

16-6953  
Phase 2 and 3, Corinthian Park  
Cheltenham, GL51 6UP

## Flood Risk Assessment & Surface Water Management Plan

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Hinton Properties Plc

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*Issue 3*

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## Executive Summary

This combined Flood Risk Assessment (FRA) and Surface Water Management Plan (SWMP) has been prepared in support of Hinton Properties proposed development of Phase 2 and 3 of their ongoing development site located at Corinthian Park, Grovefield Way, Cheltenham. GL51 6UP. The Phase 1 development consisted of the construction of a flagship BMW dealership approved under planning application number 14\_00656-Ful. It is intended to follow the approach previously accepted by the Lead Local Flood Authority (LLFA) put forward by Transport Planning Associates (TPA) in their previous report reference number 1303-30/FRA/01/A dated June 2013 and 1402-01SWP/01 dated September 2015 (contained within Appendix B of this report for reference).

It should be noted that the latter report deals with the drainage of the new access road off Grovefield Way which serves both a Flagship BMW Dealership, comprising a car showroom, servicing building with a 3000m<sup>2</sup> footprint plus car parking and the main access to the future Phase 2 and 3 development sites beyond. The developed Phase 1 site provided approximately 1.65 ha of impermeable area, and the access road will provide approximately 0.374ha of impermeable area.

This FRA is carried out in accordance with BS 8533:2011<sup>1</sup>, National Planning Policy Framework (NPPF), Planning Practice Guidance (PPG), Environment Agency (EA) Advice for Development, and following the guidance in CIRIA C624, C697 & C753. Reference is also made to the now replaced Planning Policy Statement 25 (PPS 25) and Planning Policy Statement 25 Practice Guide, which provided comprehensive tools for assessing and mitigating flood risk.

The proposed development site is a low risk (Zone 1) for fluvial or pluvial flooding; as shown on the EA's Risk of flood mapping.

The surface water drainage arising from the impermeable areas associated with Phase 2 development and its parking areas and access road is circa 1.825ha in area. It is proposed that these flows will discharge on an attenuated basis, to an existing Highway balancing pond system located along the northern boundary of the site which was constructed as part of the Phase 1 works via the existing gravity drainage system.

The surface water discharges associated with the Phase 2 development, will be contained on the site via a porous paving system together with cellular storage structures, subject to a restricted discharge of 8.4 l/s being accommodated within the existing Highway balancing pond arrangements located along the northern boundary of the development. The proposed outflow from the balancing pond will remain set at 10.2/s as per the agreed Phase 1 works. (with a further separate attenuation-based drainage system being provided to service the remainder of the Phase 3 site).

It is considered that this development will not increase the risk of flooding in the wider catchment as the surface water generated from the site will be contained within the proposed drainage systems and released on a controlled basis.

Any foul discharge from the new buildings and associated infrastructure will be connected to an existing private foul drain which crosses the Phase 2 development site, which will require a localised

diversion. before out falling to an adopted 225mm diameter foul sewer located within the south west corner of the site, at STW Manhole reference 4400 which then discharges to public system located within North Road West.

<p><i>Site Location:</i></p>	<p>The parcel of land as identified on the Site Location Plan (Appendix A) is located approximately 2 kilometres west of Cheltenham town centre, approached by Grovefield Way, a major access road which joins the A40 approximately 800m north from the site. The existing site is located within the business sector of Cheltenham and is surrounded by either agricultural land or business buildings.</p> <p>There are no main rivers running through or in the immediate vicinity of the site, although there is an unnamed ordinary watercourse which runs along the northern boundary of the site before being culverted where it crosses beneath the A40.</p>
<p><i>Size and Current Land Use:</i></p>	<p>The Phase 2 commercial scheme area consists of approximately 2.45 hectares of green fields.</p> <p>The Phase 2 site has a level difference of up to 5m from approximately 41m AOD on the south-east boundary, to approximately 36m AOD in the north-west corner of the development site.</p> <p>The Phase 3 commercial scheme area consists of approximately 1.67 hectares of green fields.</p> <p>The Phase 3 site has a level difference of up to 2m from approximately 33.75m AOD on the south-east boundary, to approximately 31.75m AOD in the north-west corner of the development site.</p> <p>The existing 1250mm diameter ditch course outfall beneath the A40 has a recorded invert level of 31.25m AOD.</p>
<p><i>Proposed Development:</i></p>	<p>Proposed development of a Costa Coffee retail outlet, Aldi Store, Day Nursery and two new high specification office buildings and associated car parking / access road infrastructure.</p> <p>The following Phase 3 development will most likely consist of a further two number office buildings and associated infrastructure, the schematic for Phase 3 is</p>

	indicative of the future proposals but may be subject to change
<i>EA Flood Zone Classification:</i>	Flood Risk Zone 1 – EA classification of less than 1 in 1000-year probability of flooding from rivers or seas in any given year.
<i>Lead Local Flood Authority &amp; SFRA:</i>	Gloucestershire County Council (GCC) - Strategic Flood Risk Assessment Level 1, and Gloucestershire SuDS Design and Maintenance Guide.
<i>Fluvial Flood Risk:</i>	None
<i>Tidal Flood Risk:</i>	None
<i>Surface Water Pluvial Flood Risk:</i>	Low risk - small area recorded to be vulnerable to 1 in 1000-year event to a depth not exceeding 300mm, this is related to a local low spot which is to be removed during the Phase 2 development works.
<i>Artificial Sources</i>	None
<i>Sewers</i>	None
<i>Groundwater Flood Risk:</i>	None
<i>Historical Flooding:</i>	None
<i>Flood Risk Vulnerability Classification:</i>	More vulnerable (applicable to the Phase 2 Day Nursery building only) – Less vulnerable to the remainder of phase 2 and 3 development.
<i>Sequential and Exception Test:</i>	Not Required

## 1. Introduction

This FRA is for the parcel of land as identified on the Site Location Plan (Appendix A). The site is located approximately 2 kilometres west of Cheltenham town centre, accessed by Grovefield Way, a major access road which joins the A40 approximately 800m north from the site. The existing site is located within the business sector of Cheltenham and is surrounded by either agricultural land or business buildings.

There are no main rivers running through or in the immediate vicinity of the site, although there is an unnamed ordinary watercourse which runs along the northern boundary of the site before being culverted where it crosses beneath the A40.

The Phase 2 scheme area consists of approximately 2.45 hectares of green fields and is bounded by tree lined hedgerows. The site has a level difference of up to 5m from approximately 41mAOD on the south-east boundary, to approximately 36mAOD in the north-west corner of the development site. The site also falls circa 3.0m across its width from south to north.

The Phase 3 scheme area consists of approximately 1.67 hectares of green fields. The site has a level difference of up to 2m from approximately 35mAOD on the south-east boundary, to approximately 31.5mAOD in the north-west corner of the development site.

The FRA is carried out in accordance with BS 8533:2011<sup>1</sup>, National Planning Policy Framework (NPPF)<sup>5</sup>, Planning Practice Guidance (PPG)<sup>9</sup> the guidance in CIRIA C624<sup>2</sup>, C697<sup>3</sup> & C753<sup>4</sup>. Reference is also made to the now replaced Planning Policy Statement 25 (PPS 25) and Planning Policy Statement 25 Practice Guide, which provide comprehensive tools for assessing and mitigating flood risk<sup>7,8</sup>

Complete Design Partnership Ltd. has been instructed by Hinton Properties Plc, to produce the FRA and SWMP to support an ongoing planning application which is to be made to Cheltenham Borough Council.

The proposed development site is located within Flood Zone 1 on the EA Risk of Flooding from Rivers and Sea Flood map.

## 1.1 Reference Data

The following documents form part of this assessment (Table 1):

Document	Prepared by:	Reference/No.
<b>Site Plan</b>	Design Development Partnership	178-96
<b>Site Location Plan</b>	Design Development Partnership	178-70
<b>Existing Site Survey</b>	Design Development Partnership	178-71
<b>Flood Mapping / Data</b>	Environment Agency and GOV	Web site
<b>Local Flood Risk Management Strategy</b>	Gloucestershire County Council (LLFA)	Flood Risk Management (Strategic Infrastructure)
<b>Strategic Flood Risk</b>	Halcrow on behalf of Cheltenham Borough Council (CBC)	Level 2 SFRA - 2013 Level 1 SFRA - 2007
<b>SWMP – Drainage Strategy</b>	Complete Design Partnership Ltd	16-6953-100 - Rev P3
<b>Site Investigation Report</b>	Structural Soils Ltd	July 2008 report no. 729381R2

Table 1: Reference Data

Existing site levels are shown upon the topographical survey. A copy of the drawing is included within Appendix A. For information, the site has a level difference of up to 8.5m from approximately 41mAOD on the south-east boundary, to approximately 31.5mAOD in the north-west corner of the development site.

The site is covered by Cheltenham Borough Council (CBC) Level 1 and later level 2 (2013) Strategic Flood Risk Assessment.

## 1.2 Climate change

Research by the Environment Agency (EA) shows that the probability of occurrence of severe flooding will increase. PPG sets out recommendations for contingency allowances for climate change. Table 2 summarises the relevant surface water increases that should be considered for an increase in peak rainfall intensity for developments with a design life horizon up to 2115:

Parameter	Total potential change anticipated for 2010-2039	Total potential change anticipated for 2040-2069	Total potential change anticipated for 2070-2115
Peak rainfall intensity	10%	20%	40%

**Table 2: PPG Table 2 contingency allowances for climate change**

The design life of the development is assumed to be around 100 years. Therefore, a climate change allowance of 40% on rainfall should be included in the design for the development.

(<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>)



## 2. Background to the site

### 2.1 General

The parcel of land as identified on the Site Location Plan (Appendix A) is located approximately 2 kilometres west of Cheltenham town centre, approached by Grovefield Way, a major access road which joins the A40 approximately 800m north from the site. The existing site is located within the business sector of Cheltenham and is surrounded by either agricultural land or business buildings. There are no main rivers running through or in the immediate vicinity of the site, although there is an unnamed ordinary watercourse which runs along the northern boundary of the site before being culverted where it crosses beneath the A40.

The Phase 2 scheme area consists of approximately 2.46 hectares and the Phase 3 site a further 1.67 hectares. The British Geological Survey and Environment Agency Maps have been studied to identify the site’s Geological and Hydrogeological properties. The following figures show the information shown within them.



Figure 1: British Geological Survey Data – Bedrock Map

As can be seen in Figure 1a the British Geological Survey 'Bedrock Map', the site is underlain by the Charmouth Mudstone formation classification of bedrock material, a sedimentary bedrock formed approximately 190 to 202 million years ago, in the Jurassic Period, where the local environment was previously dominated by shallow seas. There is no evidence of superficial deposits located within this area.

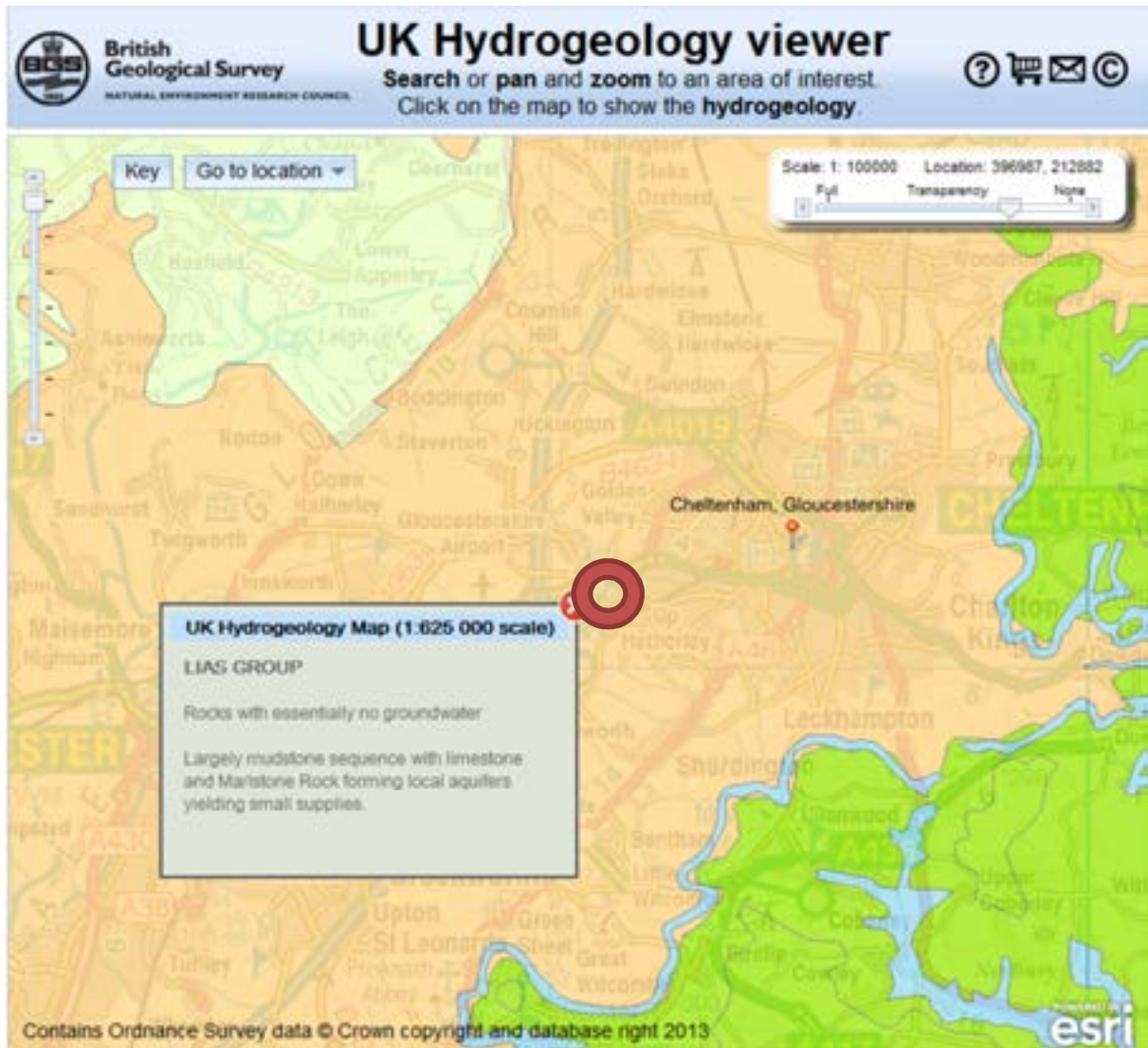


Figure 2: British Geological Survey Data – UK Hydrogeology Map

Figure 1b the British Geological Survey Data 'UK Hydrogeology Map' shows the potential for the ground to hold water. The area surrounding the development in Cheltenham is over the Lias group of bedrock material where the ground essentially has no groundwater. As shown on the map some local intrusions of Limestone provide localised aquifers with low yielding capacity.

Further to the map information in figures 1a and 1b above, an assessment of the site's infiltration properties is required to identify the site specific hydrological properties and storage capabilities.

Although the map information provided in Figures 1a and 1b shows the ground to have little or no infiltration properties.

A 'Site Investigation Report' carried out by Structural Soils Ltd in July 2008, covering the Phase 1 development provided information on three infiltration tests carried out across random locations on site. The results showed no measurable infiltration for the duration of the tests, which were carried out in accordance with BRE365 (see Appendix B containing previous TPA Phase 1 and highway FRA Data) therefore, we conclude that the use of soakaways would not be practical to use within this development site.

## 2.2 Strategic Flood Risk Assessment (SFRA)

The CBC level 1 SFRA and later level 2 SFRA denote that the site is partially at risk of surface water flooding during a 1 in 1000-year event, this is thought to be due to a localised, low lying area located along the southern boundary of the Phase 2 site. This small area is shown to flood to a depth of less than 300mm during the 1000-year event, it is thought that this is the result of a local low spot that will be removed during the Phase 2 developments proposed earthworks remodelling.

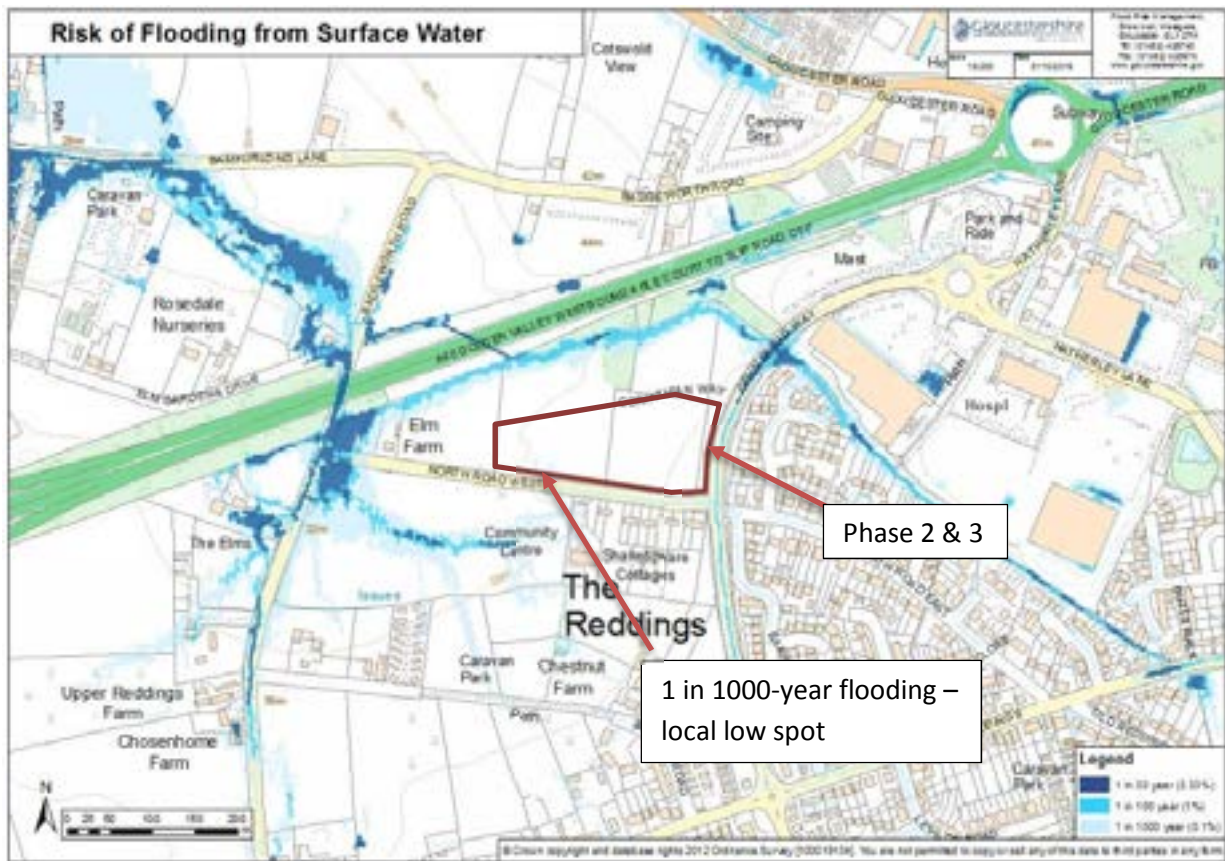


Figure 3: Flood mapping received from GCC/LLFA



### 2.2.1 Fluvial flooding

The proposed development site is located in Flood Zone 1 at low risk of fluvial flooding from rivers and sea. Figure 3 shows the site in relation to the EA Flood Map for planning;



Figure 4: EA website mapping.

### 2.2.2 Historical flooding

Historical flooding incidents within the area are: -

- Cheltenham Borough – July 1967 & summer 2007.
- Cotswold District – March 1947, July 1968, August 1977, Sept 1992, Oct 1993, April 1998, Dec 2000, Summer 2007, Jan 2008.
- Forest of Dean – March 1947, July 1968, Dec 1981, Dec 2000, summer 2007.
- Gloucester City – Jan 1939, March 1947, July 1968, Dec 1981, Jan 1990, Dec 2000, Summer 2007.
- Stroud – Jan 1939, March 1947, Dec 1965, July 1968, Dec 1981, Jan 1990, Dec 2000, Summer 2007.
- Tewkesbury Borough – Jan 1939, March 1947, July 1968, Dec 1981, 1985, Jan 1990, April 1998, Dec 2000, Summer 2007.

Cheltenham is mentioned in the historic flooding part of the CBC report as having over 600 properties being flooded by the summer 2007 floods. Cheltenham suffered from Fluvial (River Chelt, Wymans Brook, Hatherley Brook, Mill Stream), surface runoff and exceedance from highway drains and public sewers. The areas mainly affected were Charlton Kings (70 properties), River Chelt (230 properties), Hatherley (100 properties), Prestbury (70 properties) and Whaddon (250 properties).

Although there were several areas severely affected by flooding as mentioned above, the population densities within these areas were not high enough to make it to the Environment Agency's Flood Risk Areas.

Historic flood map information provided to us identified two areas close to the development site as suffering flooding during the July 1968 floods, one approximately 50m north-west of the site on the opposite side of the A40, the other approximately 100m southwest of the site on the Reddings. The historic flood map also shows areas along Hatherley Brook which suffered flooding during the summer 2007 floods, the nearest being approximately 200m east of the site next to the roundabout junction with the A40.

The information found within this report identified that although the development site itself was not subject to flooding historically and is not predicted to suffer flooding in the future, consideration will need to be made towards both Hatherley Brook and the Reddings, two areas which have historically suffered flooding.

The asset location plans provided by Severn Trent Water show a surface water sewer within Grovefield Way to the east and a foul water sewer to the south within North Road West.

STWL were not able to provide any recorded evidence of flooding from public sewers that would have opportunity to cause a flood risk to the future development sites.

The STWL mapping information is provided within Appendix D.

### 2.2.3 Surface water (Pluvial) flooding

The EA Surface Water Flood Map shows a very low risk of surface water flooding.

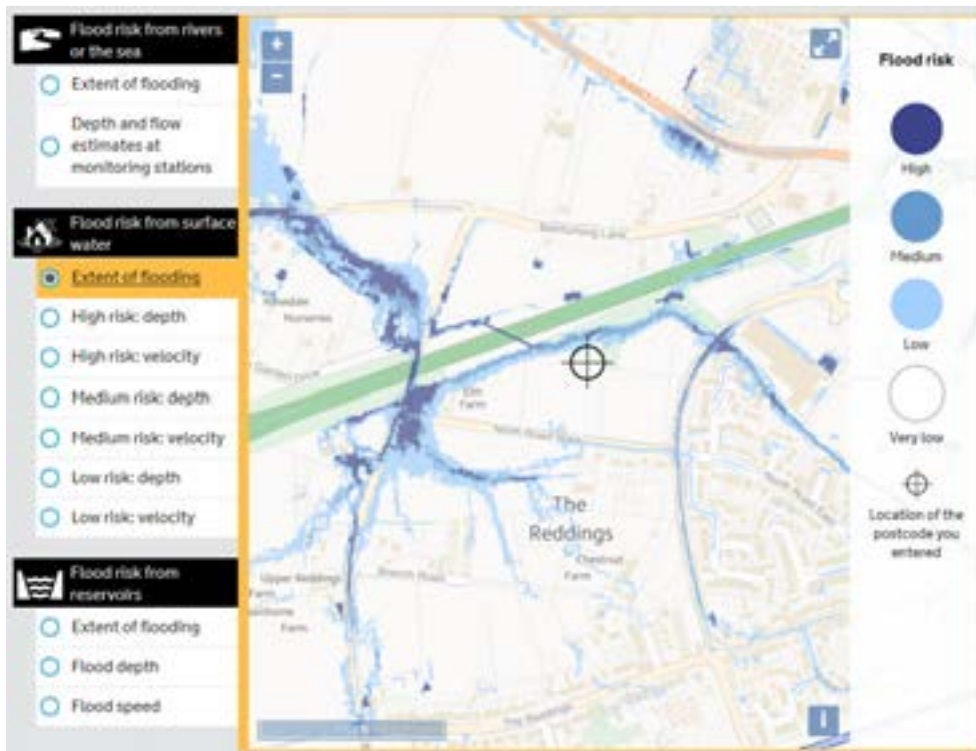


Figure 5: EA Surface Water flood mapping.

### **2.3 Ground conditions & ground water**

The ground conditions indicated by BGS data and previous site investigation works would indicate that the use of infiltration-based SuDS systems is not practicable within the proposed development, which was confirmed during the 2008 site investigation works undertaken by Structural Soils.

### **2.4 Existing drainage**

The Asset Location maps, provided by Severn Trent Water, show the location of a public Foul Water sewer within North Road West which runs along the southern boundary of the site. And a surface water system running in a northerly direction along the length of Grovefield Way to the eastern boundary of the site.

Foul Water sewers from the development can connect to the existing public Foul Water Sewer under a Section 104/106 agreement with Severn Trent Water, via new connections to an existing private foul water drain which crosses the Phase 2 site, this drain was provided during the construction of the Phase 1 works and it was intended for the Phase 2 and 3 works to be connected to this drain, which currently remains un-adopted, and will be subject to a local diversion.

### **2.5 Existing impermeable area**

The existing Phase 2 site is effectively greenfield, except for a small area (0.347ha) access road previously constructed to serve the remainder of the development during the construction of the adjacent Phase 1 BMW dealership project, which has the benefit of its own Highway balancing pond facility.

### **2.6 Sequential Test**

The majority of the proposed development is classified as “less vulnerable” and is located in Flood Zone 1. It therefore meets the compatibility requirements set out in PPG Table 3 (Figure 2); however the Day nursery is classified as “More Vulnerable” this being the higher classification to which the Phase 2 development will need to be tested against.

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

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

Table 3: Flood risk vulnerability and flood zone compatibility

It is considered that the proposals satisfy the requirements of the sequential test and is therefore appropriate for the proposed location.

### 3. Proposed Development

The majority of the proposed Phase 2 and 3 development is classified in PPG Table 3 as “Less Vulnerable” and is located in Flood Zone 1; however the Day nursery is classified as “More Vulnerable” this being the higher classification to which the development will need to be tested against.

#### 3.1 Description

The proposed Phase 2 and 3 developments are shown on the Architect’s drawings (located within Appendix A), comprising of a proposed access road (partially constructed within the Phase 1 works), Costa Coffee, Aldi store, Nursery and two new office buildings with their associated parking areas and public realm / landscaping areas.

The proposed Phase 3 development is shown on the Architect’s drawings (located within Appendix A), comprising of a proposed access road, two new office buildings with their associated parking areas and public realm / landscaping areas. Note: the later Phase 3 development is currently shown indicatively upon these drawings and has been used to calculate the overall site discharge from the remaining Phase 3 development area.

Access to the site is via the existing access road arrangement.

#### 3.2 Impermeable area

The proposed impermeable area contributing to the new network has been measured from the revised Architect’s layout (car park, access road and buildings) totalling an area of circa 18,253m<sup>2</sup> or (1.82ha) or 74.2% of the gross Phase 2 site area.

The proposed impermeable area contributing to the new network has been measured from the Architect’s layout (car park, access road and buildings) totalling an area of circa 11050m<sup>2</sup> or (1.67ha) or circa 66% of the gross Phase 3 site area.

#### 3.3 Proposed levels

Proposed levels for the external areas and finished floor level are to tie into external levels with the new access road provided to serve the existing BMW site and paved areas around the site, whilst the proposed levels will be adjusted to minimise the need for material removal.

#### 3.4 Proposed drainage

It is envisaged that the drainage arising from roofs shall enter into a combination of porous paving and piped attenuation systems.

Permeable paved areas and cellular attenuation structures to be located within the parking areas of each Phase which will attenuate flows generated by the parking court itself as well as from the hard-surfaced circulation areas and roofs, for storm events up to and including the 1 in 100 +40% CC year storm event.



The access road will use a piped traditional drainage network. The drains will be sized to accommodate the 1 in 100 +40% CC year storm event before entering a second highway balancing pond (previously constructed to serve the access road only) located adjacent the northern boundary, which is currently limited to a discharge rate of 1.8l/s.

All of the proposed Phase 2 and following Phase 3 drainage systems will discharge into the ditch running along the northern boundary via a balancing pond and flow control chamber, which will be designed to limit discharge to Greenfield runoff rate of Qbar 8.4l/s for Phase 2 and Qbar of 5.7l/s for Phase 3, whilst the original flow control for the highway system regulated to 1.8l/s will be removed and replaced with a new unit set to limit flows to 10.2l/s @1.1m head (this represents the allowable discharge from Phase 2 at 8.4l/s and the Phase 1 highway area at 1.8l/s combined).

These figures are based on the same calculation data as used within the previously approved TPA FRA covering the Phase 1 site. The Qbar calculations are given below:

The screenshot shows the 'Rural Runoff Calculator' software interface. The 'ICP SUDS' section contains input fields for Return Period (Years), Area (ha), SAAR (mm), Soil, Growth Curve, and a 'Calculate' button. The 'Results' section shows 'QBAR rural (l/s)' and 'QBAR urban (l/s)' both set to 8.4. Below this is a table titled 'Return Period Flood' with columns for Region, QBAR (l/s), Q (2yrs) (l/s), Q (1 yrs) (l/s), Q (30 yrs) (l/s), and Q (100 yrs) (l/s). The table lists various regions and their corresponding flow rates for different return periods.

Region	QBAR (l/s)	Q (2yrs) (l/s)	Q (1 yrs) (l/s)	Q (30 yrs) (l/s)	Q (100 yrs) (l/s)
Region 1	8.4	7.6	7.1	15.8	20.8
Region 2	8.4	7.6	7.3	15.9	22.0
Region 3	8.4	7.5	7.2	14.7	17.4
Region 4	8.4	7.5	6.9	16.4	21.5
Region 5	8.4	7.5	7.3	20.1	29.8
Region 6/Region 7	8.4	7.4	7.1	19.0	26.7
Region 8	8.4	7.4	6.5	16.0	20.3
Region 9	8.4	7.3	7.4	14.8	18.2
Region 10	8.4	7.3	7.3	14.2	17.4
Ireland National	8.4	8.0	7.1	13.3	15.4
Ireland East	8.4	8.0	7.1	13.6	15.9
Ireland South	8.4	8.0	7.1	13.3	15.4
Ireland West	8.4	8.0	7.1	12.9	14.9
Greenfield Volume	8.4	7.7	7.1	17.8	21.8

Table 4: Phase 2 Qbar Flow Calculations

Region	GBAR (l/s)	Q (2yrs) (l/s)	Q (11 yrs) (l/s)	Q (10 yrs) (l/s)	Q (100 yrs) (l/s)	
Region 1	5.7	5.2	4.9	10.8	14.2	
Region 2	5.7	5.2	5.0	10.8	15.0	
Region 3	5.7	5.4	4.9	10.0	11.9	
Region 4	5.7	5.1	4.7	11.2	14.7	
Region 5	5.7	5.1	5.0	13.7	20.3	
Region 6/Region 7	5.7	5.0	4.9	13.0	18.2	
Region 8	5.7	5.1	4.5	10.9	13.8	
Region 9	5.7	5.3	5.0	10.1	12.5	
Region 10	5.7	5.3	5.0	9.7	11.9	
ICP SUDS	Ireland National	5.7	5.5	4.9	9.1	10.5
ADAS 345	Ireland East	5.7	5.5	4.9	9.3	10.9
FEH	Ireland South	5.7	5.5	4.9	9.1	10.5
Greenfield Volume	Ireland West	5.7	5.5	4.9	8.8	10.2
	Ireland Greater Dublin	5.7	5.3	4.9	12.1	14.9

Table 5: Phase 3 Qbar Flow Calculations

A Windes Quick Storage Estimate showed that for the 1 in 100-year return period plus 40% Climate change storm, and assuming there are no infiltration properties through the ground (based upon hydrology map information from the British Geological Survey website and historic soakage testing carried out in 2008 for Phase 1), a volume of circa 2000m<sup>3</sup> of attenuation would be need to be included for within the onsite surface water management proposals for the Phase 2 area.

It is proposed that the Phase 2 parking areas be constructed using a permeable paving system to accommodate runoff from itself as well as from the hard-surfaced circulation roads and adjacent roof areas. Based on an area of 4890m<sup>2</sup> being provided with an approximately 400mm deep depth of filter material below and allowing for a 30% void ratio, a total of 586m<sup>3</sup> volume of attenuation can be provided.

The remaining attenuation requirement of 1414m<sup>3</sup> shall be accommodated by the provision of cellular storage structures located within the curtilage of the Phase 2 carparking and public realm areas, with the discharge rate controlled via suitable flow control devices. The exact layout and volume of the attenuation tanks will be confirmed during the detail design of the project. (For detailed Windes calculations refer to Appendix C).

The existing highway drainage and associated highway balancing pond will be able to cope with the additional 8.4l/s base flow, (refer to Appendix C for Windes simulation calculations) the results of this additional volume are that the existing highway balancing pond does not need to be extended physically to accommodate the additional flow arising from Phase 2, assuming Phase 3 provides a

separate controlled outfall to the existing watercourse; however the existing flow control device will need to be replaced and upsized to accommodate the revised highway and Phase 2 outflow of 10.2l/s.

With regard to the future Phase 3 area a Windes Quick Storage Estimate showed that for the 1 in 100-year return period plus 40% Climate change storm, assuming there are no infiltration properties through the ground (based upon hydrology map information from the British Geological Survey website and historic soakage testing carried out in 2008 for Phase 1), a volume of circa 454-650m<sup>3</sup> of attenuation would need to be included for within the onsite surface water management proposals for the Phase 3 area.

It is proposed that the Phase 3 parking areas be constructed using a permeable paving system to accommodate runoff from itself as well as from the hard-surfaced circulation roads and adjacent roof areas. Based on an area of 4225m<sup>2</sup> being provided with approximately 400mm depth of filter material below and allowing for a 30% void ratio, a total of 507m<sup>3</sup> volume of attenuation can be provided.

The remaining attenuation requirement of circa 100m<sup>3</sup> shall be accommodated by the provision of cellular storage structures located within the curtilage of the Phase 3 car parking and public realm areas, with the discharge rate of 5.7l/s controlled via a suitable flow control device. The exact layout and volume of the attenuation tanks will be confirmed during the detail design of the project. (For detailed Windes calculations refer to Appendix C).

The site has the capacity to manage the storage requirements of the 1 in 100-year + 40% climate change event, and we note the requirement that surface water management plans should account for exceedances where, for example, storm events exceed the 1 in 100-year return period.

Foul drainage will also be served by new connections to the existing private drain which crosses the Phase 2 site, this drain will require a local diversion, before out falling to the public sewer system via existing manhole reference 4400 located in the western corner of the site to the boundary of Elm Farm.

It is believed this private foul drain is capable of dealing with the foul flows arising from the remainder of the development, and that this capacity was provided for within the original Phase 1 design, noting that this drain will require a local diversion.

## 4. Surface Water Management Plan

### 4.1 SuDS storm water management and storage volume

It is envisaged that the drainage from roofs shall enter into a combination of porous paving and piped attenuation systems. Permeable paved areas linked to cellular attenuation structures which are to be located within the parking courts will attenuate flows generated by the development, for storm events up to and including the 1 in 100 +40% CC year storm event.

Highways will use an existing piped system sized to accommodate the 1 in 100 +40% CC year storm event before entering an existing Highway balancing pond located adjacent the northern boundary, limited to a revised discharge rate of 10.2l/s. (For detailed Windes calculations refer to Appendix C).

All of the proposed Phase 2 and 3 drainage systems will discharge into the minor watercourse running along the northern boundary via a Flow Control Chambers, which will be designed to limit the total Phase 2 and 3 discharges to a Greenfield runoff rate of 14.1l/s. (i.e. 8.4l/s from Phase 2 and 5.7l/s from Phase 3).

The proposed foul water drainage will be designed to connect to the existing private drainage system crossing the Phase 2 site, this system then discharges to the public sewer located to the south west of the site at manhole reference 4400, which is located within the Phase 3 site at the junction of Elm Farm and North Road West.

### 4.2 Pollution Prevention

Class 2 Oil/ petrol interceptors will be used in the Pollution Prevention train as detailed in the EA guideline PPG3, prior to discharging to the balancing pond and existing watercourse.

## 5. Flood Risk Assessment

The following sources of flooding have been considered for the site:

- Fluvial flooding from streams, springs, sewers and culverts
- Pluvial/surface water flooding
- Groundwater flooding
- Tidal Flooding

### 5.1 Risk of fluvial flooding, and flooding from reservoirs, canals and other artificial sources to the proposed development

The proposed development site is located primarily in Flood Zone 1 at low risk of flooding from rivers and sea.

### 5.2 Risk of pluvial flooding to the proposed development

The EA Surface Water Flood Map shows a very small area along the southern boundary line to be at low risk of surface water flooding. This small area is shown to flood to a depth of less than 300mm during the 1000-year event, it is thought that this is the result of a local low spot that will be removed during the Phase 2 developments proposed earthworks remodelling.

### 5.3 Risk of groundwater flooding to the proposed development

No historic groundwater flooding was found to be recorded and ground water is expected to be 5m below the existing ground level. Based on this information it is considered that the risk of flooding from this source is low.

### 5.4 Risk of tidal flooding to the proposed development

The proposed development site lies in an area shown on the EA indicative flood map as Flood Zone 1 at low risk of tidal flooding.

### 5.5 Effect of development on wider catchment

The development will generate an increase over the existing discharge volumes received to the wider catchment, following the provision of suitable storage and attenuation volumes it is considered a low risk of surface water flooding in the wider catchment, and a betterment in terms of water quality can be expected.

### 5.6 Mitigation of residual flood risk

There is no residual flood risk to be mitigated for the proposed development.

## 6. Conclusions and Recommendations

The Flood Risk Assessment identifies that the proposed development site is within Flood Zone 1 therefore posing a low risk of flooding. The flooding problem areas near to the site should benefit from the on-site attenuation provided by the SWMP.

The asset location plans provided by Severn Trent Water show a surface water sewer located within Grovefield Way and a foul water sewer located within North Road West. There is no recorded evidence of public sewers flooding in the area of the site that would cause a flood risk to the development site.

The topography of the development site shows overland flows directing towards the northwest boundary. By using permeable paving linked to traditional attenuation systems, the peak runoff volumes are reduced to that of the calculated greenfield runoff rates.

By using SuDS features such as permeable paving, cellular storage structures and the existing highway balancing pond to attenuate flows up to the 1 in 100 year + 40%CC storm event, thereby actively creating betterment to the existing downstream areas.

The Surface Water Management Plan identifies that although the impermeable area will be increased on site from that of the existing greenfield scenario, using a combination of SuDS systems for attenuation as well as water cleansing, runoff from the site is not increased and its water quality is improved.

Pollution control measures in the form of Class 2 petrol interceptors will be provided in accordance with recommendations of PPG3.

Foul Water from the site will be discharged (via an existing private drain, which requires diverting) into public foul water sewers off site under agreement with the adopting water authority, Severn Trent Water.

The impermeable area will increase for this development; however the adoption of SUDS and the provision of on-site storage capacity will not increase the risk of flooding in the wider catchment, indeed it may produce a long-term benefit to the receiving downstream catchment.

The drainage strategy proposed will provide extensive mitigation against the potential for off-site flooding relating to overland flows, resulting in a benefit to the wider downstream catchment.

## 7. References

1. BS 8533:2011 Assessing and Managing flood risk in development – Code of practice.
2. CIRIA C624 development and flood risk guidance for the construction industry. CIRIA. London 2004.
3. CIRIA C697 The SuDS Manual. London 2007.
4. CIRIA C753 The SuDS Manual. London 2015
5. National Planning Policy Framework 2012. Department for Communities and Local Government. March 2012.
6. Planning Policy Statement 25: development and Flood Risk, Communities and Local Government, TSO, March 2010.
7. Planning Policy Statement 25: Development and Flood Risk Practice Guide, Communities and Local Government, TSO, December 2009.
8. Planning Practice Guidance. Department for Communities and Local Government. March 2014
9. PPG3 Pollution Prevention Guidelines. Environment Agency. 2006.

## Appendix A: Supporting drawings

Drawing	Prepared by:	No.
<b>Proposed Site Plan</b>	Design Development Partnership	178-96
<b>Site Location Plan</b>	Design Development Partnership	178-70
<b>Existing Site Survey</b>	Design Development Partnership	178-71
<b>Drainage Strategy</b>	Complete Design Partnership Ltd	16-6953-100 - Rev P3

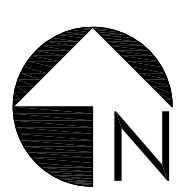


Figured dimensions only are to be taken from this drawing

- Preliminary     Comment     Planning  
 Tender     Construction     Record  
 Legal

REVISIONS			
REV	DATE	DESCRIPTION	CHECKED BY
A	03/08/17	SCHEDULE OF ACCOMMODATION ADDED - EXISTING VEGETATION IDENTIFIED	
B	22/09/17	KERB LINE AMENDED ADJACENT TO COSTA	

5m 10m 20m 30m 40m 50m



SCHEDULE OF ACCOMMODATION		
UNIT	APPLICATION SITE	GROSS INTERNAL AREA (SQM)
Costa	Detailed application	204
Aldi	Detailed application	1742
Happy Days Nursery	Detailed application	502
Office 1	Detailed application	2279
Office 2	Detailed application	2755
Office 3	Outline application	5451
Office 4	Outline application	2279

CLIENT

PROJECT **Phase 2  
Corinthian Park  
Grovefield Way  
Cheltenham**

TITLE **Proposed Block Plan**

SCALE @ A0 1:500 DATE 21-06-17

DRAWING 178 96 REV B

DRAWN BY LT CHECKED BY DW



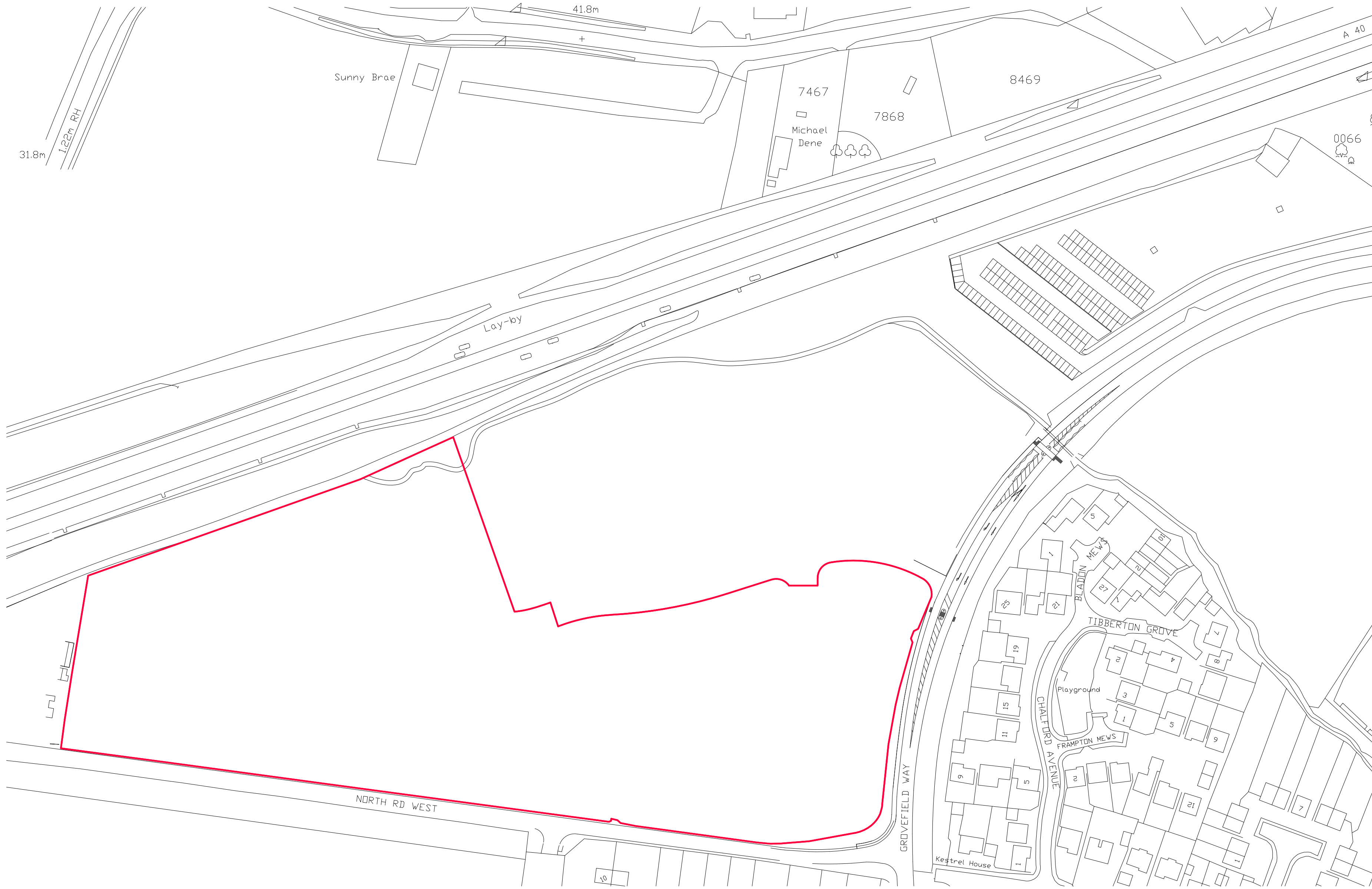
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- Tender         Construction     Record
- Legal

REVISIONS			
REV	DATE	DESCRIPTION	CHECKED BY



CLIENT **HG HINTON GROUP**

PROJECT Phase 2  
Corinthian Park  
Grovefield Way  
Cheltenham

TITLE Location Plan

SCALE @ A2 1:1250 DATE 24-11-16

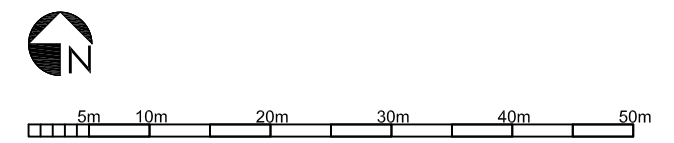
DRAWING 178-70 REV

DRAWN BY R.D CHECKED BY D.W

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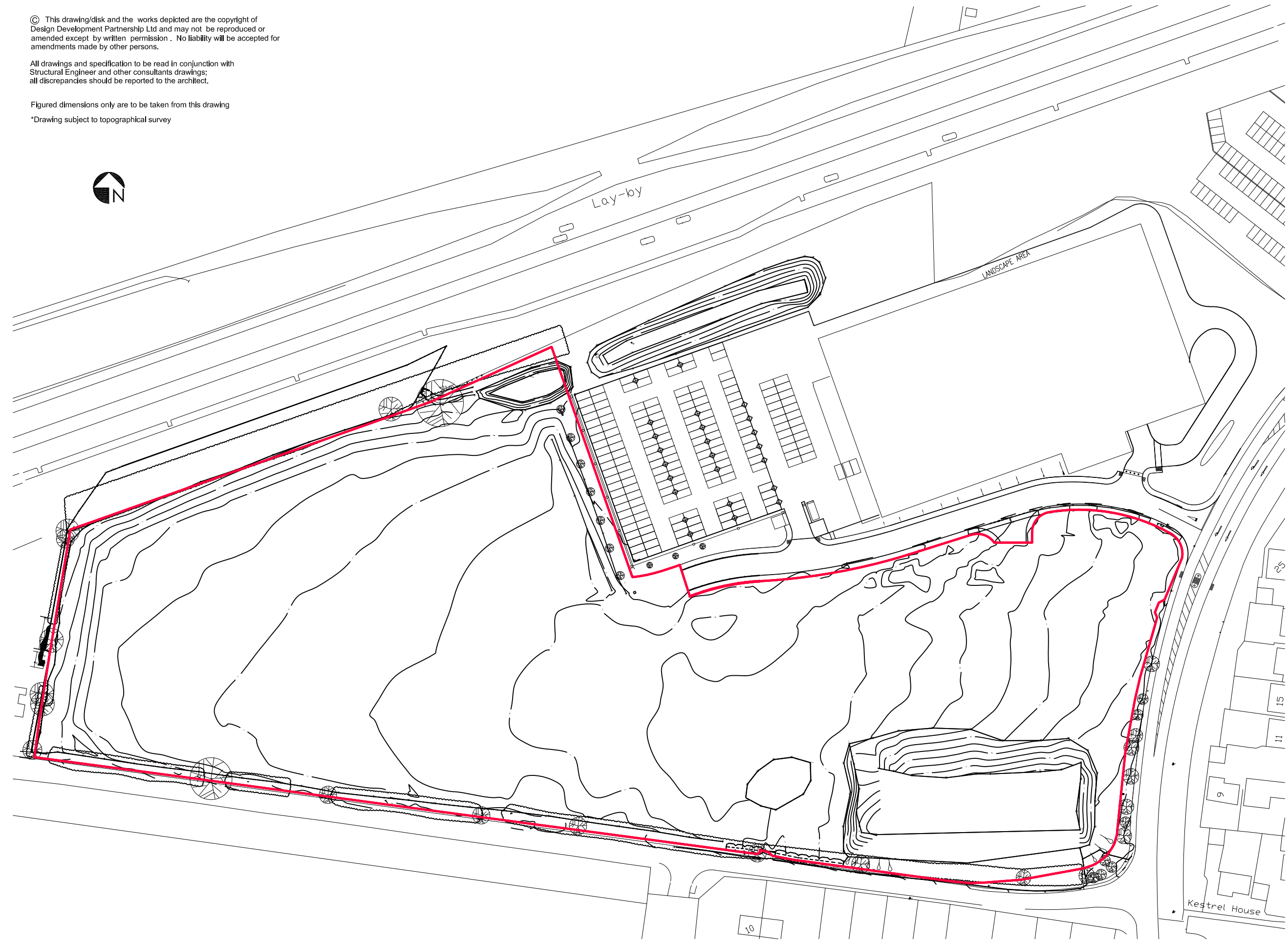
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\*Drawing subject to topographical survey



- Preliminary     Comment     Planning
- Tender     Construction     Record
- Legal

REVISIONS			
REV	DATE	DESCRIPTION	CHECKED BY



CLIENT **HG HINTON GROUP**

PROJECT Phase 2  
Corinthian Park  
Grovefield Way  
Cheltenham

TITLE Existing Site Plan

SCALE @ A3 1:1250    DATE 24-11-16

DRAWING 178-71    REV

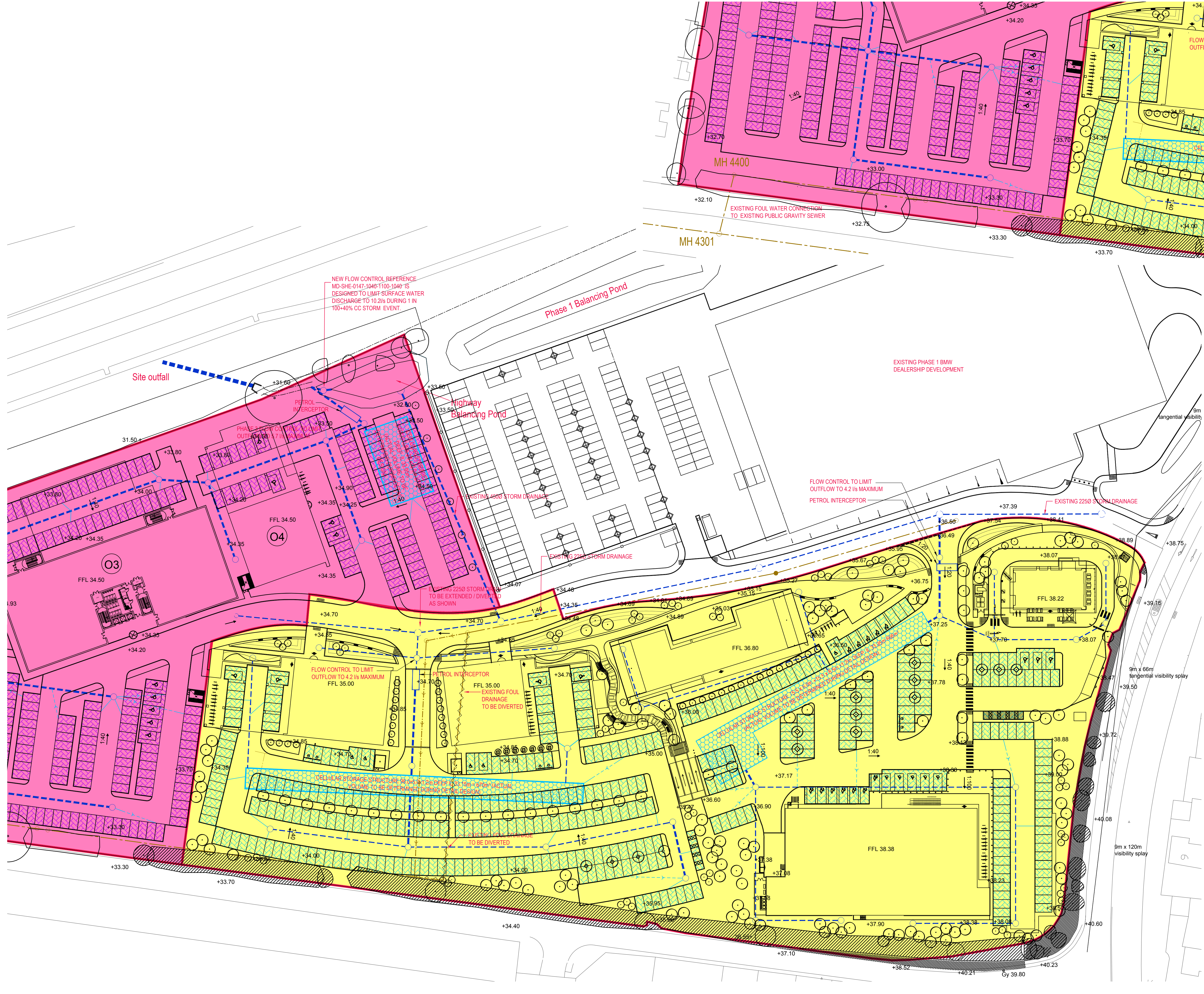
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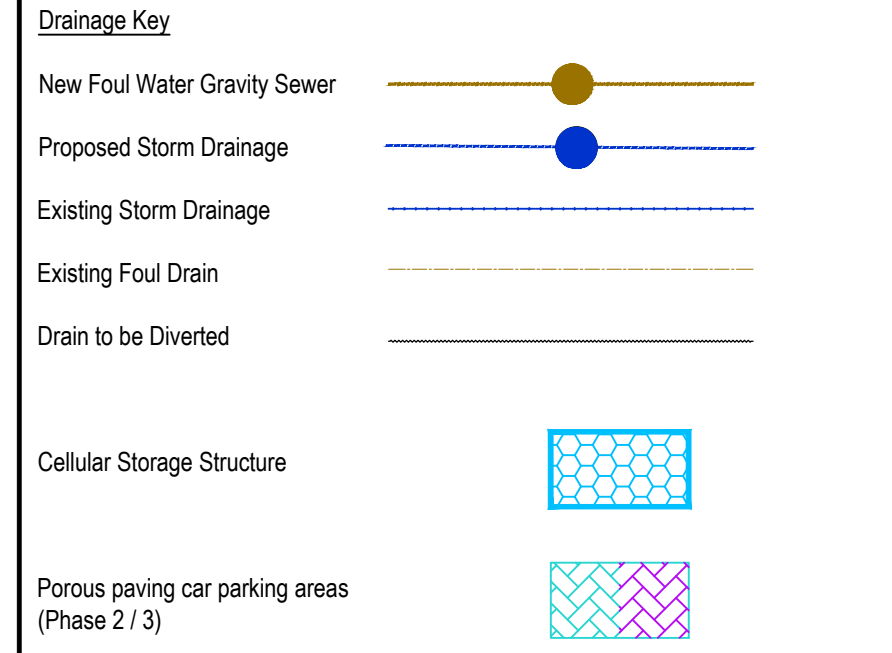
Notes:  
 DO NOT SCALE DRAWING  
 Dimensions provided are indicative only, and should be confirmed and read in conjunction with the Architect's construction drawings at such times as they are available, and/or from site measurement.  
 All setting out to be in accordance with the Architect's drawings, any ambiguities to be raised prior to construction.

RESIDUAL RISK REGISTER			
No.	Description of Hazard	Control Measures	Action By
	Standard construction		

- Notes:
- All dimensions in metres unless stated otherwise.
  - This drawing has been prepared for the exclusive use of the commissioning party and unless agreed in writing by Complete Design Partnership Ltd no other party may use or rely on its contents. No liability is accepted by CDP Limited for any use of this drawing other than for the purpose for which it was originally prepared.
  - It should be noted that this drawing may include data provided by third parties. No liability is accepted by CDP Limited as to the accuracy of this data.
  - Levels in m AOD.

Drainage Notes:  
 Proposed site area: 2.46 ha  
 Existing impermeable area: 0ha (Greenfield)  
 Proposed impermeable area: 1.82 ha (74.2% of whole site)

- Drawing should be read with accompanying Windes calculations
- The proposed storm water drainage strategy is based on the Flood Risk Assessment completed by CDP in August 2017. All storage will outfall by gravity to the existing ditch course
- The design has been carried out to ensure that no surface flooding occurs from the sewer network during a 30 year storm event, as per the statutory undertakers requirements. Due to the use of balancing ponds, the additional flows during a 1:100 year (+40%) storm event are also held within the network with no surface water flooding.
- The proposed landscaping scheme and tree locations are to be coordinated with the location of the sewer, and cellular storage areas.



**PRELIMINARY**

P3 MSK	Amended Layout inserted and drainage amended to suit	26.03.18
P2 AM	Amended Layout inserted and drainage amended to suit	31.07.17
P1 MB	Preliminary Issue	29.11.16
Rev By	Details	Date

(P=Preliminary, T=Tender, C=Construction, R=Record)

Client:

Project:  
 Corinthian Park  
 Cheltenham - Phase 2

Drawing Title:  
 Drainage Strategy Layout

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Date: Nov '16	Drawing No. 16-6953-100	Issue Rev. P 3
Scale: 1:500 @ A1		
Drawn: MB		
Chkd: JB		

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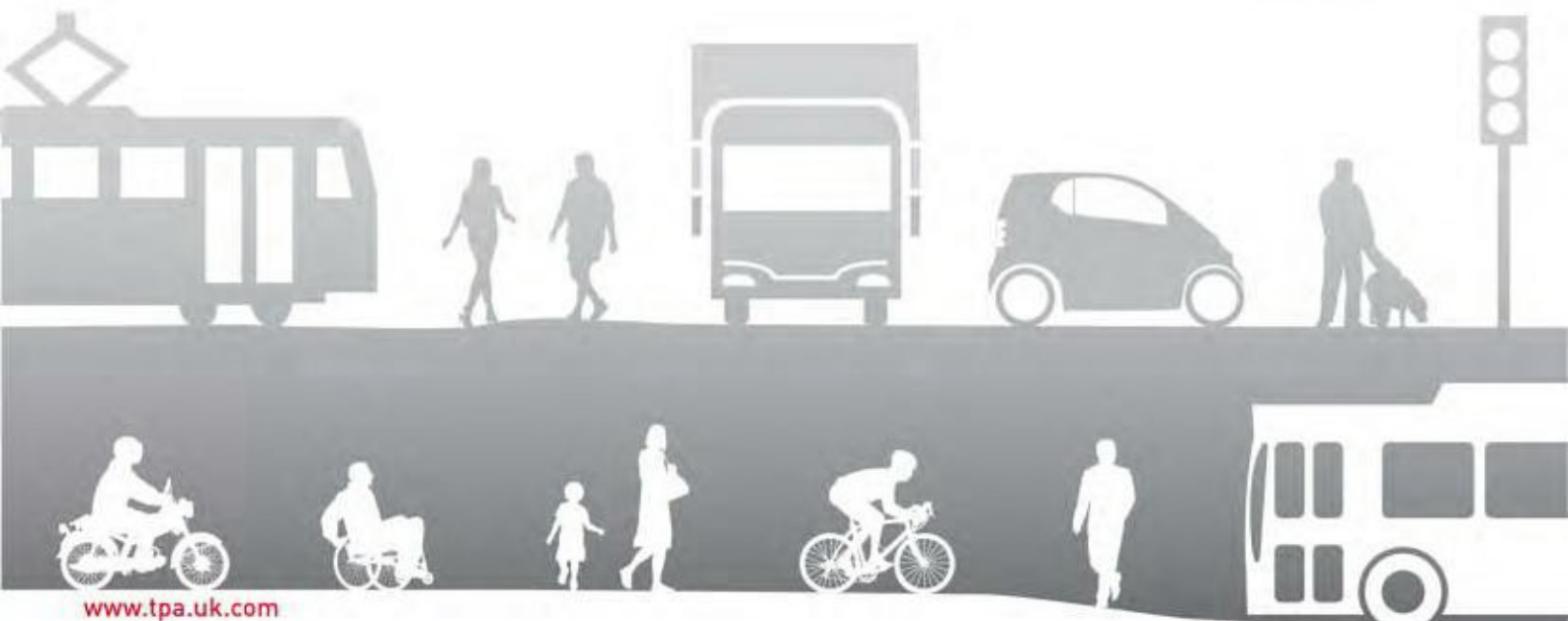
## **Appendix B: TPA Phase 1 and Highway Works FRA & Drainage Strategy**

A Planning Application by  
**COTSWOLD BMW GROUP**

In respect of  
**Flagship Dealership with Car Showroom and Servicing,  
GROVEFIELD WAY, CHELTENHAM**

**Site Specific Flood Risk Assessment  
and Surface Water Management Plan**

June 2013




**DOCUMENT SIGNATURE AND REVIEW SHEET**

**Project Details**

<b>Project Title:</b>	Flagship Dealership with Car Showroom and Servicing, GROVEFIELD WAY, CHELTENHAM		
<b>Project No.:</b>	1303-30	<b>Report No.:</b>	1303-30/FRA/01/A
<b>Client:</b>	COTSWOLD BMW GROUP		

	<b>Prepared By:</b>	<b>Checked By:</b>	<b>Approved for issue</b>
<b>Name</b>	ALEX HALFORD	PHIL PARKER	CRAIG RAWLINSON
<b>Signature</b>			
<b>Date</b>	JUNE 2013	JUNE 2013	

**Document Review**

Revision	Date	Description	Checked By
A	25.06.13	Amended to suit Rainwater Harvesting requirements.	CMR 

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- C WINDES QBAR ANALYSIS AND STORAGE ESTIMATES
- D FLOODING CONSULTATION
- E ENVIRONMENT AGENCY CONSULTATION
- F ENVIRO-SEARCH REPORT
- G PAGES 15, 22 & 34 FROM 'SITE INVESTIGATION REPORT', CARRIED OUT BY STRUCTURAL SOILS, JULY 2008.
- H RAINWATER HARVESTING ESTIMATE.

# 1 EXECUTIVE SUMMARY

## INTRODUCTION

- 1.1 Transport Planning Associates have been appointed to provide a combined Site Specific Flood Risk Assessment (FRA) and Surface Water Management Plan (SWMP) for Cotswold BMW Group's land off Grovefield Way, Cheltenham.
- 1.2 The purpose of this FRA and SWMP is to identify the historical, current and future flood risks of the development as well as to identify the developer's strategy to reduce the impact of the development upon the neighbouring surface watercourses.
- 1.3 This Flood Risk Assessment has been carried out in accordance with the National Planning Policy Framework (NPPF), March 2012 and Planning Policy Statement 25 annexes D and E, which although have now been replaced by the NPPF, are still best practice methods to proving the appropriateness of a site's proposals with regards to its location and its susceptibility to flooding. The Surface Water Management Plan has been carried out in accordance with PPS25 Annex F and Ciria document C697 'The SuDS Manual'.

## METHOD STATEMENT

### Flood Risk Assessment

- 1.4 To ascertain the potential flood risks to the development site a desktop study has been undertaken gathering information from the British Geological Survey 'Bedrock Map', the Environment Agency 'Flood Maps', and historical and current regional information from the 'Strategic Flood Risk Assessment for local development framework – Level 1' – produced by Halcrow, on behalf of Cheltenham Borough Council, dated September 2008, the 'Preliminary Flood Risk Assessment' – produced by Gloucestershire County Council, dated November 2011 (see Appendix D).
- 1.5 Early correspondence with the Environment Agency's (EA) Riversmeet House, Tewkesbury, Gloucestershire office, helped to determine the local areas main points for concern. Local knowledge of the area provided valuable information on the EA's concerns for the site which will be addressed within the report.
- 1.6 Information found within these resources was then used to ascertain the development site's risk of flooding through following the guidance provided within the PPS 25, Annexes D and E. The annexes provide categorisation methods to ascertain the risk of flooding to the development site, its potential to increase flooding to the immediate and broader areas, the proposed land use's appropriateness to the flood zone and the mitigating requirements of the flood risk assessment to prove its appropriateness for development.

### **Surface Water Management Plan**

- 1.7 Planning Policy Statement 25, Annex F outlines the requirements of the Surface Water Management Plan to satisfy the development's requirements to reduce the risk of flooding to the immediate and surrounding areas.
  
- 1.8 As the development site is more than 1 hectare the Environment Agency will be consulted at the planning stage of the development and as such will require proof that the proposed development will not increase the existing Greenfield surface water run-off discharge rate or volume. The Interim Code of Practice for Sustainable Drainage Systems (ICPSuDS) (for developments less than 50ha) method of calculating Qbar was used to calculate the Greenfield run-off rate.
  
- 1.9 The SWMP will acknowledge the sources of flooding discovered in the FRA, provide guidance to the developer on how to manage surface water run-off and provide evidence that proves that the developed site's surface water run-off will be managed on-site, using appropriate SuDS, to at least mimic existing Greenfield run-off flows.

## 2 EXISTING SITE CONDITIONS

### SITE DESCRIPTION

- 2.1 The parcel of land as identified on the site location plan (Appendix A.1) is located approximately 2 kilometres west of Cheltenham town centre, approached by Grovefield Way, a major access road which joins the A40 approximately 800m north from the site. The existing site is located within the business sector of Cheltenham and is surrounded by either agricultural land or business buildings. There are no main rivers running through or in the immediate vicinity of the site, although there is an unnamed ordinary watercourse which runs along the northern boundary of the site before being culverted where it crosses beneath the A40.
- 2.2 The commercial scheme area consists of approximately 2.35 hectares of green fields and is bounded by tree lined hedgerows. The site has a level difference of up to 6m from approximately 38.5mAOD on the south-east boundary, to approximately 32.5mAOD in the north-west corner of the development site.
- 2.3 The British Geological Survey and Environment Agency Maps have been studied to identify the site's Geological and Hydrogeological properties. The following figures show the information shown within them.

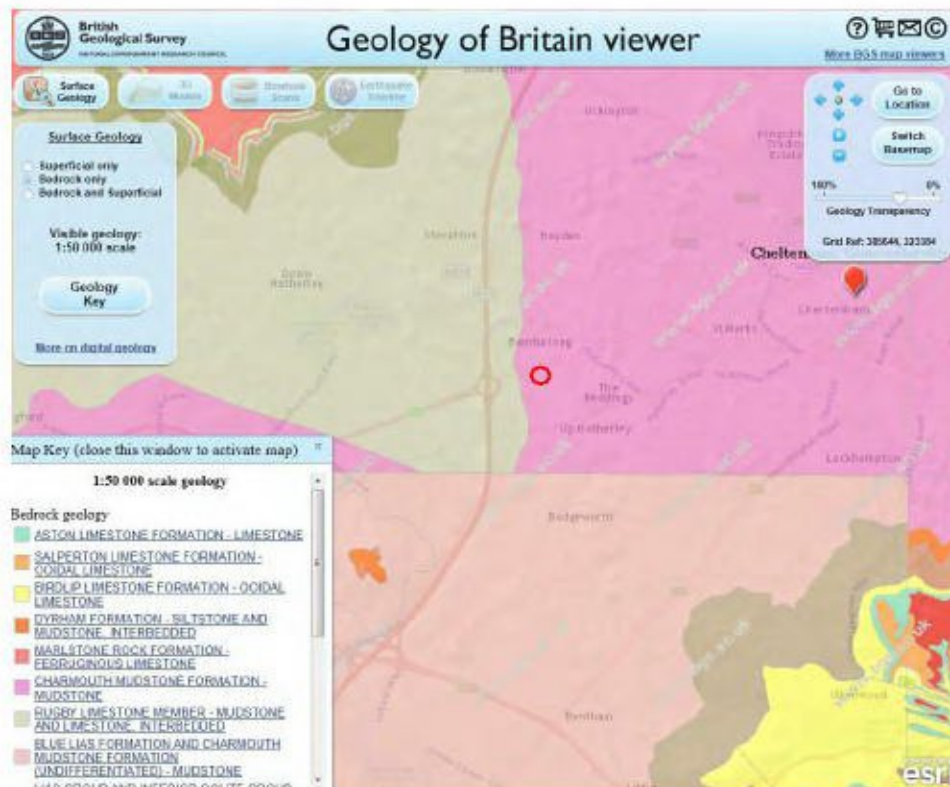
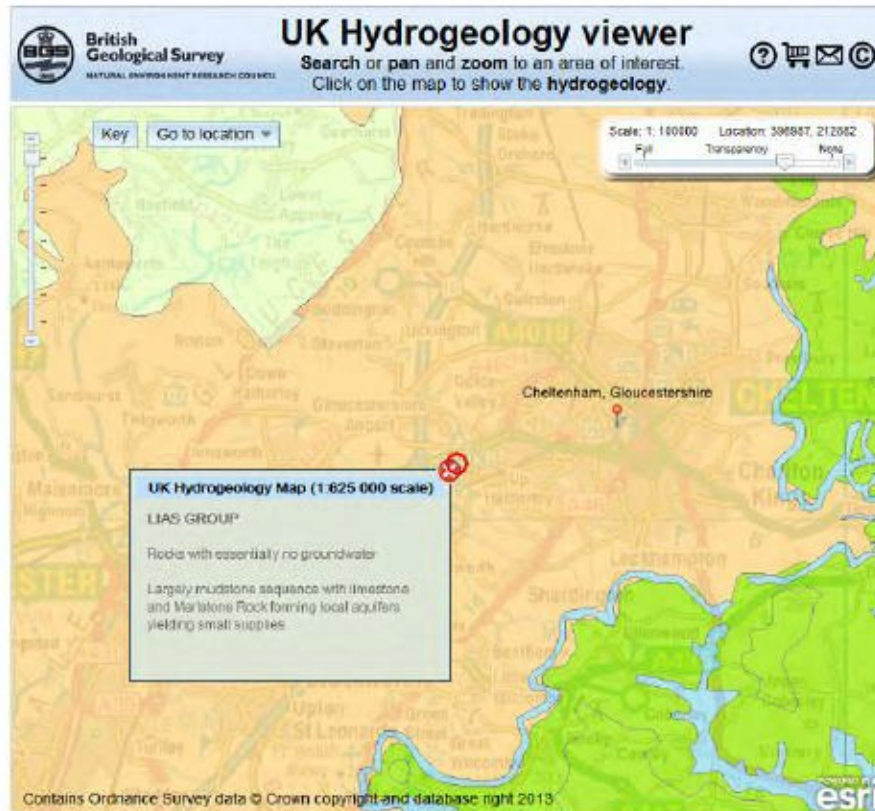


Figure 1a British Geological Survey Data – Bedrock Map



- 2.4 As can be seen in Figure 1a the British Geological Survey 'Bedrock Map', the site is underlain by the Charmouth Mudstone formation classification of bedrock material, a sedimentary bedrock formed approximately 190 to 202 million years ago in the Jurassic Period, where the local environment was previously dominated by shallow seas. There is no evidence of superficial deposits located within this area.



**Figure 1b British Geological Survey Data – UK Hydrogeology Map**

- 2.5 Figure 1b the British Geological Survey Data 'UK Hydrogeology Map' shows the potential for the ground to hold water. The area surrounding the development in Cheltenham is over the Lias group of bedrock material where the ground essentially has no groundwater. As shown on the map some local intrusions of Limestone provide localised aquifers with low yielding capacity.
- 2.6 Further to the map information in figures 1a and 1b above, an assessment of the site's infiltration properties is required to identify the site specific hydrological properties and storage capabilities. Although the map information provided in Figures 1a and 1b shows the ground to have little or no infiltration properties, site based trial pits with infiltration testing will provide more accurate ground properties which would not necessarily be shown on the maps.
- 2.7 A 'Site Investigation Report' carried out by Structural Soils Ltd in July 2008, provided information on three infiltration tests carried out across random locations on site. The results showed no soakage for the duration of the tests which were carried out in

accordance with BRE365 (see Appendix G). Soakaways would not be practical to use on this site.

### **SURFACE WATER RUN-OFF ANALYSIS**

- 2.8 The development site is classified as being Greenfield with the site being solely covered in vegetation. The Surface Water run-off for the site is accepted at the Greenfield run-off rate, in accordance with PPS25, Annex F – Managing Surface Water.
- 2.9 Windes and the ICP-SUDS was used to calculate the Greenfield Run-off rate for the onsite development, (IH124 would be used if the development site is greater than 50 ha in area). The site area, amounts to approximately **2.35 ha** and based on Flood Studies Report (FSR) Figure 1.2.4, gives a  $QBAR_{rural}$  (average annual flood) rate of **8 l/s** (see Appendix C.1). The proposed development must not generate more runoff than this if it is proposed to discharge to a natural watercourse.
- 2.10 The developed site will provide 1.65 ha of impermeable area, made up of 0.761ha from roof area, 0.142 ha from driveways, 0.037 ha from footpaths and .0668 ha from driveways and parking bays.
- 2.11 Since the implementation of the Flood and Water Management Act, April 2010, new developments have to recognise exceedance in design. Appendix A.5 shows the overland flood route for the site based on existing site levels. The arrows shown on the plan indicate the direction of run-off flow through the site. Additional arrows outside the site are also shown indicating how run-off from the site affects neighbouring landowners.

### **3 FLOOD RISK ASSESSMENT - CONSULTATION AND POLICY GUIDANCE**

#### **CONSULTATION**

- 3.1 As part of the research into the Flood Risk Assessment for this development, the Environment Agency (EA) and Severn Trent Water were consulted.
- 3.2 The response from looking at the EA flood maps confirms that the development site falls within Flood Zone 1. As the site is greater than 1 ha, Annex's D and E of PPS25 should still be adhered to within the planning application and that a Site Specific Flood Risk Assessment with incorporated Surface Water Management Plan should be submitted with the planning application.
- 3.3 The EA 'Flood Map' (see Appendix E) helped to ascertain the Flood Zone for the site with reference to the site's proximity to potential flood sources. The flood map for the area covering Grovefield Way showed the site as being within Flood Zone 1 where there is a less than 0.1% or 1 in 1000 probability of flooding in any one year. The nearest area for concern is approximately 750m south of site along Ham Brook an ordinary watercourse and tributary of the River Severn that runs through Gloucester approximately 7.69km west from the site.
- 3.4 Early correspondence with the EA confirmed the site is situated on Lias Formation Clays. The aquifer designation of the bedrock material was designated as being Unproductive, whereby the material's capacity for the storage of groundwater is too low to recognise.
- 3.5 The groundwater vulnerability designation for the site is Minor whereby the potential for groundwater to pose a flood risk to the site is low.
- 3.6 The EA confirmed that the site is not located over a groundwater source protection zone, whereby the site's location is far enough away from a source of drinking water to be deemed to have no impact.
- 3.7 The EA confirmed that the site is located in an area where surface water is vulnerable to Nitrates. Sites within these zones must comply with the Nitrate Pollution Prevention Regulations 2008, which are about to be amended during 2013. The impact of Nitrates upon the surface water strategy will require water cleansing facilities within the SuDS.
- 3.8 Asset Location searches were also carried out as part of this assessment with Severn Trent Water and their response was received in May 2013. The Asset Location maps show the location of a public Foul Water sewer within North Road West which runs along the southern boundary of the site. The map information provided shows a public surface water sewer running in a northerly direction along the length of Grovefield Way to the eastern

boundary of the site (see Appendix B for Asset location maps provided by Severn Trent Water).

## POLICY GUIDANCE

3.9 The Flood Risk Assessment has considered National Policy and Local planning strategies in order to understand the wider implications of the development upon its surrounding area.

### 3.10 NATIONAL POLICY - 'NATIONAL PLANNING POLICY FRAMEWORK' (NPPF), MARCH 2012.

3.11 The NPPF takes over from where PPS25 left off, although looks further into more community driven priorities. Its main driver is sustainability making developments concentrate on how the proposals impact upon the community in which it resides. It incorporates a number of key objectives including providing quality homes, improving quality of life and meeting the challenge of climate change, flooding and coastal change.

3.12 Where the NPPF relates to Flooding and Flood Risk it states:-

100. *Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere. Local Plans should be supported by Strategic Flood Risk Assessment and develop policies to manage flood risk from all sources, taking account of advice from the Environment Agency and other relevant flood risk management bodies, such as lead local flood authorities and internal drainage boards. Local Plans should apply a sequential, risk-based approach to the location of development to avoid where possible flood risk to people and property and manage any residual risk, taking account of the impacts of climate change, by:*

- *Applying the Sequential Test;*
- *If necessary, applying the Exception Test;*
- *Safeguarding land from development that is required for current and future flood management;*
- *Using opportunities offered by new development to reduce the causes and impacts of flooding; and*
- *Where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking*

101. *The aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding. The Strategic Flood Risk Assessment will provide the*



*basis for applying this test. A sequential approach should be used in areas known to be at risk from any form of flooding.*

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

- *it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and*
- *a site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.*

Both elements of the test will have to be passed for development to be allocated or permitted.

**Table 1 Flood Zones Categorization (PPS25 Table D.1)**

<p><b>Zone 1 Low Probability</b></p> <p><b>Definition</b></p> <p>This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (&lt;0.1%).</p> <p><b>Appropriate uses</b></p> <p>All uses of land are appropriate</p> <p><b>FRA requirements</b></p> <p>For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be incorporated in a FRA. This need only be brief unless the factors above or local considerations require particular attention. See Annex E for minimum requirements.</p> <p><b>Policy aims</b></p> <p>In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of development, and the appropriate application of sustainable drainage techniques.</p>
<p><b>Zone 2 Medium Probability</b></p> <p><b>Definition</b></p> <p>This zone comprises land assessed as having 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.</p> <p><b>Appropriate uses</b></p> <p>The water-compatible, less vulnerable and more vulnerable uses of land and essential infrastructure in table D.2 are appropriate in this zone.</p> <p>Subject to the Sequential Test being applied, the highly vulnerable uses in table D.2 are only appropriate in this zone if the Exception Test is passed.</p> <p><b>FRA requirements</b></p> <p>All development proposals in this zone should be accompanied by a FRA. See Annex E for minimum requirements.</p>

<p><b>Policy aims</b></p> <p>In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage techniques.</p>
<p><b>Zone 3a High Probability</b></p> <p><b>Definition</b></p> <p>This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (&gt;1%) or a 1 in 200 or greater annual probability of flooding from the sea (&gt;0.5%) in any year.</p> <p><b>Appropriate uses</b></p> <p>The water-compatible and less vulnerable uses of land in Table D.2 are appropriate in this zone.</p> <p>The highly vulnerable uses in table D.2 should not be permitted in this zone.</p> <p>The more vulnerable and essential infrastructure uses in table D.2 should only be permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood.</p> <p><b>FRA requirements</b></p> <p>All development proposals in this zone should be accompanied by a FRA. See Annex E for minimum requirements.</p> <p><b>Policy aims</b></p> <p>In this zone, developers and local authorities should see opportunities to:</p> <ol style="list-style-type: none"> <li>i. reduce the overall level of flood risk in the area through the layout and form of development and appropriate application of sustainable drainage techniques;</li> <li>ii. relocate existing development to land in zones with a lower probability of flooding; and</li> <li>iii. create space for flooding to occur by restoring functional flood plain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.</li> </ol>
<p><b>Zone 3b The Functional Flood Plain</b></p> <p><b>Definition</b></p> <p><b>This zone comprises land where water has to flow or be stored in times of flood.</b></p> <p>Local planning authorities should identify in their SFRA's areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But 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, should provide a starting point for consideration and discussions to identify the functional floodplain.</p> <p><b>Appropriate uses</b></p> <p>Only the water-compatible uses and the essential infrastructure listed in table D.2 that has to be there should be permitted in this zone. It should be designed and constructed to:</p> <ul style="list-style-type: none"> <li>- remain operational and safe for user in times of flood;</li> <li>- result in no net loss of floodplain storage;</li> <li>- not impede water flows; and</li> <li>- not increase flood risk elsewhere.</li> </ul> <p>Essential infrastructure in this zone should pass the Exception Test.</p> <p><b>FRA requirements</b></p> <p>All development proposals in this zone should be accompanied by a FRA. See Annex E for minimum requirements.</p> <p><b>Policy aims</b></p> <p>In this zone, developers and local authorities should seek opportunities to:</p> <ol style="list-style-type: none"> <li>i. reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques; and</li> <li>ii. relocate existing development to land with a lower probability of flooding.</li> </ol>

**Table 2 Flood Risk Vulnerability Classification (PPS25 Table D.2)**



<p><b><u>Essential Infrastructure</u></b></p>	<p>Essential transport infrastructure (including mass excavation routes) which has to cross the area at risk.</p> <p>Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood.</p> <p>Wind turbines.</p>
<p><b><u>Highly Vulnerable</u></b></p>	<p>Police stations, Ambulance stations and Fire station and Command centres and telecommunications installations required to be operational during flooding.</p> <p>Emergency dispersal points.</p> <p>Basement dwellings.</p> <p>Caravans, mobile homes and park homes intended for permanent residential use.</p> <p>Installations requiring hazardous substances consent. (where there is a risk demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure').</p>
<p><b><u>More Vulnerable</u></b></p>	<p>Hospitals.</p> <p>Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.</p> <p>Buildings used for: dwelling houses; student's halls of residence; drinking establishments; nightclubs; and hotels.</p> <p>Non-residential uses for health services, nurseries and educational establishments.</p> <p>Landfill and sites used for waste management facilities for hazardous waste.</p> <p>Sites used for holiday or short-let caravans and camping, <b>subject to a specific warning and evacuation plan.</b></p>
<p><b><u>Less Vulnerable</u></b></p>	<p>Police, ambulance and fire stations which are <b>not</b> required to be operational during flooding.</p> <p>Buildings used for: shops; financial, professional and other services; restaurants and cafes; hot food takeaways; offices; general industry; storage and distribution; non-residential institutions not included in 'more vulnerable'; and assembly and leisure.</p> <p>Land and buildings used for agriculture and forestry.</p> <p>Waste treatment (except landfill and hazardous waste facilities).</p> <p>Mineral working and processing (except for sand and gravel working).</p> <p>Water treatment works which do <b>not</b> need to remain operational during times of flood.</p> <p>Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).</p>

<b>Water-compatible Development</b>	Flood control infrastructure. Water transmission infrastructure and pumping stations. Sewage transmission infrastructure and pumping stations. Sand and gravel workings. Dock, marinas and wharves. Navigation facilities. MOD defence installations. Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. Water-based recreation (excluding sleeping accommodation). Lifeguard and coastguard stations. Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. Essential ancillary sleeping or residential accommodation for staff required by uses in this category, <b>subject to a specific warning and evacuation plan.</b>
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**Table 3 Flood Risk Vulnerability and Flood Zone ‘Compatibility’ (PPS25 Table D.3)**

Flood Risk Vulnerability classification (see Table D2)		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone (see Table D.1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	x	Exception Test required	✓
	Zone 3b	Exception Test required	✓	x	x	x

3.13 This development site is within Flood Zone 1 (Table 1), the proposed commercial land use is categorised as being ‘Less Vulnerable’ from effects of flooding (Table 2). Table 3 indicates that a ‘Less Vulnerable’ categorised site, such as proposed for this site, is an appropriate land use for a Flood Zone 1 and an Exception Test is not required.

**NATIONAL POLICY – ‘PLANNING POLICY STATEMENT 25, DEVELOPMENT AND FLOOD RISK’ (PPS 25), MARCH 2010.**