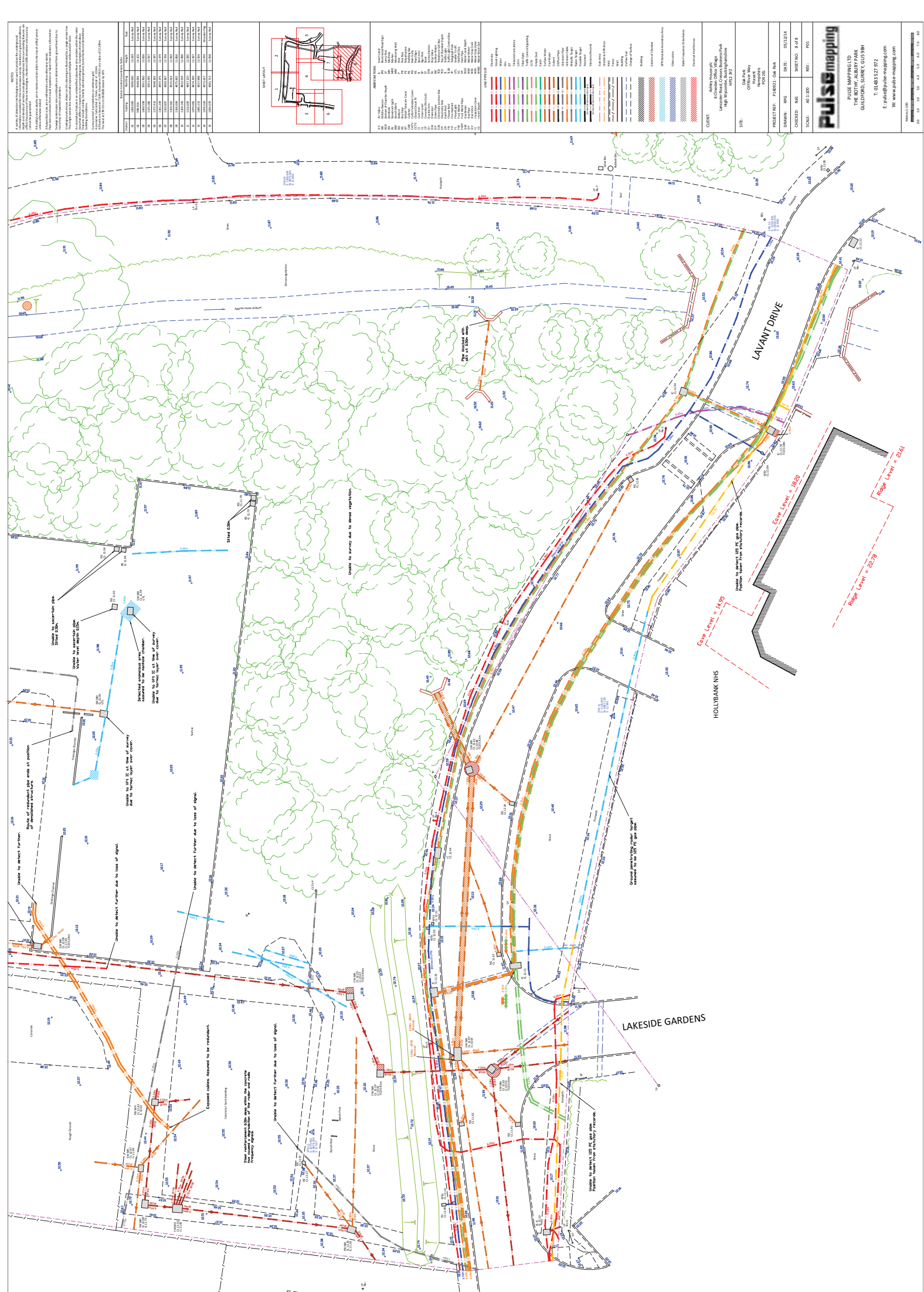
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	Maths	Blue
	Science	Green
	History	Yellow
	Geography	Purple
	Art	Orange
	Music	Pink
	Physical Education	Light Blue
	Language	Light Green
	Other	Light Yellow
Specific	Maths	Blue
	Science	Green
	History	Yellow
	Geography	Purple
	Art	Orange
	Music	Pink
	Physical Education	Light Blue
	Language	Light Green
	Other	Light Yellow
	Other	Light Yellow
Other	Maths	Blue
	Science	Green
	History	Yellow
	Geography	Purple
	Art	Orange
	Music	Pink
	Physical Education	Light Blue
	Language	Light Green
	Other	Light Yellow
	Other	Light Yellow
Other	Maths	Blue
	Science	Green
	History	Yellow
	Geography	Purple
	Art	Orange
	Music	Pink
	Physical Education	Light Blue
	Language	Light Green
	Other	Light Yellow
	Other	Light Yellow

CURRENT	Address: 4000 Old Village Highway 101, Suite 100 High Wycombe, Bucks HP12 3PQ UK	Country: UK	City: High Wycombe	Office: 0494 471 100 Mobile: 07792 339333 Fax: 0494 471 101	Website: www.pulse-mapping.com
DATE:	DATE:	DATE:	DATE:	DATE:	DATE:
PROJECT REF:	P140521 ON RNS	DRAWN:	ING	SHEET:	01/12/14
CHECKED:	ING	DATE:	7 of 8	REV:	P01
SCALE:	As 1:50				



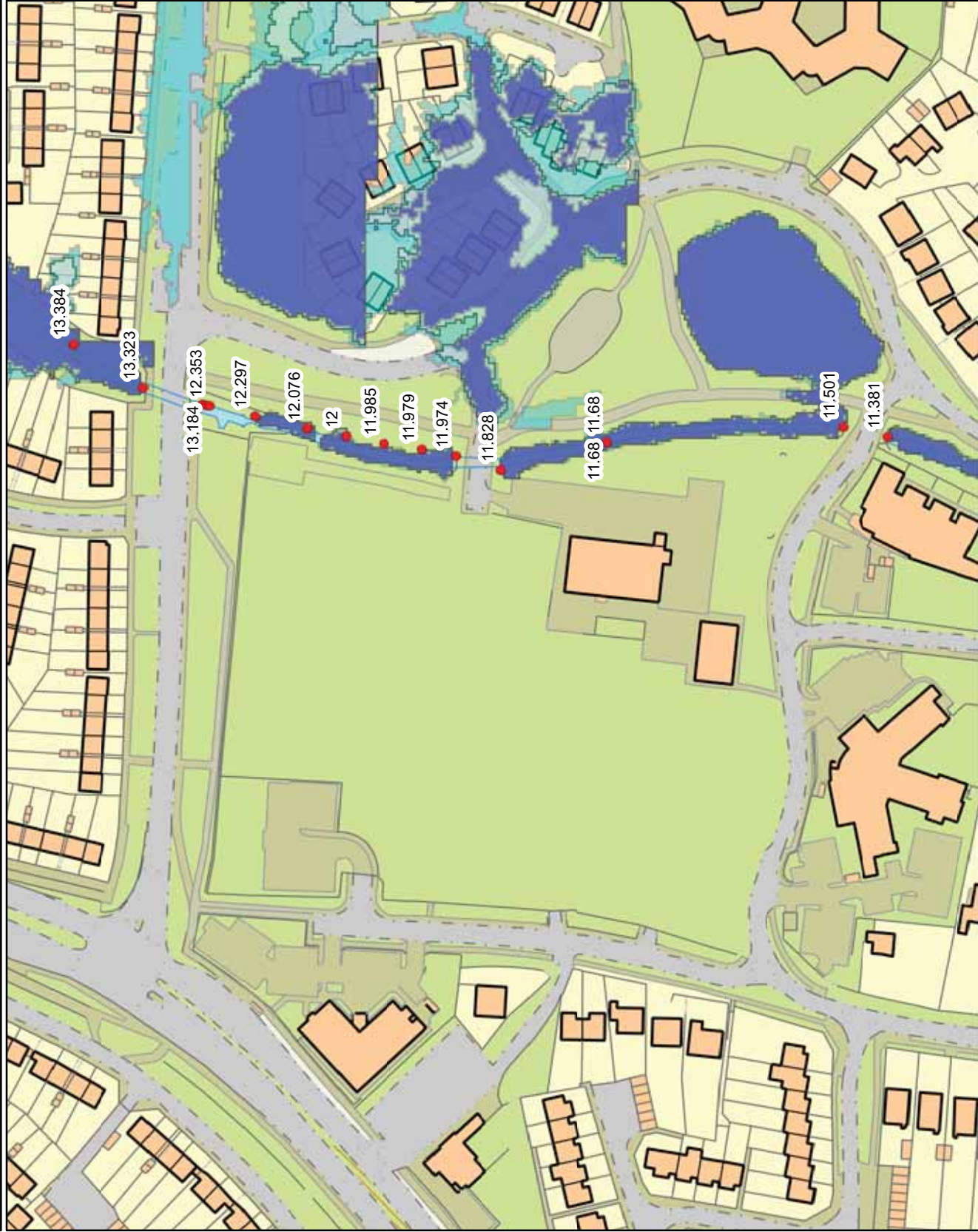
THE PULSE MAPPING LTD
THE ROTH, ALPOT PARK
GROVEWOOD, SUDBURY, GLOSHP1
T: 01453 532 978
E: info@pulse-mapping.com
W: www.pulse-mapping.com

REVISION NO.	DATE	BY	REASON
01	2014	200	4.52
02	2014	200	4.52
03	2014	200	4.52
04	2014	200	4.52
05	2014	200	4.52
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07	2014	200	4.52
08	2014	200	4.52
09	2014	200	4.52
10	2014	200	4.52

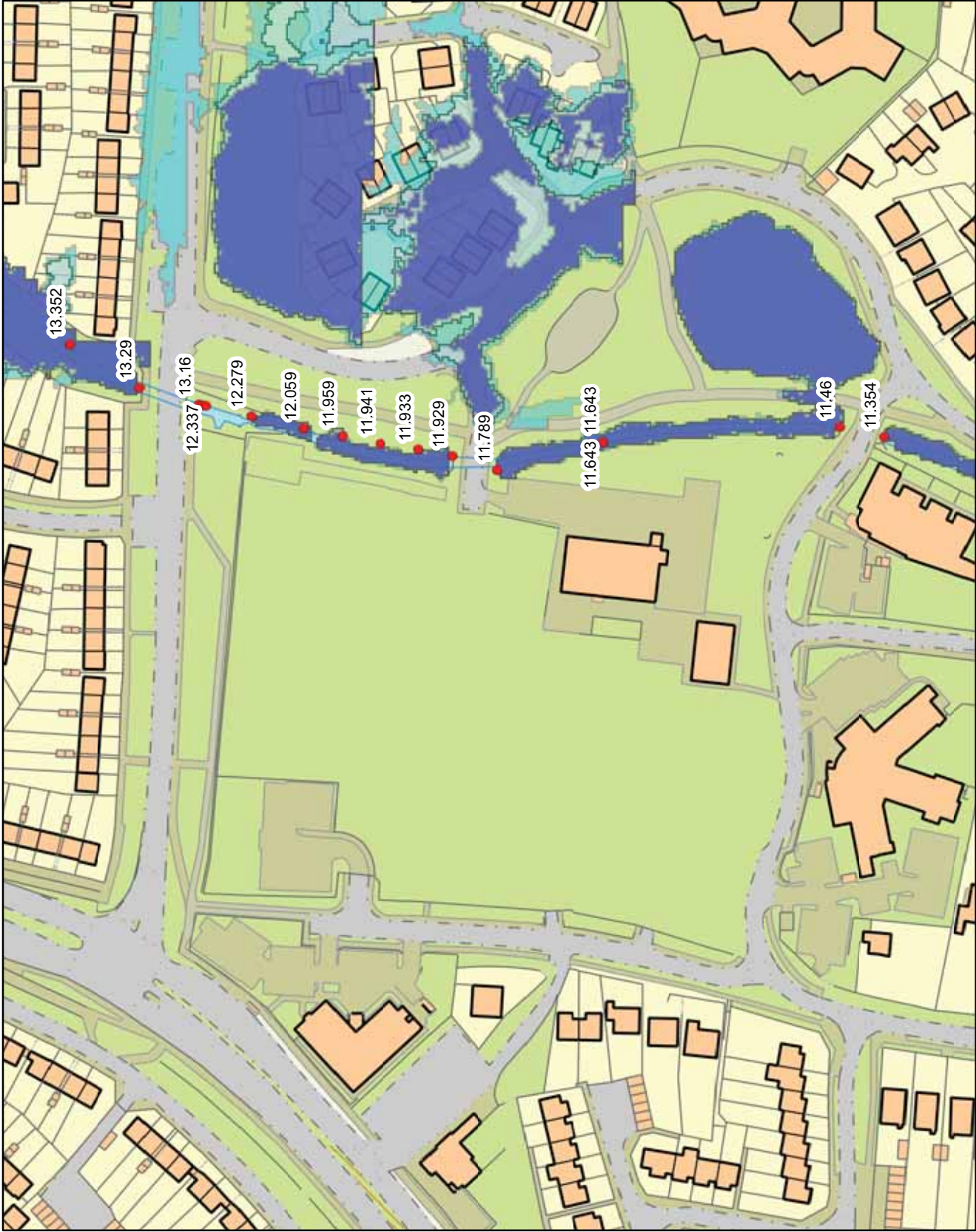


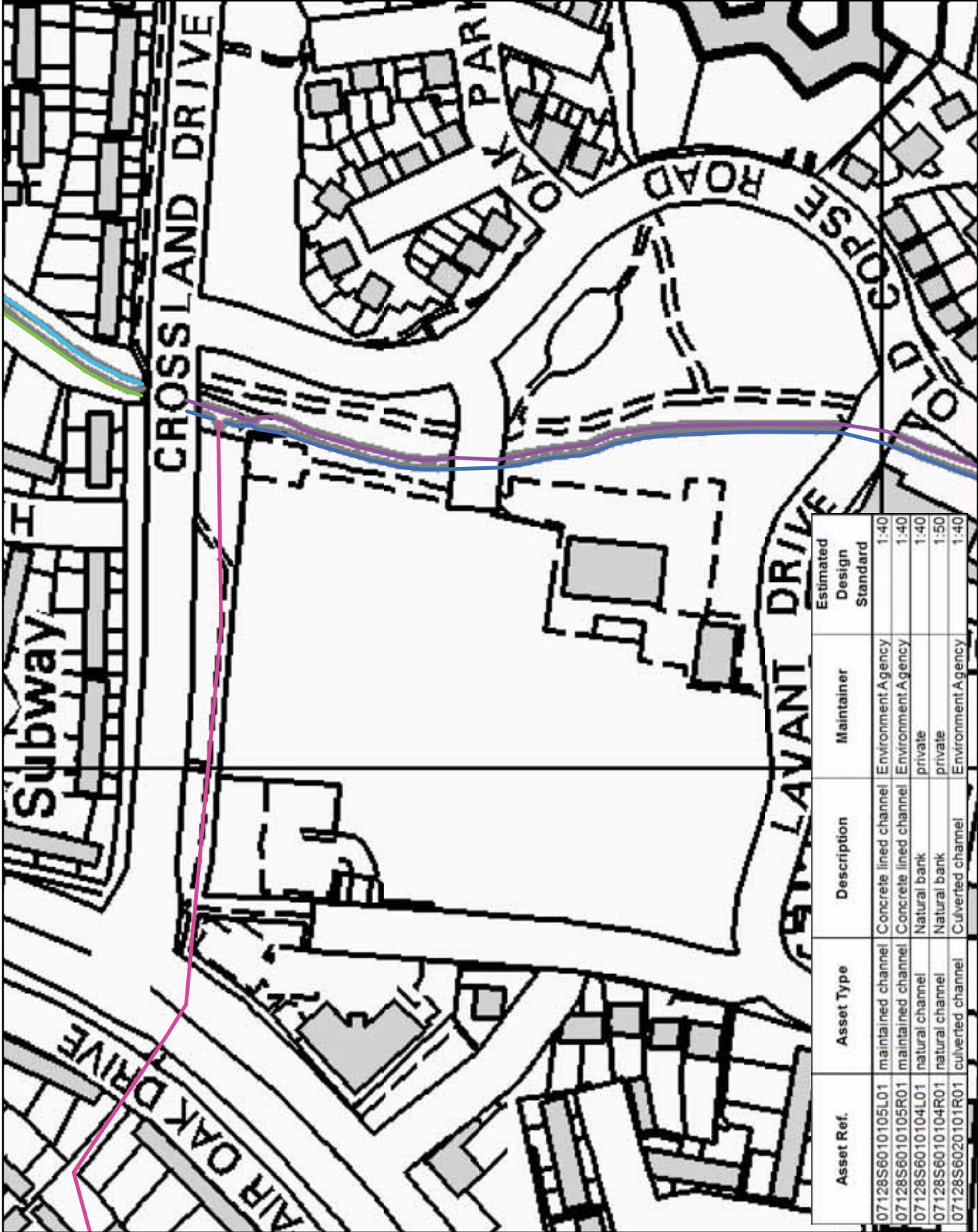
Appendix 3 – Environment Agency Correspondence

100 Year Climate Change Flood Levels (in mAoD) Centered on River Way - Created 23 Dec 2014 (Ref: SSD/5498)



100 Year Flood Levels (in mAoD) Centered on River Way - Created 23 December 2014 (Ref: SSD/5498)

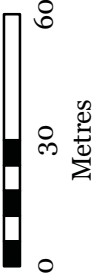




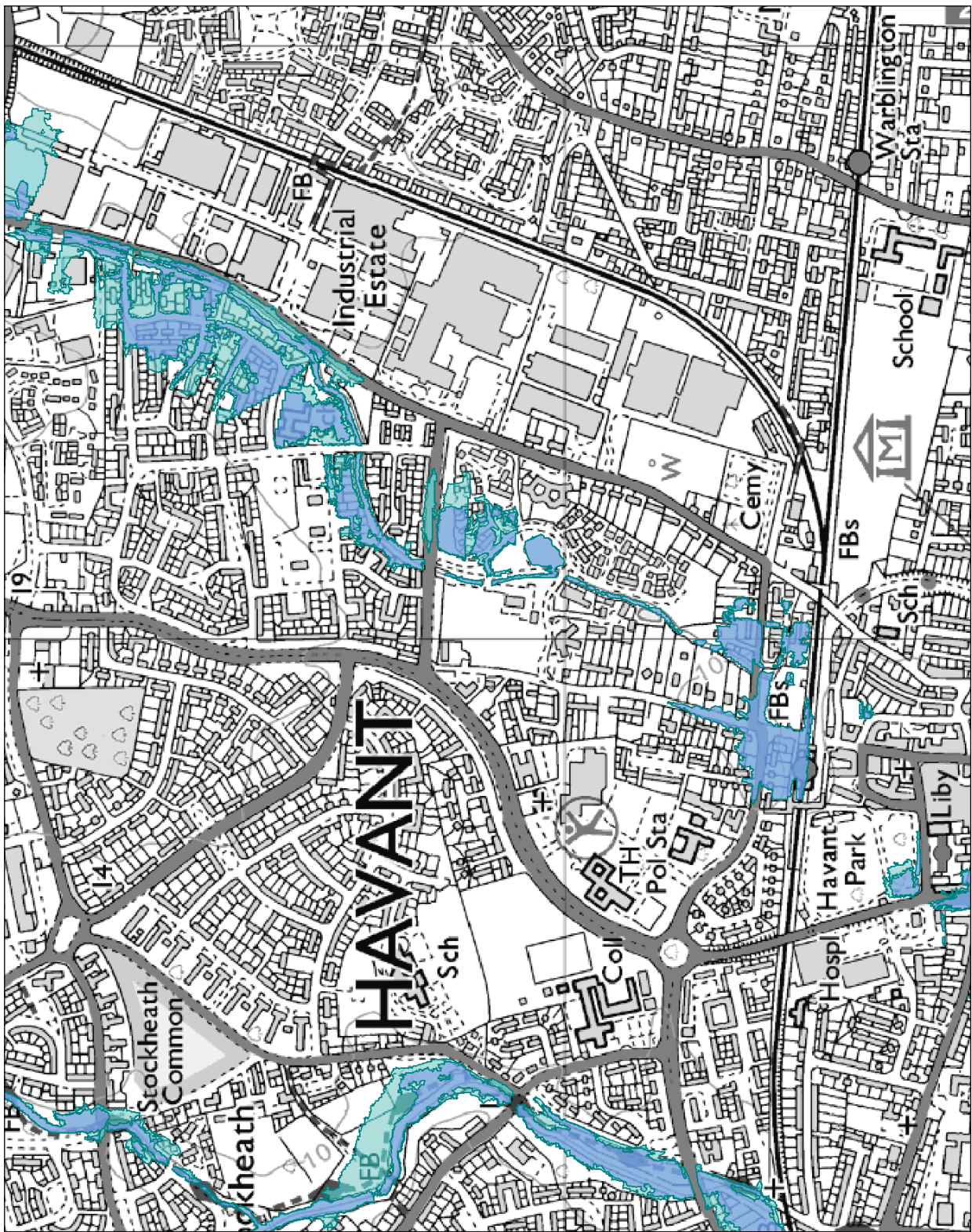
Legend

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- 07128S6010104L01
- 07128S6010104R01
- 07128S6010105L01
- 07128S6010105R01

1:1,796 *
*when printed at A4.



Flood Map (Rivers & Sea) Centered on River Way - Created 23 December 2014



Scale 1:10,001



**Flood Map for Planning
(Rivers and Sea)**

- Flood Map - Defences
- Areas Benefiting from Flood Defences
- Flood Map - Flood Storage Areas
- Flood Map - Flood Zone 3
- Flood Map - Flood Zone 2

**Flood Map for Planning (Rivers and Sea)
(assuming no defences)**

Flood Zone 3 shows the area that could be affected by flooding:
- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.
Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

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Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Use of Environment Agency Information for Flood Risk / Flood Consequence Assessments

Important

If you have requested this information to help inform a development proposal, then we recommend that you undertake a formal pre-application enquiry using the form available from our website:-

<http://www.environment-agency.gov.uk/research/planning/33580.aspx>

Depending on the enquiry, we may also provide advice on other issues related to our responsibilities including flooding, waste, land contamination, water quality, biodiversity, navigation, pollution, water resources, foul drainage or Environmental Impact Assessment.

In **England**, you should refer to the Environment Agency's Flood Risk Standing Advice, the technical guidance to the National Planning Policy Framework and the existing PPS25 Practice Guide for information about what flood risk assessment is needed for new development in the different Flood Zones. These documents can be accessed via:

<http://www.environment-agency.gov.uk/research/planning/82587.aspx>

<http://www.communities.gov.uk/publications/planningandbuilding/nppftechnicalguidance>

<http://www.communities.gov.uk/publications/planningandbuilding/pps25guideupdate>

You should also consult the Strategic Flood Risk Assessment produced by your local planning authority.

In **Wales**, you should refer to TAN15 for information about what flood consequence assessment is needed for new development in the different flood zones

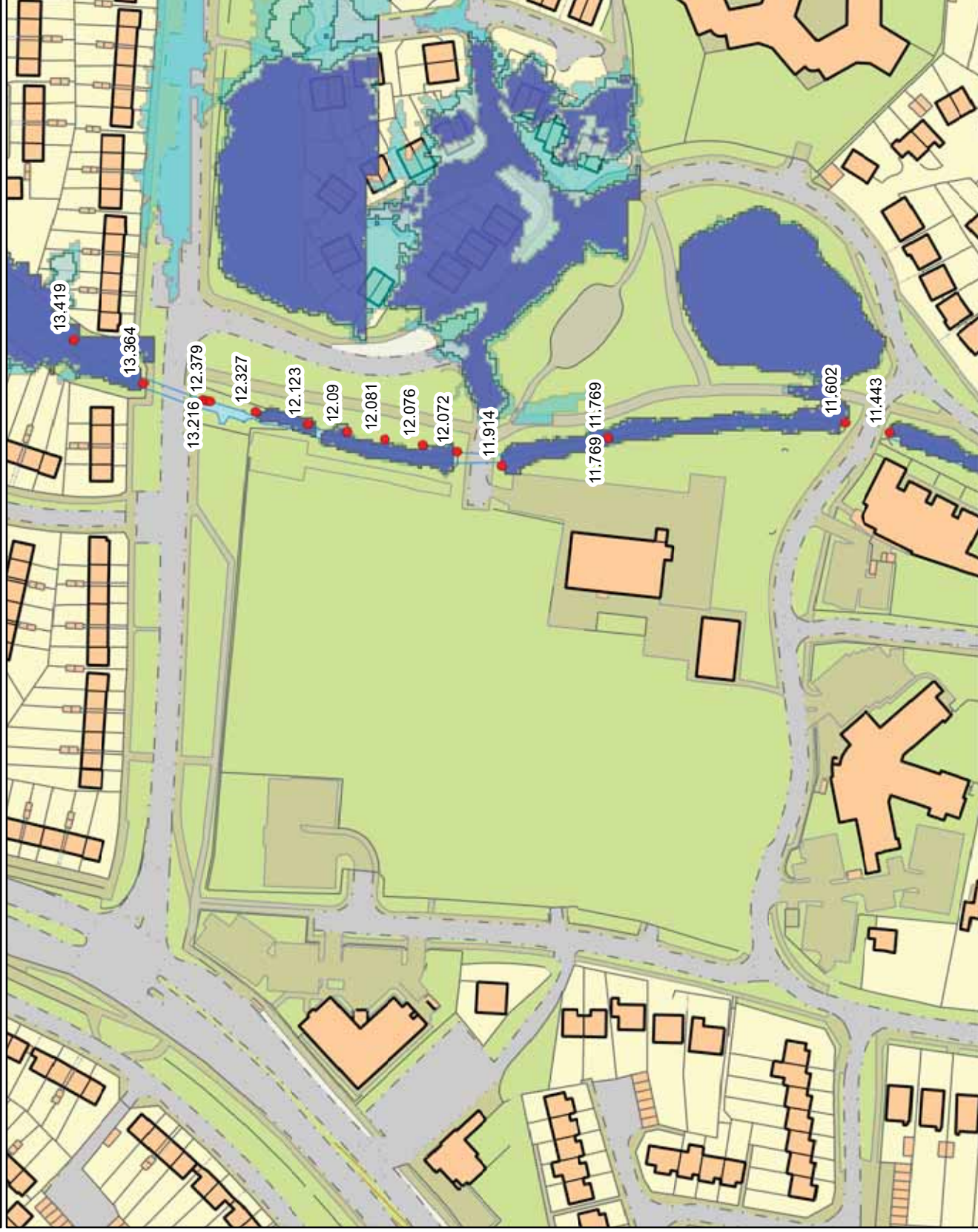
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You should also consult the Strategic Flood Consequence Assessment if one has been produced by your local planning authority.

In both **England and Wales** you should note that:

1. Information supplied by the Environment Agency may be used to assist in producing a Flood Risk / Consequence Assessment (FRA / FCA) where one is required, but does not constitute such an assessment on its own.
2. This information covers flood risk from main rivers and the sea, and you will need to consider other potential sources of flooding, such as groundwater or overland runoff. The information produced by the local planning authority referred to above may assist here.
3. Where a planning application requires a FRA / FCA and this is not submitted or deficient, the Environment Agency may well raise an objection.
4. For more significant proposals in higher flood risk areas, we would be pleased to discuss details with you ahead of making any planning application, and you should also discuss the matter with your local planning authority.

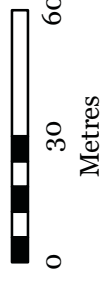
1000 Year Flood Levels (in mAoD) Centered on River Way - Created 23 Dec 2014 (Ref: SSD/5498)



Legend

- Lavant & Hermitage 1D Levels
- Lavant & Hermitage 100Yr (Flood Zone 3)
- Lavant & Hermitage 100Yr + Climate Change
- Lavant & Hermitage 1000Yr (Flood Zone 2)

1:1,796 *
*when printed at A4.



Appendix 4 – Southern Water Correspondences



Department of Planning and
Development
Havant Borough Council
Public Service Plaza
Civic Centre Road
Havant
Hampshire
PO9 2AX

Developer Services
Southern Water
Sparrowgrove House
Sparrowgrove
Otterbourne
Hampshire
SO21 2SW

Tel: 0330 303 0119

Email: developerservices@southernwater.co.uk

Your Ref

GEN/14/01023

Our Ref

PLAN-007779

Date

28/10/2014

Dear Sir

Proposal: Proposed Oak Park 'Health and Wellbeing Campus'.
Site: Oak Park Health & Wellbeing Campus, River Way, Havant, PO9 2EL.
GEN/14/01023

Thank you for your letter of 13/10/2014.

Further to your recent pre-application for the above site I have the following observations to make in respect of the proposed development:-

- Southern Water's current sewerage records show that there is a 675 mm foul sewer and 450mm surface water sewer crossing the proposed development site/s. No new development/building works will be permitted to be constructed over or within 3.5 metres of the existing foul and surface water sewer. Sewer record attached for your information.
- Please note there is a deed of easement for sewers within the site and there is a decommissioned foul sewer within the site.
- In addition due to changes in legislation that came in to force on 1st October 2011 regarding the future ownership of sewers it is possible that a sewer/s now deemed to be public could be crossing the above property.
- A capacity assessment will be required to determine if the existing foul water and surface water system can accommodate the proposed development flows.
- Southern Water requires a formal application for a connection to the public foul and surface water sewer to be made by the applicant or developer.
- Southern Water does not supply water to this area.

If you require any further information please do not hesitate to contact our office on the above telephone number.

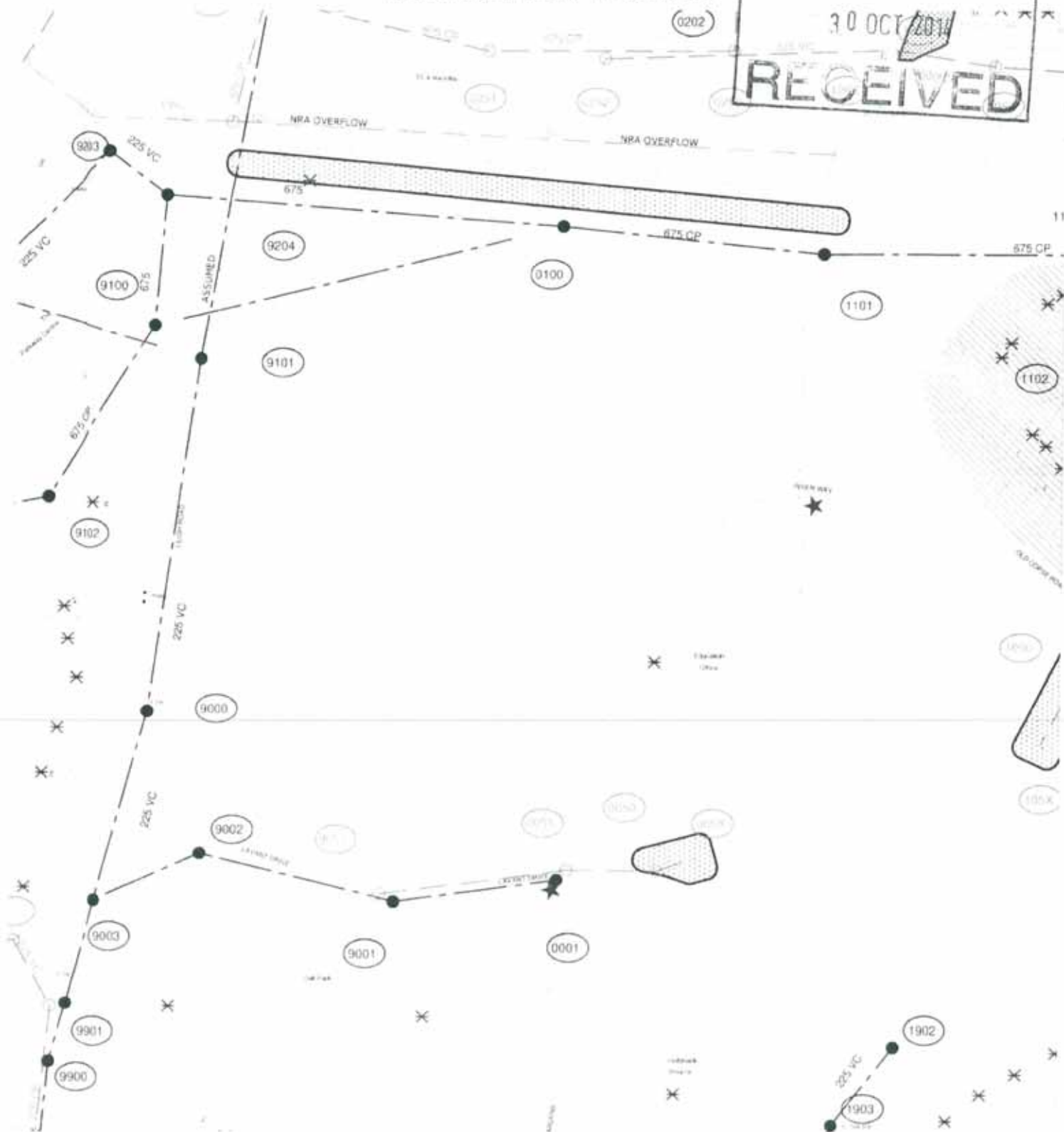
Please note that the Atkins Planning Team (Winchester) is no longer contracted to Southern Water Services and all consultations/correspondence should be sent to the following address:- **Southern Water Services, Developer Services Team, Southern House, Sparrowgrove, Otterbourne, Hants SO21 2SW** or email developerservices@southernwater.co.uk.

Yours sincerely



Developer Services

HAVANT BOROUGH
COUNCIL
30 OCT 2014
RECEIVED



WARNING: Editions of *NSA* manuscripts may include Bonded Adhesive Elements.



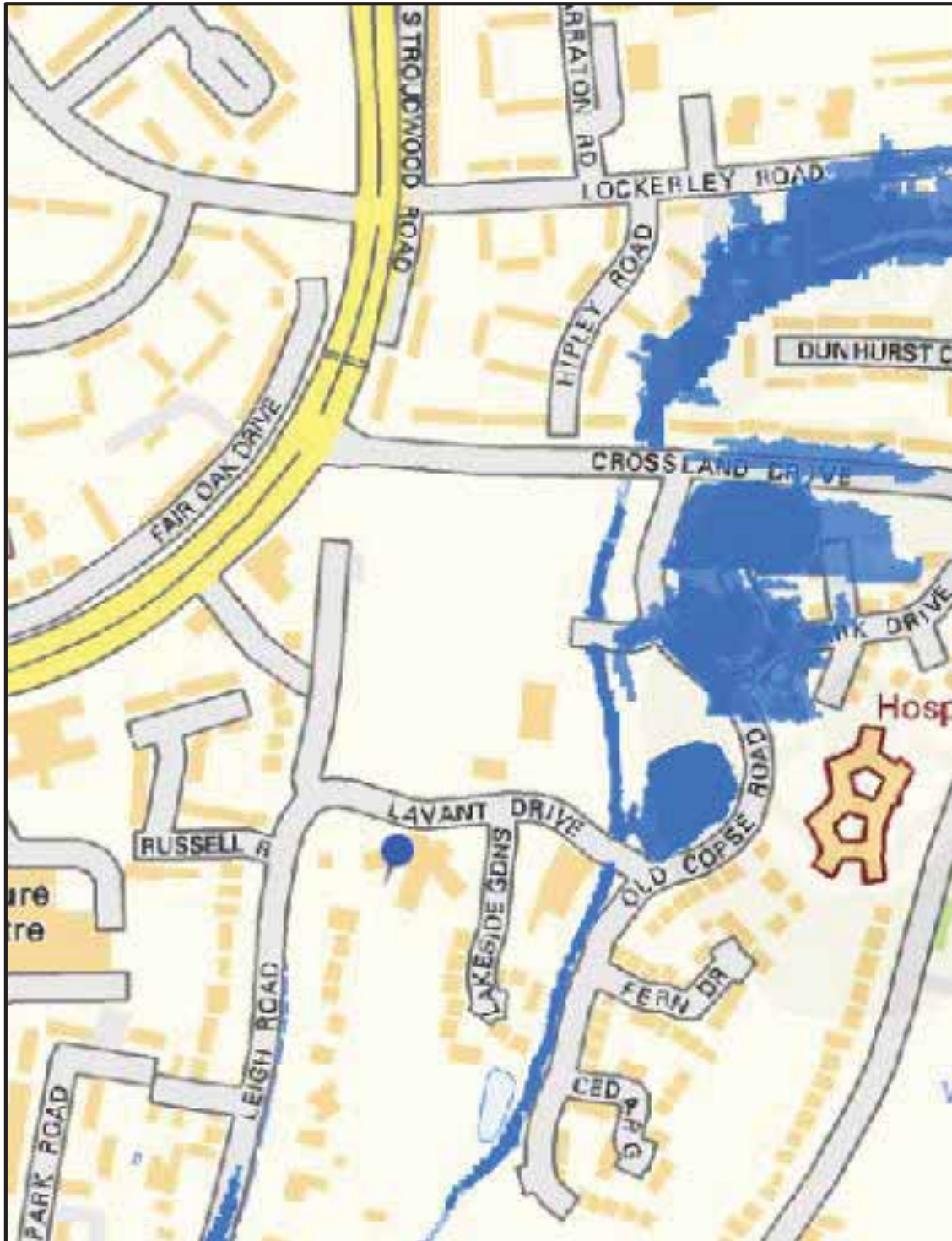
Requested By:



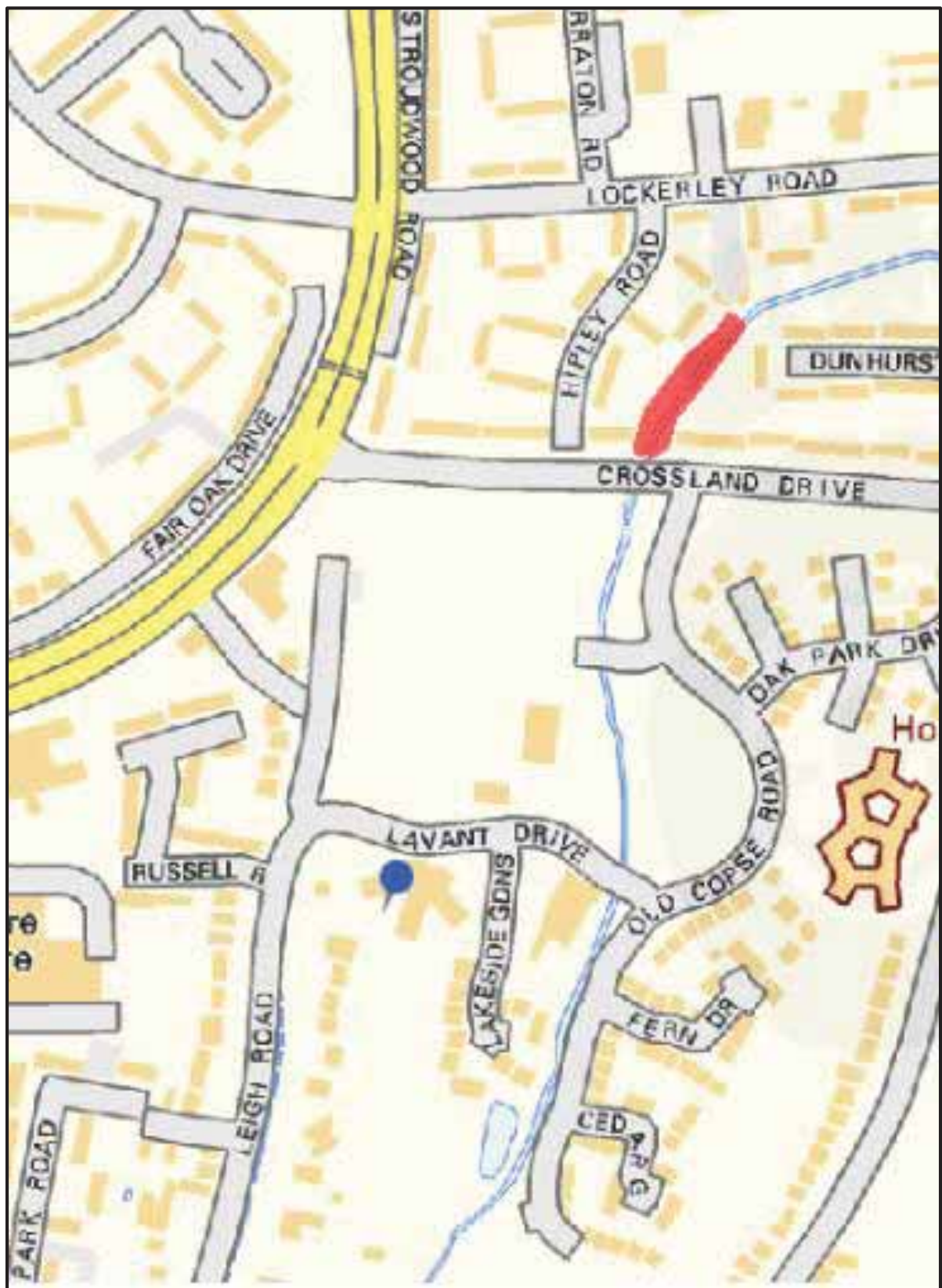
Appendix 5 – SFRA Extracts

Oak Park Havant SFRA Extracts

Flood Zones 2 and 3



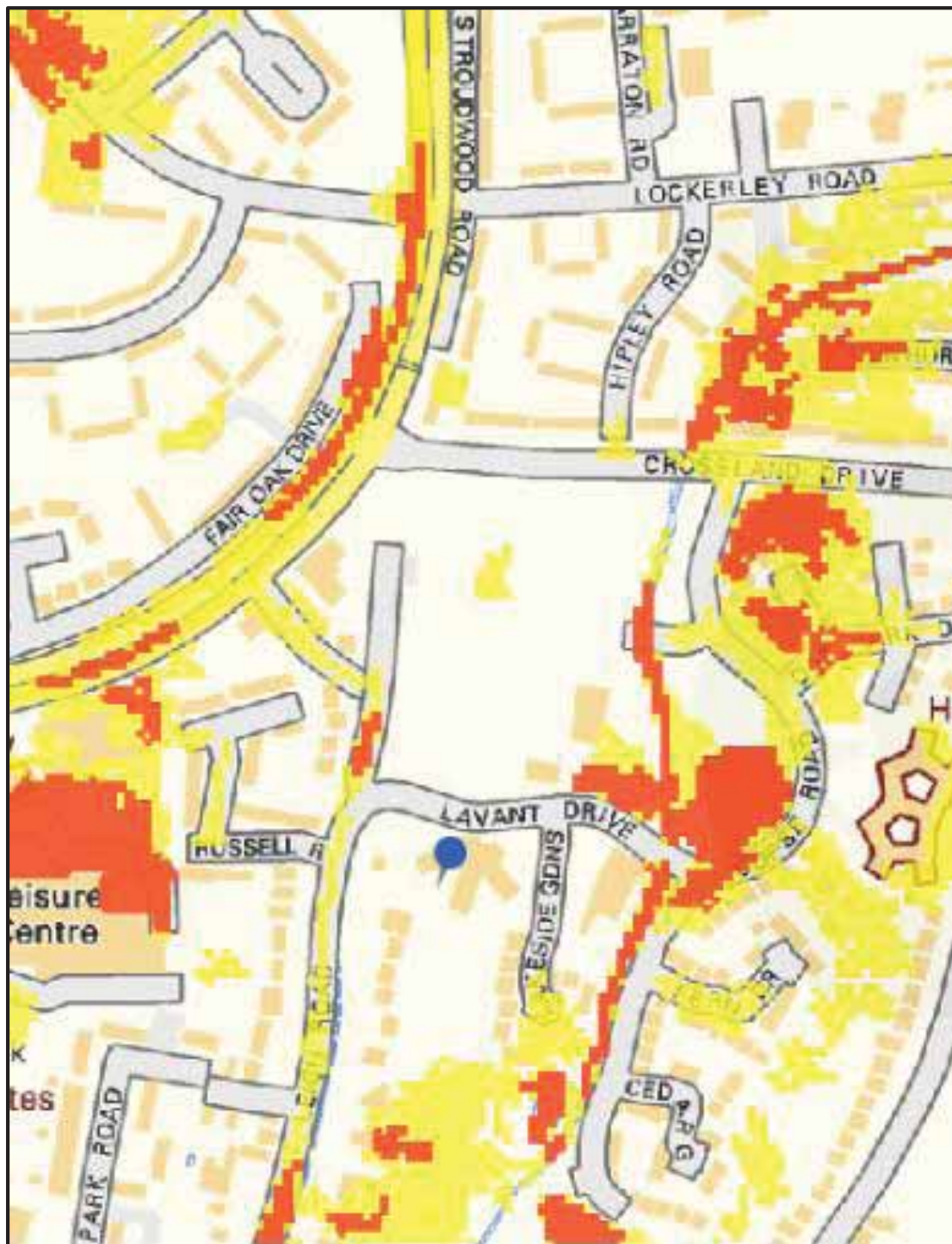
Historic Flooding



Surface Water Flooding



Flood Map for Surface Water



[illegible]

Appendix 6 – Soakaway Tests



Site..... Oak Park, Havant
Job Number..... CRM.1112.005
Date of Test..... 02/12/2014

Trial Pit Number..... SA3
Length..... 1.16 m
Width..... 0.67 m
Depth..... 1.54 m
Groundwater Level..... 0 m

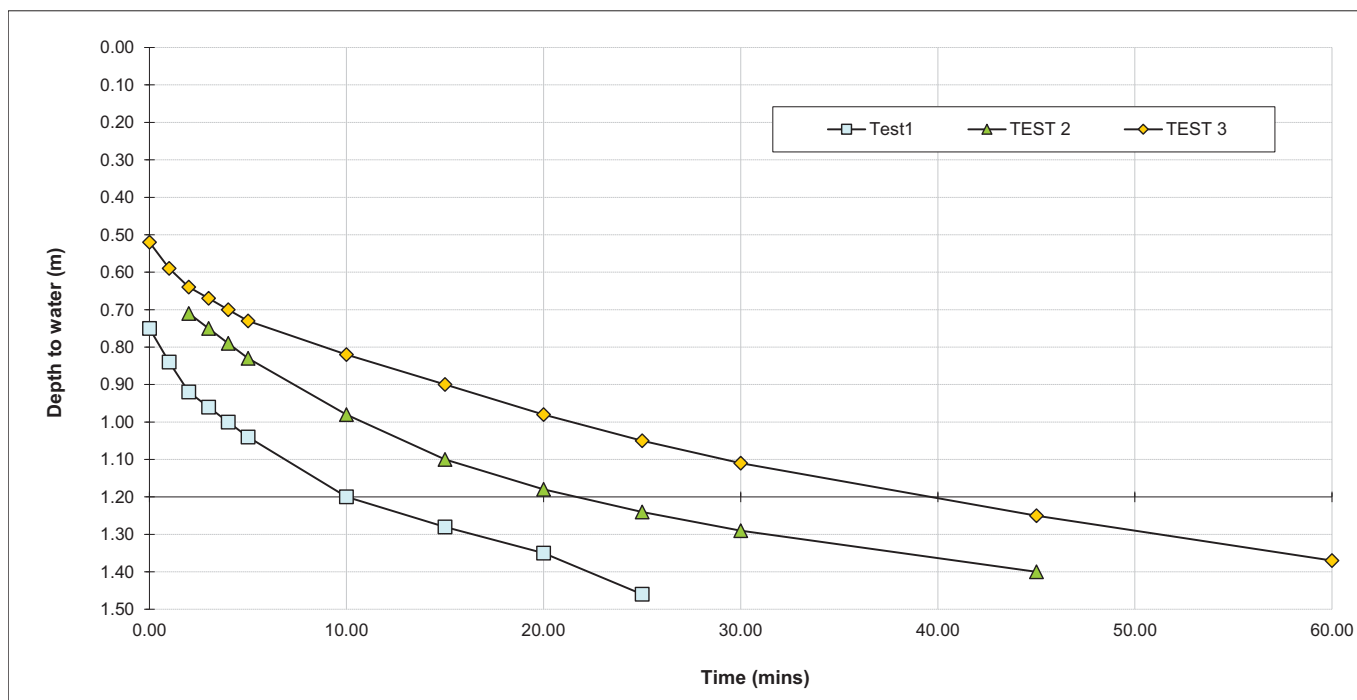
SOIL INFILTRATION RATE TEST
See B.R.E. Digest 365, 1991, Soakaway Design.

Remarks -	TEST 1		TEST 2		TEST 3	
	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
	0.00	0.75	0.00	0.58	0.0	0.53
	1.00	0.84	1.00	0.66	1.0	0.59
	2.00	0.92	2.00	0.71	2.0	0.64
	3.00	0.96	3.00	0.75	3.0	0.67
	4.00	1.00	4.00	0.79	4.0	0.70
	5.00	1.04	5.00	0.83	5.0	0.73
	10.00	1.20	10.00	0.98	10.0	0.82
	15.00	1.28	15.00	1.10	15.0	0.90
	20.00	1.35	20.00	1.18	20.0	0.98
	25.00	1.46	25.00	1.24	25.0	1.05
	30.00	0.00	30.00	1.29	30.0	1.11
	45.00	0.00	45.00	1.40	45.0	1.25
	60.00	0.00	60.00	0.00	60.0	1.37
	0.00	0.00	0.00	0.00		
	0.00	0.00	0.00	0.00		
	0.00	0.00	0.00	0.00		
	1.00	0.00				
Effective Storage Depth	m	0.79	0.96	1.01		
75% Effective Storage Depth	m	0.59	0.72	0.76		
(i.e. depth below GL)	m	0.95	0.82	0.78		
25% Effective Storage Depth	m	0.20	0.24	0.25		
(i.e. depth below GL)	m	1.34	1.30	1.29		
Effective Storage Depth 75%-25%	m	0.40	0.48	0.51		
Time to fall to 75% effective depth	mins	2.50	5.00	8.00		
Time to fall to 25% effective depth	mins	19.00	30.00	50.00		
V (75%-25%)	m3	0.31	0.37	0.39		
a (50%)	m2	2.22	2.53	2.63		
t (75%-25%)	mins	16.50	25.00	42.00		
SOIL INFILTRATION RATE	m/s	1.40E-04	9.81E-05	5.93E-05		

DESIGN SOIL INFILTRATION RATE, f

5.93E-05

m/s





Site..... Oak Park, Havant
Job Number..... CRM.1112.005
Date of Test..... 02/12/2014

Trial Pit Number..... SA2
Length..... 1.55 m
Width..... 0.63 m
Depth..... 2.04 m
Groundwater Level..... 0 m

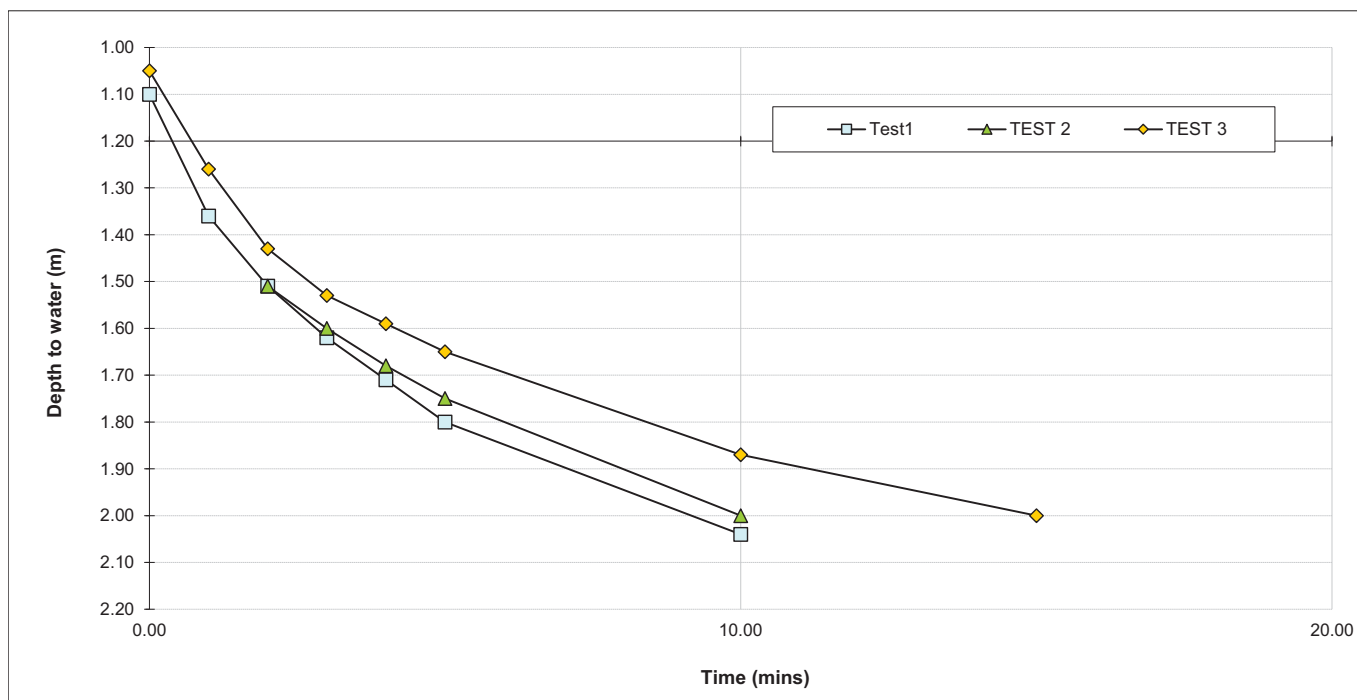
SOIL INFILTRATION RATE TEST
See B.R.E. Digest 365, 1991, Soakaway Design.

Remarks -	TEST 1		TEST 2		TEST 3	
	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
	0.00	1.10	0.00	1.05	0.0	1.05
	1.00	1.36	1.00	1.31	1.0	1.26
	2.00	1.51	2.00	1.51	2.0	1.43
	3.00	1.62	3.00	1.60	3.0	1.53
	4.00	1.71	4.00	1.68	4.0	1.59
	5.00	1.80	5.00	1.75	5.0	1.65
	10.00	2.04	10.00	2.00	10.0	1.87
	0.00	0.00	0.00	0.00	15.0	2.00
	0.00	0.00	0.00	0.00		
	0.00	0.00	0.00	0.00		
	0.00	0.00	0.00	0.00		
	0.00	0.00	0.00	0.00		
	0.00	0.00	0.00	0.00		
	0.00	0.00	0.00	0.00		
	0.00	0.00	0.00	0.00		
	0.00	0.00	0.00	0.00		
	0.00	0.00	0.00	0.00		
	0.00	0.00	0.00	0.00		
	1.00	0.00				
	Effective Storage Depth	m	0.94	0.99	0.99	
75% Effective Storage Depth	m	0.71	0.74	0.74		
(i.e. depth below GL)	m	1.34	1.30	1.30		
25% Effective Storage Depth	m	0.24	0.25	0.25		
(i.e. depth below GL)	m	1.81	1.79	1.79		
Effective Storage Depth 75%-25%	m	0.47	0.50	0.50		
Time to fall to 75% effective depth	mins	1.00	1.00	1.00		
Time to fall to 25% effective depth	mins	5.00	5.00	8.00		
V (75%-25%)	m3	0.46	0.48	0.48		
a (50%)	m2	3.03	3.13	3.13		
t (75%-25%)	mins	4.00	4.00	7.00		
SOIL INFILTRATION RATE	m/s	6.32E-04	6.42E-04	3.67E-04		

DESIGN SOIL INFILTRATION RATE, f

3.67E-04

m/s





Site..... Oak Park, Havant
Job Number..... CRM.1112.005
Date of Test..... 02/12/2014

Trial Pit Number..... SA1
Length..... 1.25 m
Width..... 0.71 m
Depth..... 2.03 m
Groundwater Level..... 0 m

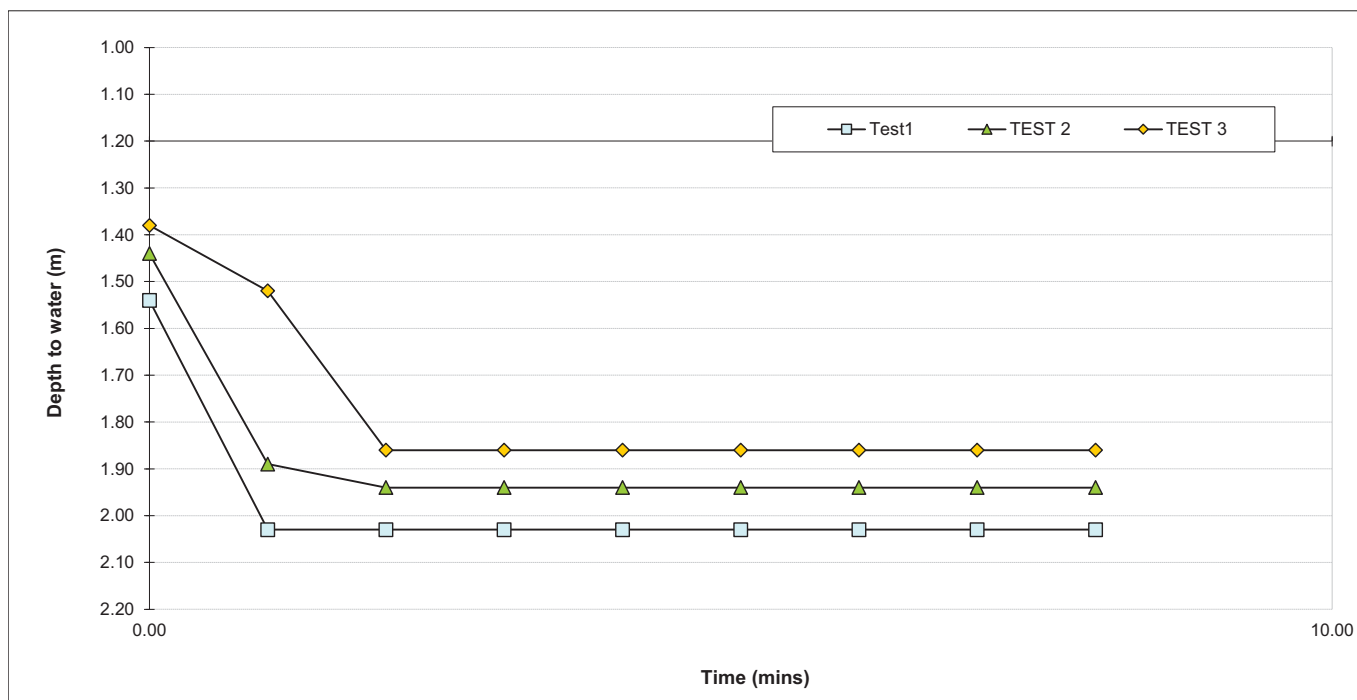
SOIL INFILTRATION RATE TEST
See B.R.E. Digest 365, 1991, Soakaway Design.

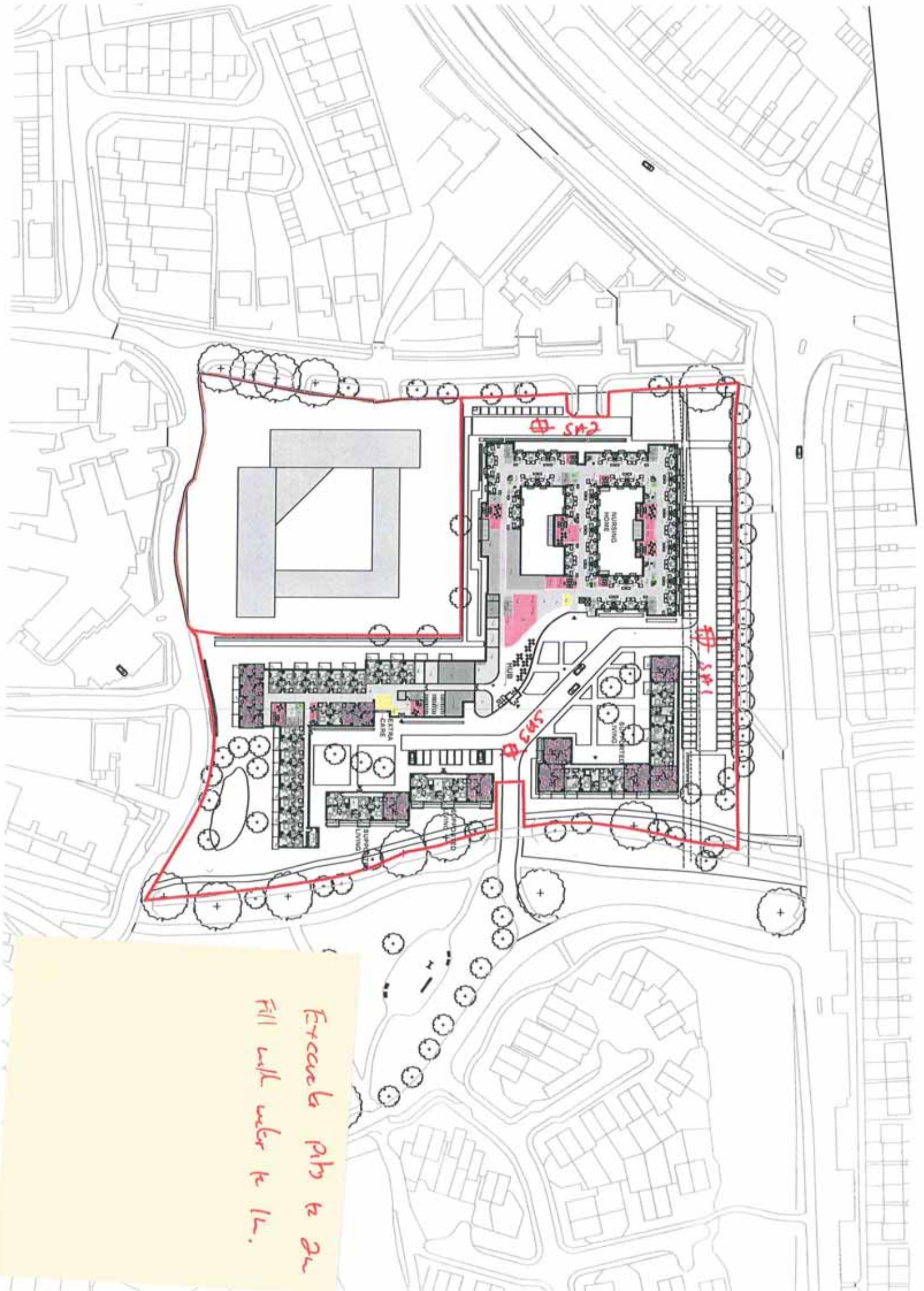
Remarks -	TEST 1		TEST 2		TEST 3	
	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
	0.00	1.54	0.00	0.00	0.0	1.38
	1.00	2.03	0.00	0.00	1.0	1.52
	2.00	2.03	0.00	1.44	2.0	1.83
	3.00	2.03	1.00	1.89	3.0	1.83
	4.00	2.03	2.00	1.94	4.0	1.83
	5.00	2.03	3.00	1.94	5.0	1.83
	6.00	2.03	4.00	1.94	6.0	
	7.00	2.03	5.00	1.94	7.0	
	8.00	2.03	6.00	1.94	8.0	
	9.00	0.00	7.00	1.94	9.0	
	10.00	0.00	8.00	1.94	10.0	
	0.00	0.00	0.00	0.00		
	0.00	0.00	0.00	0.00		
	0.00	0.00	0.00	0.00		
	0.00	0.00	0.00	0.00		
	0.00	0.00	0.00	0.00		
	0.00	0.00	0.00	0.00		
	0.00	0.00	0.00	0.00		
Effective Storage Depth m		0.49		2.03		0.65
75% Effective Storage Depth m		0.37		1.52		0.49
(i.e. depth below GL) m		1.66		0.51		1.54
25% Effective Storage Depth m		0.12		0.51		0.16
(i.e. depth below GL) m		1.91		1.52		1.87
Effective Storage Depth 75%-25% m		0.25		1.02		0.33
Time to fall to 75% effective depth mins		1.00		1.00		1.00
Time to fall to 25% effective depth mins		2.00		2.00		2.00
V (75%-25%) m3		0.22		0.90		0.29
a (50%) m2		1.85		4.87		2.16
t (75%-25%) mins		1.00		1.00		1.00
SOIL INFILTRATION RATE m/s		1.96E-03		3.09E-03		2.22E-03

DESIGN SOIL INFILTRATION RATE, f

2.22E-03

m/s





Excavate pits to 2m
Fill with water to 1m.

Appendix 7 – Hampshire County Council



Hampshire
County Council



LAND AT OAK PARK, HAVANT PRELIMINARY DRAINAGE STRATEGY

Prepared by: Robin Dooley

Checked by: Simon Fryer

Approved by: David Ryder

Signed: *R. Dooley*

Signed: *[Signature]*

Signed: *D. Ryder*

Date: 28/06/13

Date:

Date: 28/6/2013

JOB NO: R.J5027808.03



Certificate No. FS 21845

engineering
CONSULTANCY

Stuart Jarvis, BSc DipTP FCIHT MRTPI, Director of Environment, The Castle, Winchester

CONTENTS

1.	EXISTING SITE	2
1.1.	Introduction	2
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APPENDIX A. – INDICATIVE DRAINAGE LAYOUT

APPENDIX B. - MICRODRAINAGE CALCULATIONS FOR THE CARE HOME AND EXTRA CARE SCHEME

APPENDIX C. - ASSESSMENT OF EXISTING RETENTION BASIN CAPACITY USING MICRODRAINAGE

1. EXISTING SITE

1.1. Introduction

Engineering Consultancy (EC) have been commissioned by Hampshire County Council Property Services (HCCPS) to prepare a preliminary drainage strategy report for a parcel of land in Oak Park, Havant. The site of the former Oak Park Secondary School is to be redeveloped to provide a 60 bed nursing home and a 50 unit Extra Care Apartment scheme. An NHS healthcare facility may be constructed on the south western portion of the site. The adjacent HCC Education office site is also to be redeveloped as part of the Oak Park Scheme.

An indicative drainage layout for the site can be found at Appendix A. This is for illustrative purposes only to help inform the conclusions of this report.

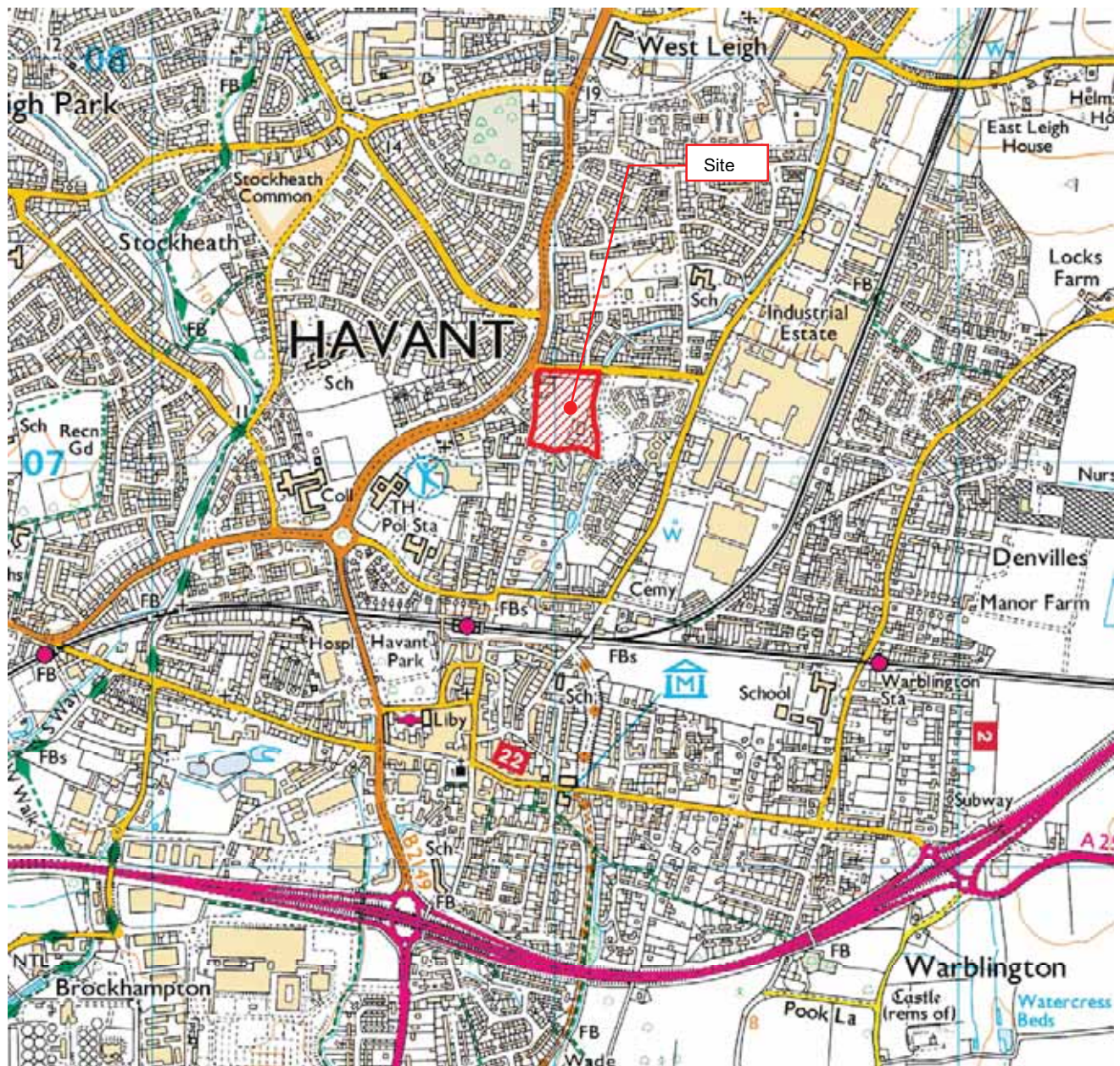


Fig. 1 - Location Plan

1.2. Scope of Report

This report outlines the drainage proposals with regards to surface water and foul water flows generated by the proposed development.

This document considers the following:

- Existing drainage regime for the site;
- Drainage design options considered for the site;
- Design parameters and considerations;
- The outline drainage strategy for the site;

This document has been prepared based on the following information:

- Site Visits;
- Consultation with Southern Water.

2. EXISTING SITE

2.1. Site Context

The proposed development site is located 0.8km to the north of Havant town centre at approximate National Grid Reference 472026N, 107127E.

The development site covers a total area of 2.63ha and is bounded on all sides by well established residential housing developments. To the south lies Lavant Drive, Oak Park Children's Services Centre and Hollybank Nursing Home, both owned by the East Hampshire NHS Trust. To the east is Lavant Stream with a grassed amenity area and children's play area beyond. Leigh Road forms the western boundary.

Referring to Figure 2 below and the 'Indicative Drainage Layout' at Appendix A:

Area A

Measuring approximately 1.39ha it is proposed to construct a 60 bed residential care home and a 50 unit extra care apartment scheme within the former Oak Park Secondary Modern school site. The school was demolished in the 1980's and has remained undeveloped since. An Adult Mental Health unit was constructed in the northwest corner but this too has since been demolished. Remnants of the demolished buildings are still evident on the site in the form of areas of hardstanding. These measure approximately 0.18ha. However, due to the time that has elapsed since the demolition of the school, these have been ignored in calculations and the site is treated as a greenfield site for the purposes of this report.

Area B

It is proposed to construct a Community Health Centre on the land to the south of area A which was also part of the former school grounds. Measuring approximately 0.70 ha the area has remained undeveloped since the demolition of the school and will be treated as a greenfield site for the purposes of this report.

Area C

It is proposed to redevelop the site of the Hampshire County Council Education Office which currently occupies the site. The Education Department has relocated from this 0.54 ha site, therefore the two storey and smaller single storey buildings are scheduled for closure and demolition. The existing impermeable area measures 0.22ha. The indicative residential development will increase this slightly to 0.27ha. The site could yield approximately 18 dwellings.

The Site slopes from the north west corner to the south east corner with an approximate gradient of 3%.



Fig.2 - Aerial Photograph

2.2. Existing Drainage

Public sewer records received from Southern Water indicate that there are foul sewers to the north, south and west of the proposed site and a surface water sewer located in Lavant Drive. The surface water sewer discharges into the existing retention basin to the south of the Education Office. Flows from the pond discharge at a restricted rate into the Lavant Stream via a 150mm dia pipe with a non-return flap valve.

Surface Water run off from the Education office and the surrounding car parking (Area C) drains into the retention basin.

The foul flows from the existing Education Office (Area C) discharge to the 150mm dia Southern Water sewer that runs west along Lavant Drive before connecting into a 225mm dia. foul sewer in Leigh Road.

All buildings on Areas A and B have long since been demolished. Due to the passage of time since the demolition of the school which once occupied the site little is known about the surface water drainage. Due to the lack of existing surface water sewers and the unsuitability of infiltration drainage features, it can be reasonably assumed that it ultimately discharges into the Lavant Stream via the retention basin.

The former school and latterly the Adult Mental Health Centre discharged to 150mm dia foul sewer in the northwest of the site which connects into the public foul sewer in Leigh Road. This will need to be CCTV surveyed to confirm suitability for re-use.

A 625mm Dia foul sewer crosses the north of the site as shown on the 'Indicative Drainage Layout Drawing' in Appendix A.

3. DRAINAGE PROPOSALS

3.1. Surface Water

Area A

Surface water run off from Area A is to be attenuated for the 1 in 30 year storm event and discharged into the Lavant Stream at 5.6 l/s to match the 1 in 2 year greenfield run-off rates. If a direct connection to the Lavant Stream cannot be made due to ground levels an alternative solution would be to connect into a new surface water sewer laid through Area C which will discharge into the existing retention basin.

Microdrainage Windes software was used to size the underground attenuation tanks which would attenuate the run-off from Area A for the 1 in 30 year return period. Refer to Appendix B for calculations. A summary of the results are shown in Table 1 below.

Return Period	Storage Volume (m ³)
1 in 30 year	521

Table 1 – Summary of storage volumes for area A

Sewers for Adoption 7th Edition (SFA) requires that drainage system should not flood during the 1 in 30 year storm event. Any flooding over and above the 1 in 30 year storm up to the 1 in 100 + 30% for climate change storm is to be routed away from properties but should be contained within the site boundary. An overflow is to be provided which will connect into the existing surface water detention basin.

Flow control is to be achieved using a Hydrobrake or equivalent proprietary vortex flow control device.

Area C

Surface water run off from the Area C will discharge via a new gravity sewer into the retention basin. The retention basin discharges at a restricted rate into the Lavant Stream. Flows are restricted using a 150 dia pipe and non-return flap valve.

A 3D ground model was built of the existing basin using topographical survey data. This was used to establish the volume of the existing retention basin as being 1094m³ and assess the available spare capacity.

Microdrainage Windes software was used to check the available capacity of the retention basin using a return period of 1 in 100 years and an allowance of 30% for climate change. Two scenarios were modelled.

Scenario A - Assesses the storage requirements for Area C, the health centre (Area B) and the adjacent Oak Park Children's Centre.

Scenario B - Assesses the storage requirements if in addition to the above run-off from Area A was also included.

A copy of the calculations are included as Appendix C.

The results are summarised below:

Description	Volume (m ³)
Total Storage Volume of Existing Retention Basin	1094
Additional Storage required for the Area C, including allowance for Area B and adjacent Oak Park Children's Centre	418.2
Additional Storage required for the Care Home and Extra Care Scheme (Area A)	273.6
Net Spare Capacity in Retention Basin	402.2

The top of the basin has been assumed as 12.000m AOD and the bottom of the basin as 10.600m AOD.

The critical design storm is the 180 minute winter storm for the 1 in 100 year + 30% for climate change.

The results show that even with the increase in flows from all the potential proposed development the existing basin continues to function within its existing capacity. The critical storm event of 180 minutes during winter gives a maximum surcharge level of 11.611m AOD. This gives approximately 389mm freeboard during the design storm event, equivalent to over 400m³ of additional flood storage.

3.2. Foul Water

Area A

Historical records show that over 1000 pupils attended the high school which previously occupied the site. An estimation of foul flows indicates that the peak foul discharge would have been approximately 5.6 l/s (assuming 0.006 l/s - Southern Water rate per pupil)

Sewage effluent from the proposed Care Home and the Extra Care Scheme (Area A) are to be discharged into the existing public foul sewer located within Leigh Road and will utilise pre-existing capacity. Peak flows have been estimated in agreement with Southern Water to be 2.9 l/s based on 6.1 times the Dry Weather Flow from the site.

From this comparison it can be seen that foul flows to the public foul sewer in Leigh Road will be significantly reduced following the redevelopment of the school site and the construction of the proposed nursing home and Extra Care Scheme.

Area C

The existing Education Office currently discharges into the public foul sewer located in Lavant Drive. It is assumed that Area B and Area C will re-use this connection.

Foul flows from the existing Education Office have been calculated as being approximately 2.1 l/s based on 750 litres per day per 100m² of floor area. This figure was agreed with Southern Water.

An estimation of peak foul flows from the indicative residential development based on 4000 litres / unit dwelling / per day (Sewers for Adoption 7th Edition) indicate that the peak design flow would be approximately 0.9 l/s.

Again this would result in a net reduction in foul flows to the existing public foul sewer in Lavant Drive. This would leave 1.2 l/s available for the proposed Health Centre. Alternatively, the Health Centre could connect into the foul sewer in Leigh Road.

Existing Site		Proposed Site	
Facility	Flows (l/s)	Facility	Flows (l/s)
High School	6	Care Home + Extra Care Scheme	2.9
Education Office	2.1	Residential	0.9
		NHS Health Centre	≈ 2
	8.1		5.8
Net reduction to foul flows to the public sewer is			2.3

4. CONCLUSIONS

4.1. Surface Water

Surface water run-off from Area A, the 60 bed residential care home and a 50 unit extra care apartment scheme, are to be attenuated in underground geocellular tanks designed for storm events up to and including the 1 in 30 year storm event and discharged into the Lavant Stream at the 1 in 2 year greenfield run-off rates.

Due to the nature of the topography a direct connection to the stream may not be possible. The surface water could be pumped up to a level where it can discharge into the stream or alternatively it can connect into a new surface water sewer which would serve the proposed residential development to the south.

Areas B and C, NHS healthcare facility and the potential residential development, are to discharge into the existing retention basin before discharging into the adjacent Lavant Stream. A 150mm dia pipe with non-return flap valve regulates the discharge rate.

A check on the capacity of the retention basin indicates that it has sufficient capacity to take flows from the proposed development including the Care Home, Extra Care Scheme, Health Centre, Residential development and the Oak Park Children's Centre located on the south side of Lavant Drive.

Calculations indicate that for the critical 180 minute winter storm with a 1 in 100 year plus 30% for climate change return period would produce a maximum water level of approximately 11.611m AOD. Compared with a top of bank level of approximately 12.0m AOD this would give a freeboard of 389mm or 400m³ of additional flood storage should it be needed.

As Lavant Stream is an EA main river, no construction will be allowed closer than 8m from the top of bank without the prior consent of the EA. The indicative development scheme does not indicate any construction within the 8m buffer zone. However, the previous study for the community hospital did show some car parking in the buffer zone. The EA commented on this and agreed to allow a localised reduction to 5m provided this posed no inherent flood risk to the property.

4.2. Foul Water

The foul discharge from Area A, the Care Home and Extra Care Scheme, will utilise the existing connection from the former high school. A CCTV survey will be required to confirm the condition and suitability of the connection.

A new connection into the 225mm dia. public foul sewer in Leigh Road will be required if the existing connection is found to be in poor condition or does not suit the proposed final layout.

Calculations indicate that the foul discharge will be approximately 2.9 l/s based on the current preliminary information available at the time of writing this report. This will equate to a net reduction of flow to the sewer when compared with the pre-existing flows from the site. Refer to section 3.2 for further details.

Areas B and C, the proposed Health Centre and the potential residential development on the site of the Education Office, will discharge into the 150 dia. foul sewer in Lavant Drive. The existing connection could be re-used or a new connection in a more suitable location may be necessary due to development layout constraints and to avoid the need for easements.

Calculations show that the indicative residential development will produce a net reduction of 1.2 l/s when compared with the existing Education Office. The spare capacity can then be allocated to Area B.

The final layout for the Care Home and Extra Care Scheme will need to take into account the location of the existing 625mm dia. foul sewer which crosses the north of Area A. If necessary this could be diverted with the agreement of Southern Water.

APPENDIX A. – INDICATIVE DRAINAGE LAYOUT
(FOR ILLUSTRATIVE PURPOSES ONLY)

**APPENDIX B. - MICRODRAINAGE CALCULATIONS FOR THE CARE
HOME AND EXTRA CARE SCHEME**

Hampshire County Council		Page 1
Ashburton Court West The Castle Winchester SO23 8UD	Oak Park Havant Greenfield Runoff Rates	
Date 24/06/13 File	Designed by R.Dooley Checked by	
Micro Drainage Source Control 2013.1		
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 2 Soil 0.450 Area (ha) 1.280 Urban 0.000 SAAR (mm) 778 Region Number Region 7 Results l/s QBAR Rural 6.4 QBAR Urban 6.4 Q2 years 5.6 Q1 year 5.4 Q30 years 14.4 Q100 years 20.3		
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Hampshire County Council		Page 1																										
Ashburton Court West The Castle Winchester SO23 8UD	Oak Park Havant Greenfield Volume																											
Date 24/06/13 File	Designed by R.Dooley Checked by																											
Micro Drainage Source Control 2013.1																												
<u>Greenfield Runoff Volume</u> FSR Data <table> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>Storm Duration (mins)</td> <td>360</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> </tr> <tr> <td>M5-60 (mm)</td> <td>19.400</td> </tr> <tr> <td>Ratio R</td> <td>0.350</td> </tr> <tr> <td>Areal Reduction Factor</td> <td>1.00</td> </tr> <tr> <td>Area (ha)</td> <td>1.280</td> </tr> <tr> <td>SAAR (mm)</td> <td>778</td> </tr> <tr> <td>CWI</td> <td>115.065</td> </tr> <tr> <td>Urban</td> <td>0.000</td> </tr> <tr> <td>SPR</td> <td>47.000</td> </tr> </table> Results <table> <tr> <td>Percentage Runoff (%)</td> <td>48.70</td> </tr> <tr> <td>Greenfield Runoff Volume (m³)</td> <td>399.948</td> </tr> </table>			Return Period (years)	100	Storm Duration (mins)	360	Region	England and Wales	M5-60 (mm)	19.400	Ratio R	0.350	Areal Reduction Factor	1.00	Area (ha)	1.280	SAAR (mm)	778	CWI	115.065	Urban	0.000	SPR	47.000	Percentage Runoff (%)	48.70	Greenfield Runoff Volume (m ³)	399.948
Return Period (years)	100																											
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Hampshire County Council						Page 1		
Ashburton Court West			Oak Park					
The Castle			Havant					
Winchester SO23 8UD			Attenuation Tank					
Date 24/06/13			Designed by R.Dooley					
File Oak Park Havant_...			Checked by					
Micro Drainage			Source Control 2013.1					
<u>Summary of Results for 30 year Return Period (+10%)</u> Half Drain Time : 947 minutes.								
Storm Event	Max Level	Max Depth	Max Infiltration	Max Control	Max Overflow	Σ Outflow	Max Volume	Status
	(m)	(m)	(l/s)	(l/s)	(l/s)	(l/s)	(m³)	
15 min Summer	99.326	0.326	0.0	4.4	0.0	4.4	178.1	O K
30 min Summer	99.432	0.432	0.0	4.4	0.0	4.4	236.2	O K
60 min Summer	99.544	0.544	0.0	4.4	0.0	4.4	297.8	O K
120 min Summer	99.657	0.657	0.0	4.4	0.0	4.4	359.7	O K
180 min Summer	99.719	0.719	0.0	4.6	0.0	4.6	393.4	Flood Risk
240 min Summer	99.757	0.757	0.0	4.7	0.0	4.7	414.3	Flood Risk
360 min Summer	99.802	0.802	0.0	4.8	0.0	4.8	439.0	Flood Risk
480 min Summer	99.825	0.825	0.0	4.9	0.0	4.9	451.6	Flood Risk
600 min Summer	99.835	0.835	0.0	4.9	0.0	4.9	456.9	Flood Risk
720 min Summer	99.837	0.837	0.0	4.9	0.0	4.9	458.0	Flood Risk
960 min Summer	99.836	0.836	0.0	4.9	0.0	4.9	457.2	Flood Risk
1440 min Summer	99.821	0.821	0.0	4.9	0.0	4.9	449.2	Flood Risk
2160 min Summer	99.786	0.786	0.0	4.8	0.0	4.8	430.1	Flood Risk
2880 min Summer	99.746	0.746	0.0	4.7	0.0	4.7	408.0	Flood Risk
4320 min Summer	99.664	0.664	0.0	4.5	0.0	4.5	363.4	O K
5760 min Summer	99.586	0.586	0.0	4.4	0.0	4.4	320.7	O K
7200 min Summer	99.511	0.511	0.0	4.4	0.0	4.4	279.6	O K
8640 min Summer	99.439	0.439	0.0	4.4	0.0	4.4	240.4	O K
10080 min Summer	99.371	0.371	0.0	4.4	0.0	4.4	202.8	O K
15 min Winter	99.365	0.365	0.0	4.4	0.0	4.4	200.0	O K
30 min Winter	99.485	0.485	0.0	4.4	0.0	4.4	265.2	O K
60 min Winter	99.611	0.611	0.0	4.4	0.0	4.4	334.5	O K
Storm Event			Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)	
15 min Summer			76.143	0.0	174.0	0.0	26	
30 min Summer			50.690	0.0	231.0	0.0	41	
60 min Summer			32.335	0.0	306.2	0.0	70	
120 min Summer			20.026	0.0	379.2	0.0	128	
180 min Summer			14.961	0.0	424.8	0.0	188	
240 min Summer			12.104	0.0	457.9	0.0	246	
360 min Summer			8.959	0.0	507.6	0.0	364	
480 min Summer			7.232	0.0	545.3	0.0	482	
600 min Summer			6.122	0.0	575.6	0.0	600	
720 min Summer			5.340	0.0	600.7	0.0	688	
960 min Summer			4.302	0.0	639.4	0.0	798	
1440 min Summer			3.167	0.0	674.3	0.0	1050	
2160 min Summer			2.329	0.0	800.9	0.0	1468	
2880 min Summer			1.871	0.0	857.2	0.0	1880	
4320 min Summer			1.372	0.0	940.1	0.0	2720	
5760 min Summer			1.100	0.0	1011.8	0.0	3520	
7200 min Summer			0.927	0.0	1065.0	0.0	4320	
8640 min Summer			0.806	0.0	1110.9	0.0	5032	
10080 min Summer			0.716	0.0	1150.0	0.0	5752	
15 min Winter			76.143	0.0	194.9	0.0	26	
30 min Winter			50.690	0.0	257.7	0.0	40	
60 min Winter			32.335	0.0	343.0	0.0	70	
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Hampshire County Council						Page 2		
Ashburton Court West The Castle Winchester SO23 8UD			Oak Park Havant Attenuation Tank					
Date 24/06/13 File Oak Park Havant_...			Designed by R.Dooley Checked by					
Micro Drainage			Source Control 2013.1					
Summary of Results for 30 year Return Period (+10%)								
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
120 min Winter	99.740	0.740	0.0	4.7	0.0	4.7	405.0	Flood Risk
180 min Winter	99.811	0.811	0.0	4.9	0.0	4.9	443.8	Flood Risk
240 min Winter	99.856	0.856	0.0	5.0	0.0	5.0	468.4	Flood Risk
360 min Winter	99.911	0.911	0.0	5.1	0.0	5.1	498.4	Flood Risk
480 min Winter	99.941	0.941	0.0	5.2	0.0	5.2	514.9	Flood Risk
600 min Winter	99.957	0.957	0.0	5.3	0.0	5.3	523.5	Flood Risk
720 min Winter	99.963	0.963	0.0	5.3	0.0	5.3	527.1	Flood Risk
960 min Winter	99.960	0.960	0.0	5.3	0.0	5.3	525.2	Flood Risk
1440 min Winter	99.939	0.939	0.0	5.2	0.0	5.2	513.6	Flood Risk
2160 min Winter	99.888	0.888	0.0	5.1	0.0	5.1	486.0	Flood Risk
2880 min Winter	99.828	0.828	0.0	4.9	0.0	4.9	452.8	Flood Risk
4320 min Winter	99.704	0.704	0.0	4.6	0.0	4.6	385.3	Flood Risk
5760 min Winter	99.585	0.585	0.0	4.4	0.0	4.4	320.3	O K
7200 min Winter	99.468	0.468	0.0	4.4	0.0	4.4	256.1	O K
8640 min Winter	99.349	0.349	0.0	4.4	0.0	4.4	191.2	O K
10080 min Winter	99.250	0.250	0.0	4.4	0.0	4.4	136.7	O K
Storm Event			Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)	
120 min Winter			20.026	0.0	424.6	0.0	126	
180 min Winter			14.961	0.0	475.4	0.0	184	
240 min Winter			12.104	0.0	512.3	0.0	242	
360 min Winter			8.959	0.0	567.4	0.0	358	
480 min Winter			7.232	0.0	608.8	0.0	472	
600 min Winter			6.122	0.0	641.5	0.0	582	
720 min Winter			5.340	0.0	667.7	0.0	692	
960 min Winter			4.302	0.0	704.0	0.0	896	
1440 min Winter			3.167	0.0	708.3	0.0	1114	
2160 min Winter			2.329	0.0	897.0	0.0	1580	
2880 min Winter			1.871	0.0	959.9	0.0	2044	
4320 min Winter			1.372	0.0	1051.4	0.0	2908	
5760 min Winter			1.100	0.0	1133.3	0.0	3760	
7200 min Winter			0.927	0.0	1193.0	0.0	4608	
8640 min Winter			0.806	0.0	1244.5	0.0	5280	
10080 min Winter			0.716	0.0	1288.7	0.0	5848	
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Ashburton Court West The Castle Winchester SO23 8UD	Oak Park Havant Attenuation Tank	
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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.100	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+10

Time Area Diagram

Total Area (ha) 1.278

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
From:	To:	From:	To:	From:	To:
0	4	4	8	8	12
	0.426		0.426		0.426

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Ashburton Court West The Castle Winchester SO23 8UD	Oak Park Havant Attenuation Tank	
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Micro Drainage	Source Control 2013.1	

Model Details

Storage is Online Cover Level (m) 100.000

Cellular Storage Structure

Invert Level (m) 99.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	576.0	576.0	1.001	0.0	672.0
1.000	576.0	672.0			

Hydro-Brake® Outflow Control

Design Head (m) 1.000 Hydro-Brake® Type Md6 SW Only Invert Level (m) 99.000
Design Flow (l/s) 5.4 Diameter (mm) 97

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.9	1.200	5.9	3.000	9.3	7.000	14.2
0.200	4.4	1.400	6.4	3.500	10.0	7.500	14.7
0.300	4.3	1.600	6.8	4.000	10.7	8.000	15.2
0.400	4.1	1.800	7.2	4.500	11.4	8.500	15.7
0.500	4.1	2.000	7.6	5.000	12.0	9.000	16.1
0.600	4.3	2.200	8.0	5.500	12.6	9.500	16.5
0.800	4.8	2.400	8.3	6.000	13.1		
1.000	5.4	2.600	8.7	6.500	13.7		

Pipe Overflow Control

Diameter (m) 0.150 Entry Loss Coefficient 0.500
Slope (1:X) 150.0 Coefficient of Contraction 0.600
Length (m) 1.000 Upstream Invert Level (m) 100.000
Roughness k (mm) 0.600

**APPENDIX C. - ASSESSMENT OF EXISTING RETENTION BASIN
CAPACITY USING MICRODRAINAGE**

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Ashburton Court West The Castle Winchester SO23 8UD		Oak Park, Havant Res + Health + Oak Park			
Date 22/10/12 File Oak Park Havant_...		Designed by R.Dooley Checked by			
Micro Drainage		Source Control W.12.6.1			
<u>Summary of Results for 100 year Return Period (+30%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	10.972	0.372	29.6	222.1	O K
30 min Summer	11.073	0.473	33.1	288.3	O K
60 min Summer	11.151	0.551	35.6	341.9	O K
120 min Summer	11.186	0.586	36.7	366.8	O K
180 min Summer	11.188	0.588	36.8	368.2	O K
240 min Summer	11.178	0.578	36.5	360.8	O K
360 min Summer	11.148	0.548	35.6	340.2	O K
480 min Summer	11.116	0.516	34.6	318.1	O K
600 min Summer	11.085	0.485	33.5	296.8	O K
720 min Summer	11.056	0.456	32.6	276.8	O K
960 min Summer	11.003	0.403	30.7	241.7	O K
1440 min Summer	10.919	0.319	27.5	187.8	O K
2160 min Summer	10.833	0.233	23.8	134.4	O K
2880 min Summer	10.776	0.176	21.1	100.2	O K
4320 min Summer	10.713	0.113	17.4	63.2	O K
5760 min Summer	10.685	0.085	14.2	47.2	O K
7200 min Summer	10.666	0.066	12.1	36.5	O K
8640 min Summer	10.652	0.052	10.6	28.8	O K
10080 min Summer	10.642	0.042	9.4	22.9	O K
15 min Winter	11.016	0.416	31.2	250.7	O K
30 min Winter	11.128	0.528	34.9	326.4	O K
60 min Winter	11.218	0.618	37.7	389.6	O K
120 min Winter	11.258	0.658	38.8	418.2	O K
Storm Event	Rain (mm/hr)		Time-Peak (mins)		
15 min Summer	117.069		24		
30 min Summer	78.692		36		
60 min Summer	50.485		62		
120 min Summer	31.269		100		
180 min Summer	23.274		132		
240 min Summer	18.738		166		
360 min Summer	13.779		236		
480 min Summer	11.072		304		
600 min Summer	9.336		370		
720 min Summer	8.117		434		
960 min Summer	6.503		562		
1440 min Summer	4.749		810		
2160 min Summer	3.461		1172		
2880 min Summer	2.761		1528		
4320 min Summer	2.005		2212		
5760 min Summer	1.595		2944		
7200 min Summer	1.335		3672		
8640 min Summer	1.156		4408		
10080 min Summer	1.023		5136		
15 min Winter	117.069		24		
30 min Winter	78.692		37		
60 min Winter	50.485		62		
120 min Winter	31.269		104		
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Date 22/10/12 File Oak Park Havant_...		Designed by R.Dooley Checked by				
Micro Drainage		Source Control W.12.6.1				
<u>Summary of Results for 100 year Return Period (+30%)</u>						
	Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
	180 min Winter	11.257	0.657	38.8	417.4	O K
	240 min Winter	11.240	0.640	38.3	405.0	O K
	360 min Winter	11.194	0.594	37.0	372.5	O K
	480 min Winter	11.146	0.546	35.5	338.9	O K
	600 min Winter	11.101	0.501	34.1	307.3	O K
	720 min Winter	11.058	0.458	32.6	278.5	O K
	960 min Winter	10.985	0.385	30.1	229.9	O K
	1440 min Winter	10.875	0.275	25.7	160.5	O K
	2160 min Winter	10.775	0.175	21.0	99.7	O K
	2880 min Winter	10.719	0.119	17.8	66.9	O K
	4320 min Winter	10.676	0.076	13.2	42.5	O K
	5760 min Winter	10.653	0.053	10.6	29.1	O K
	7200 min Winter	10.637	0.037	8.9	20.4	O K
	8640 min Winter	10.626	0.026	7.8	14.3	O K
	10080 min Winter	10.617	0.017	6.9	9.4	O K
	Storm Event	Rain (mm/hr)		Time-Peak (mins)		
	180 min Winter	23.274		142		
	240 min Winter	18.738		180		
	360 min Winter	13.779		254		
	480 min Winter	11.072		324		
	600 min Winter	9.336		394		
	720 min Winter	8.117		462		
	960 min Winter	6.503		590		
	1440 min Winter	4.749		840		
	2160 min Winter	3.461		1192		
	2880 min Winter	2.761		1532		
	4320 min Winter	2.005		2248		
	5760 min Winter	1.595		2944		
	7200 min Winter	1.335		3680		
	8640 min Winter	1.156		4408		
	10080 min Winter	1.023		5144		
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Ashburton Court West The Castle Winchester SO23 8UD	Oak Park, Havant Res + Health + Oak Park	
Date 22/10/12 File Oak Park Havant_...	Designed by R.Dooley Checked by	
Micro Drainage Source Control W.12.6.1		

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.200	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time / Area Diagram

Total Area (ha) 1.140

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.380	4-8	0.380	8-12	0.380

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Date 22/10/12 File Oak Park Havant_...	Designed by R.Dooley Checked by	
Micro Drainage	Source Control W.12.6.1	

Model Details

Storage is Online Cover Level (m) 12.000

Tank or Pond Structure

Invert Level (m) 10.600

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	545.2	1.400	929.4

Pipe Outflow Control

Diameter (m) 0.150 Entry Loss Coefficient 0.500
 Slope (1:X) 80.0 Coefficient of Contraction 0.600
 Length (m) 6.300 Upstream Invert Level (m) 10.500
 Roughness k (mm) 0.600

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Date 22/10/12 File Oak Park Havant_...		Designed by R.Dooley Checked by				
Micro Drainage		Source Control W.12.6.1				
<u>Summary of Results for 100 year Return Period (+30%)</u>						
	Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
	15 min Summer	11.159	0.559	35.9	347.4	O K
	30 min Summer	11.307	0.707	40.2	454.0	O K
	60 min Summer	11.430	0.830	43.4	546.9	O K
	120 min Summer	11.496	0.896	45.1	598.5	O K
	180 min Summer	11.506	0.906	45.3	606.9	O K
	240 min Summer	11.500	0.900	45.2	601.6	O K
	360 min Summer	11.472	0.872	44.5	579.6	O K
	480 min Summer	11.437	0.837	43.6	552.5	O K
	600 min Summer	11.401	0.801	42.7	524.4	O K
	720 min Summer	11.364	0.764	41.7	496.9	O K
	960 min Summer	11.297	0.697	39.9	446.4	O K
	1440 min Summer	11.181	0.581	36.6	363.3	O K
	2160 min Summer	11.052	0.452	32.4	274.3	O K
	2880 min Summer	10.958	0.358	29.1	213.0	O K
	4320 min Summer	10.837	0.237	24.1	137.0	O K
	5760 min Summer	10.766	0.166	20.5	94.5	O K
	7200 min Summer	10.724	0.124	18.1	69.9	O K
	8640 min Summer	10.702	0.102	16.1	56.9	O K
	10080 min Summer	10.686	0.086	14.4	48.0	O K
	15 min Winter	11.221	0.621	37.7	391.4	O K
	30 min Winter	11.386	0.786	42.3	513.0	O K
	60 min Winter	11.525	0.925	45.8	621.6	O K
	120 min Winter	11.605	1.005	47.7	686.5	O K
	Storm Event	Rain (mm/hr)		Time-Peak (mins)		
	15 min Summer	117.069		24		
	30 min Summer	78.692		37		
	60 min Summer	50.485		64		
	120 min Summer	31.269		110		
	180 min Summer	23.274		140		
	240 min Summer	18.738		174		
	360 min Summer	13.779		244		
	480 min Summer	11.072		312		
	600 min Summer	9.336		380		
	720 min Summer	8.117		446		
	960 min Summer	6.503		578		
	1440 min Summer	4.749		830		
	2160 min Summer	3.461		1196		
	2880 min Summer	2.761		1560		
	4320 min Summer	2.005		2260		
	5760 min Summer	1.595		2992		
	7200 min Summer	1.335		3680		
	8640 min Summer	1.156		4408		
	10080 min Summer	1.023		5136		
	15 min Winter	117.069		24		
	30 min Winter	78.692		37		
	60 min Winter	50.485		64		
	120 min Winter	31.269		118		
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File Oak Park Havant_...		Checked by			
Micro Drainage		Source Control W.12.6.1			
Summary of Results for 100 year Return Period (+30%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
180 min Winter	11.611	1.011	47.8	691.8	O K
240 min Winter	11.600	1.000	47.6	682.6	O K
360 min Winter	11.557	0.957	46.5	647.6	O K
480 min Winter	11.505	0.905	45.3	605.6	O K
600 min Winter	11.450	0.850	43.9	562.9	O K
720 min Winter	11.397	0.797	42.6	522.0	O K
960 min Winter	11.300	0.700	40.0	448.8	O K
1440 min Winter	11.141	0.541	35.3	335.4	O K
2160 min Winter	10.977	0.377	29.8	225.0	O K
2880 min Winter	10.871	0.271	25.5	157.7	O K
4320 min Winter	10.752	0.152	19.8	86.3	O K
5760 min Winter	10.703	0.103	16.2	57.4	O K
7200 min Winter	10.680	0.080	13.6	44.3	O K
8640 min Winter	10.664	0.064	11.9	35.2	O K
10080 min Winter	10.652	0.052	10.5	28.4	O K
Storm Event	Rain (mm/hr)		Time-Peak (mins)		
180 min Winter	23.274		148		
240 min Winter	18.738		186		
360 min Winter	13.779		262		
480 min Winter	11.072		336		
600 min Winter	9.336		408		
720 min Winter	8.117		478		
960 min Winter	6.503		612		
1440 min Winter	4.749		870		
2160 min Winter	3.461		1236		
2880 min Winter	2.761		1592		
4320 min Winter	2.005		2292		
5760 min Winter	1.595		2944		
7200 min Winter	1.335		3680		
8640 min Winter	1.156		4408		
10080 min Winter	1.023		5144		
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Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.200	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time / Area Diagram

Total Area (ha) 1.740

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.580	4-8	0.580	8-12	0.580

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Ashburton Court West The Castle Winchester SO23 8UD	Oak Park, Havant Whole Site + Oak Park	
Date 22/10/12 File Oak Park Havant_...	Designed by R.Dooley Checked by	
Micro Drainage Source Control W.12.6.1		

Model Details

Storage is Online Cover Level (m) 12.000

Tank or Pond Structure

Invert Level (m) 10.600

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	545.2	1.400	929.4

Pipe Outflow Control

Diameter (m)	0.150	Entry Loss Coefficient	0.500
Slope (1:X)	80.0	Coefficient of Contraction	0.600
Length (m)	6.300	Upstream Invert Level (m)	10.500
Roughness k (mm)	0.600		

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