

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 2*

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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):

**Table 1: Reference Data**

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 P1
<b>Site Investigation Report</b>	Structural Soils Ltd	July 2008 report no. 729381R2

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:

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

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%

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.

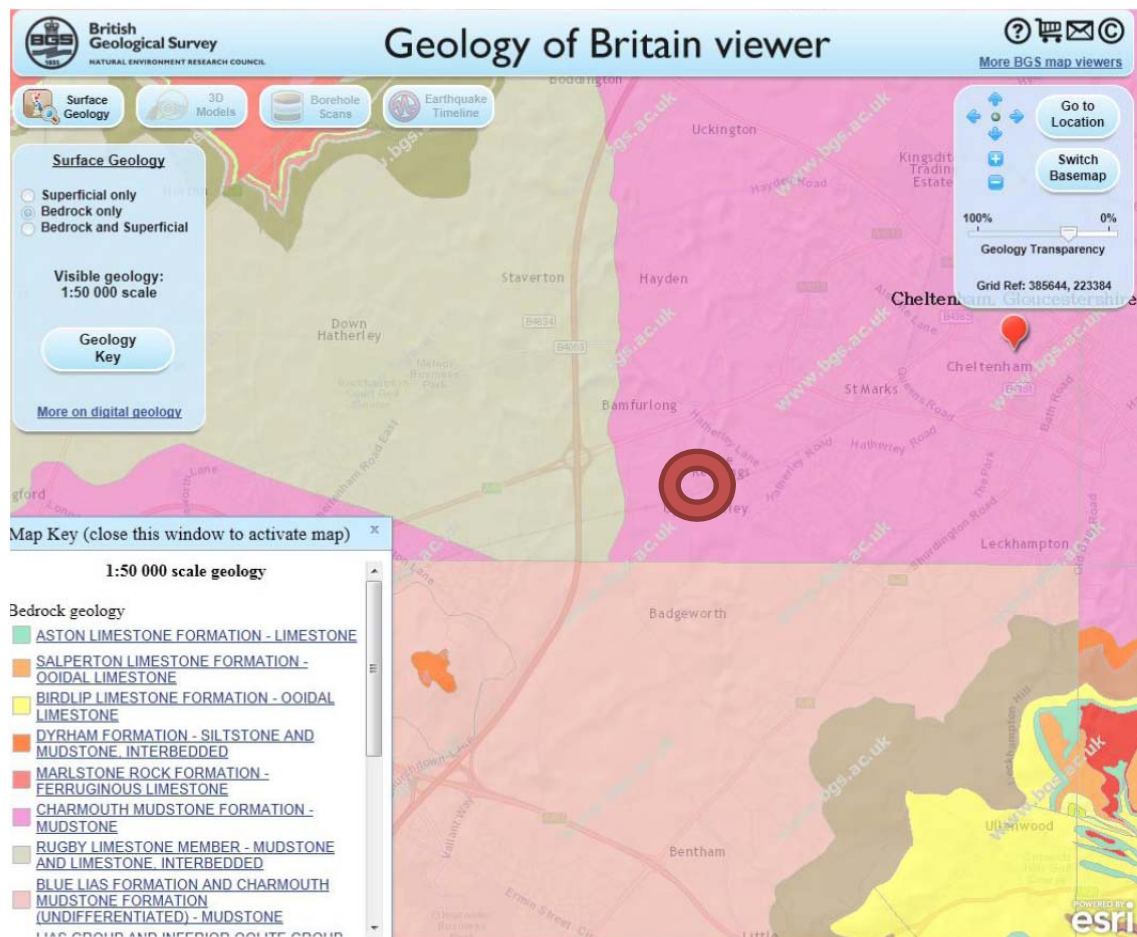


Figure 1a British Geological Survey Data – Bedrock Map

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.

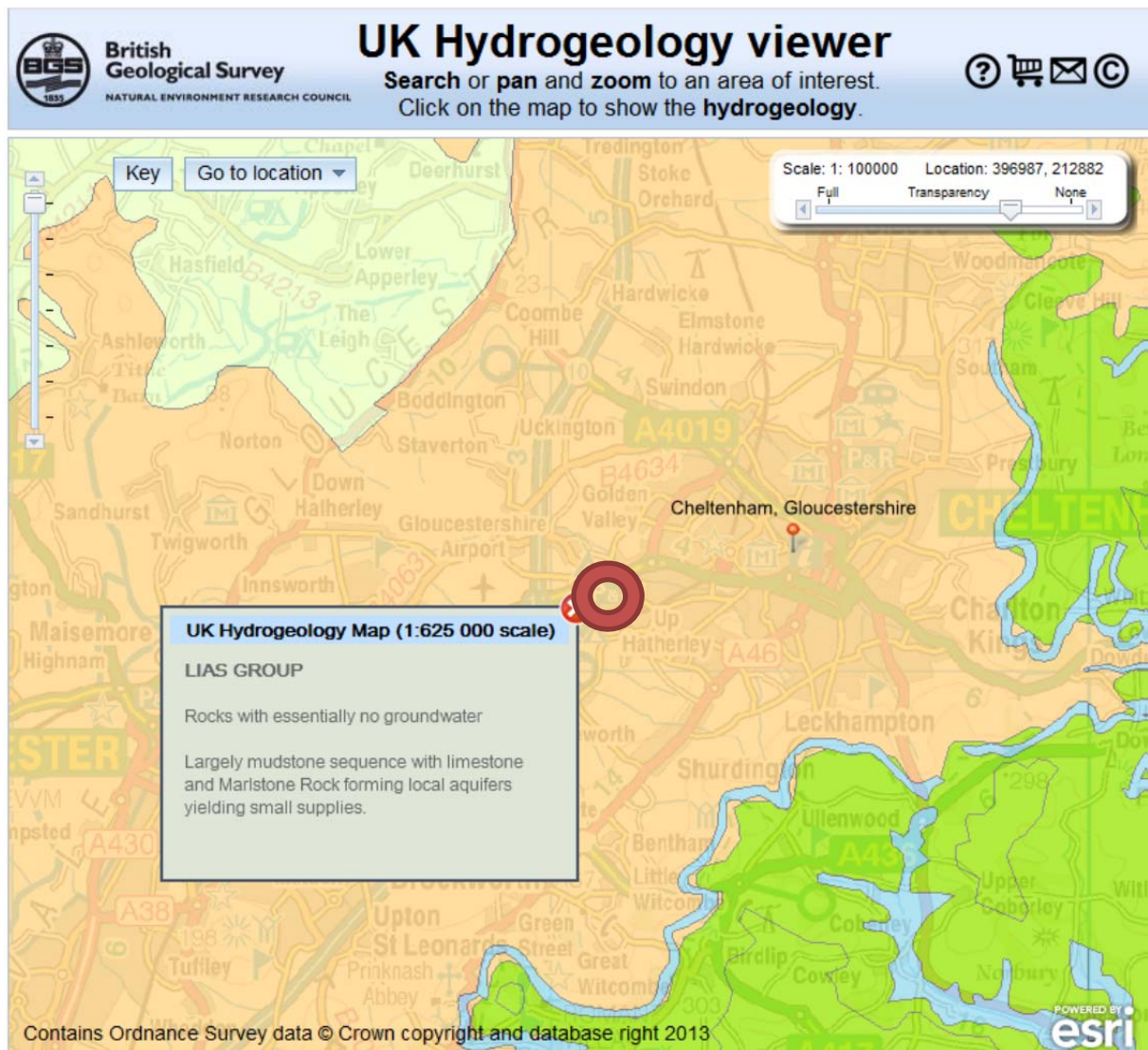


Figure 1b British Geological Survey Data – UK Hydrogeology Map

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, and is not thought to be of relevance due to proposed earthworks alterations within that area effectively removing the low spot.

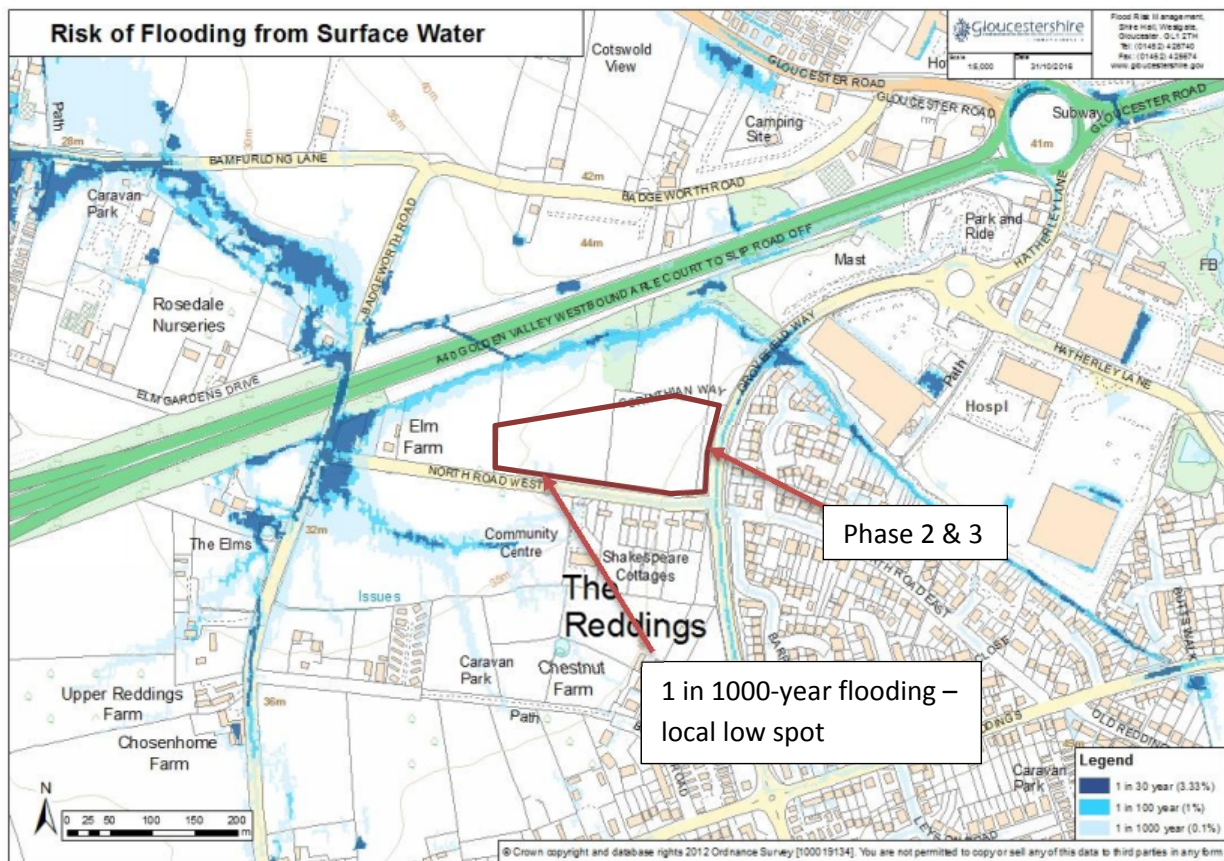


Figure 2, Flood mapping received from GCC/LLFA

### 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;

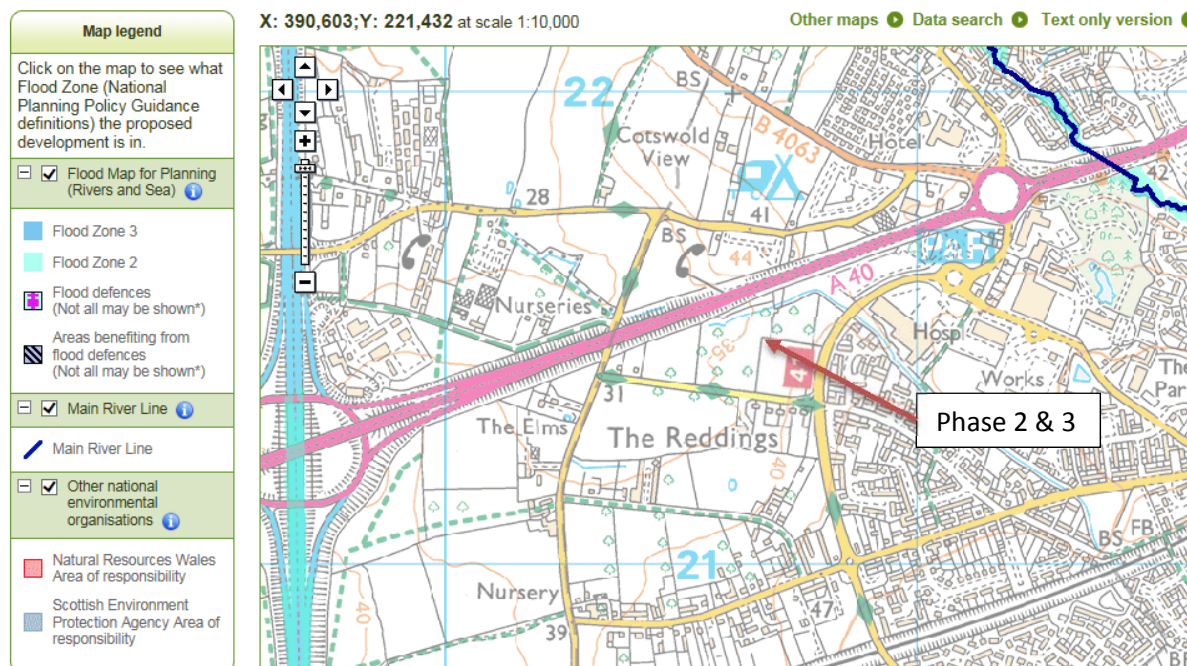


Figure 3 EA website mapping.

## 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 s 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.

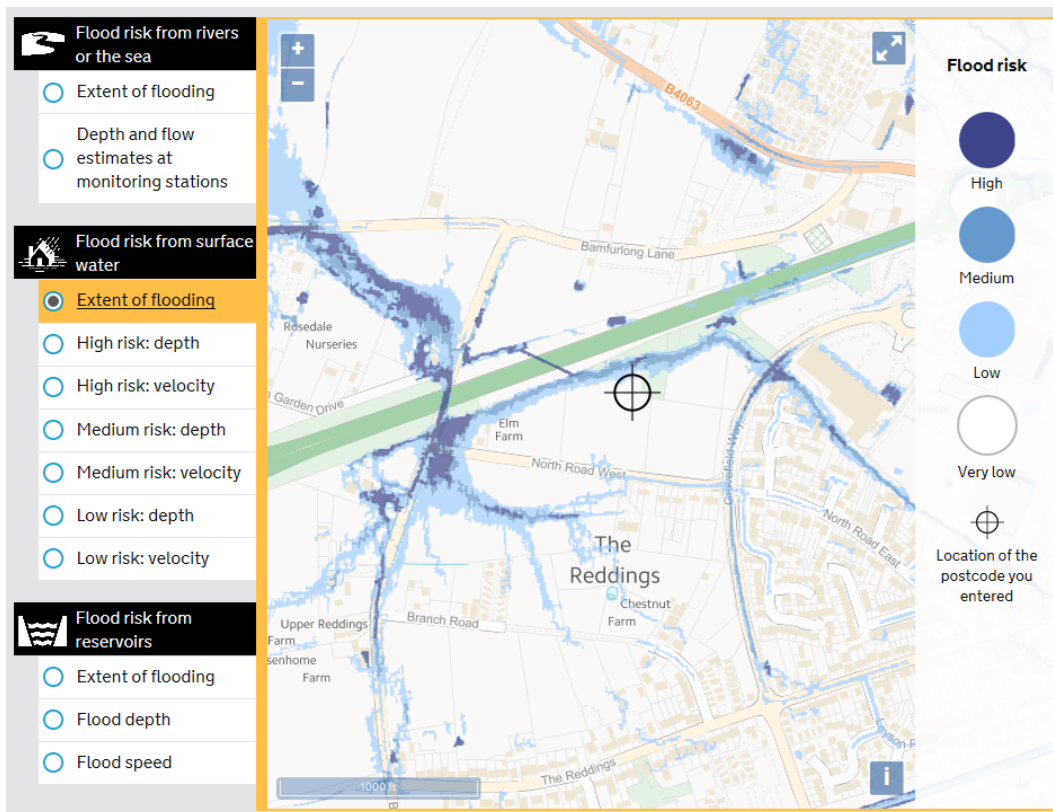


Figure 5 EA (Surface Water) flood mapping.

## 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:

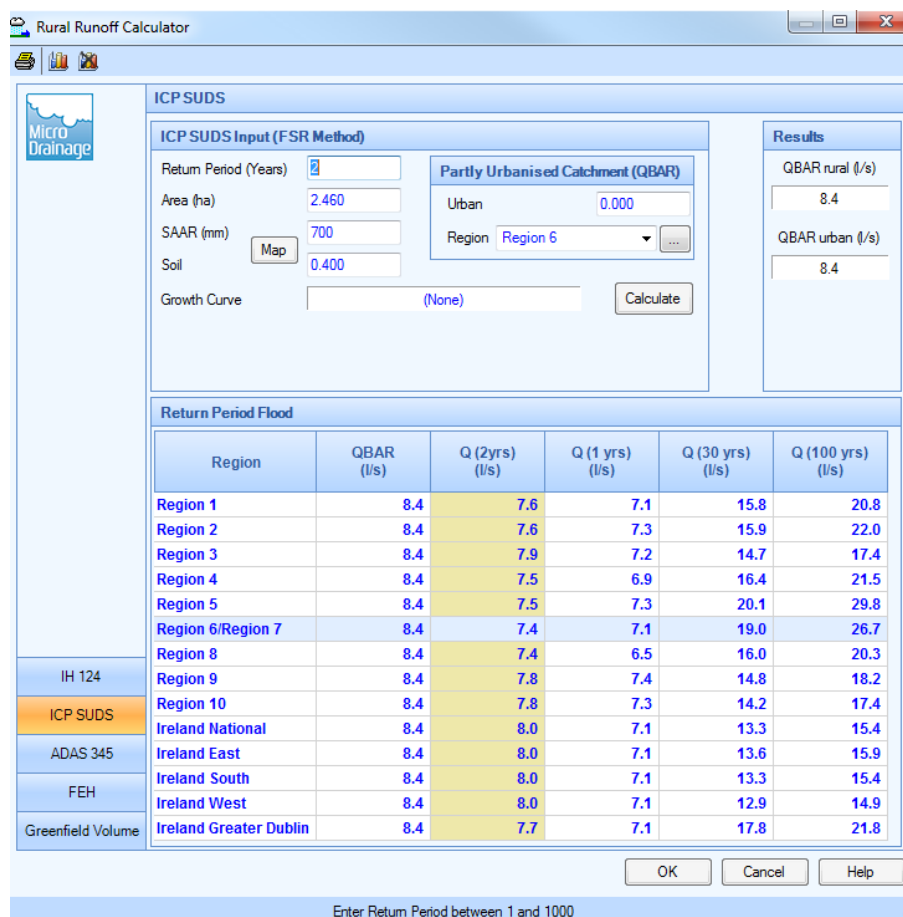


Table 4 – Phase 2 Qbar Flow Calculations

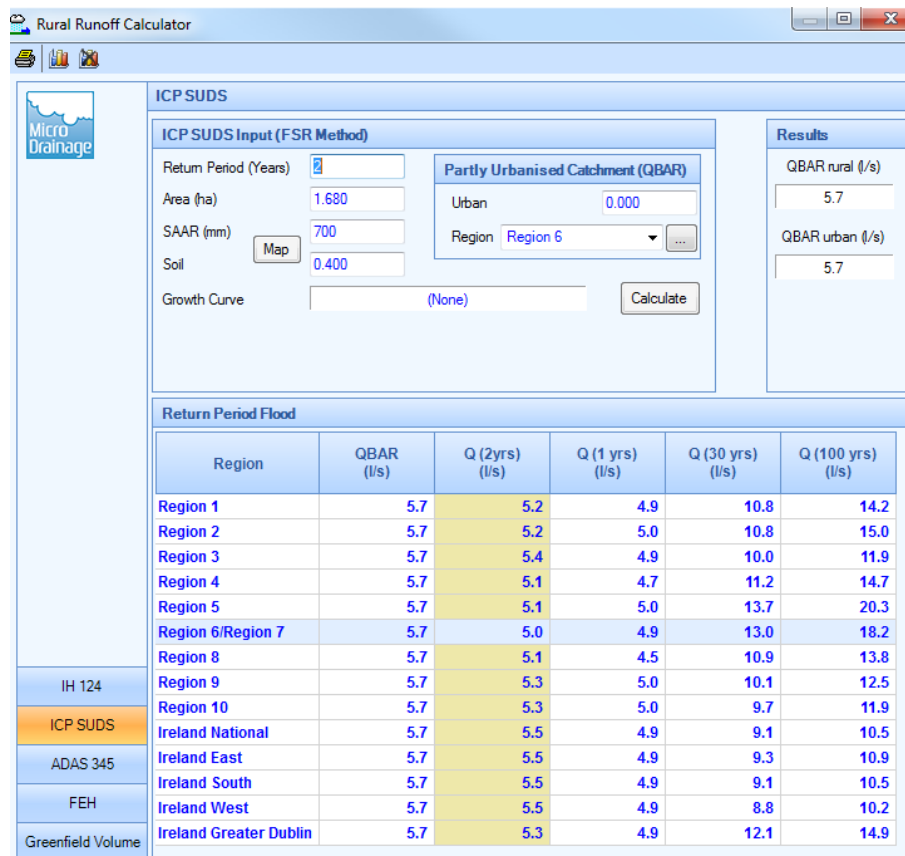


Table 5 – Phase 3 Qbar Flow Calculations

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 which 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-P2

Figured dimensions only are to be taken from this drawing.

- Preliminary     Comment     Planning  
 Tender     Construction     Record  
 Legal

REVISIONS			
REV	DATE	DESCRIPTION	CHECKED BY



**HG HINTON GROUP**  
 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**

**DRAWN BY** LT    **CHECKED BY** DW

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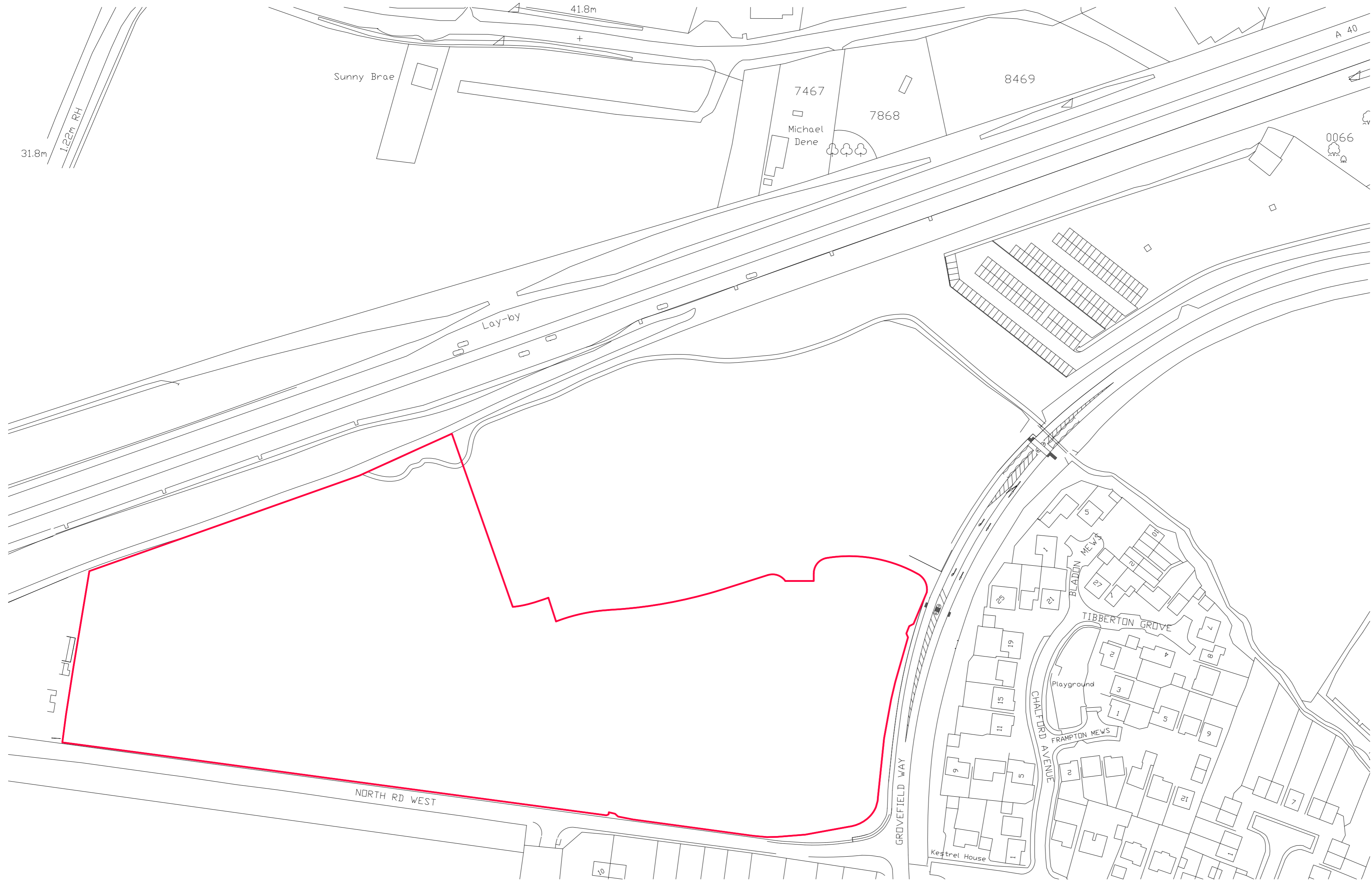
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All drawings and specification to be read in conjunction with Structural Engineer and other consultants drawings; all discrepancies should be reported to the architect.

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CLIENT **HG HINTON GROUP**

PROJECT Phase 2  
Corinthian Park  
Grovefield Way  
Cheltenham

TITLE Location Plan

SCALE @ A2 1:1250    DATE 24-11-16

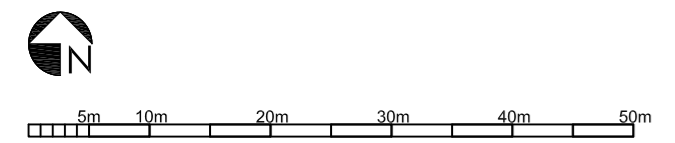
DRAWING 178-70    REV

DRAWN BY R.D    CHECKED BY D.W

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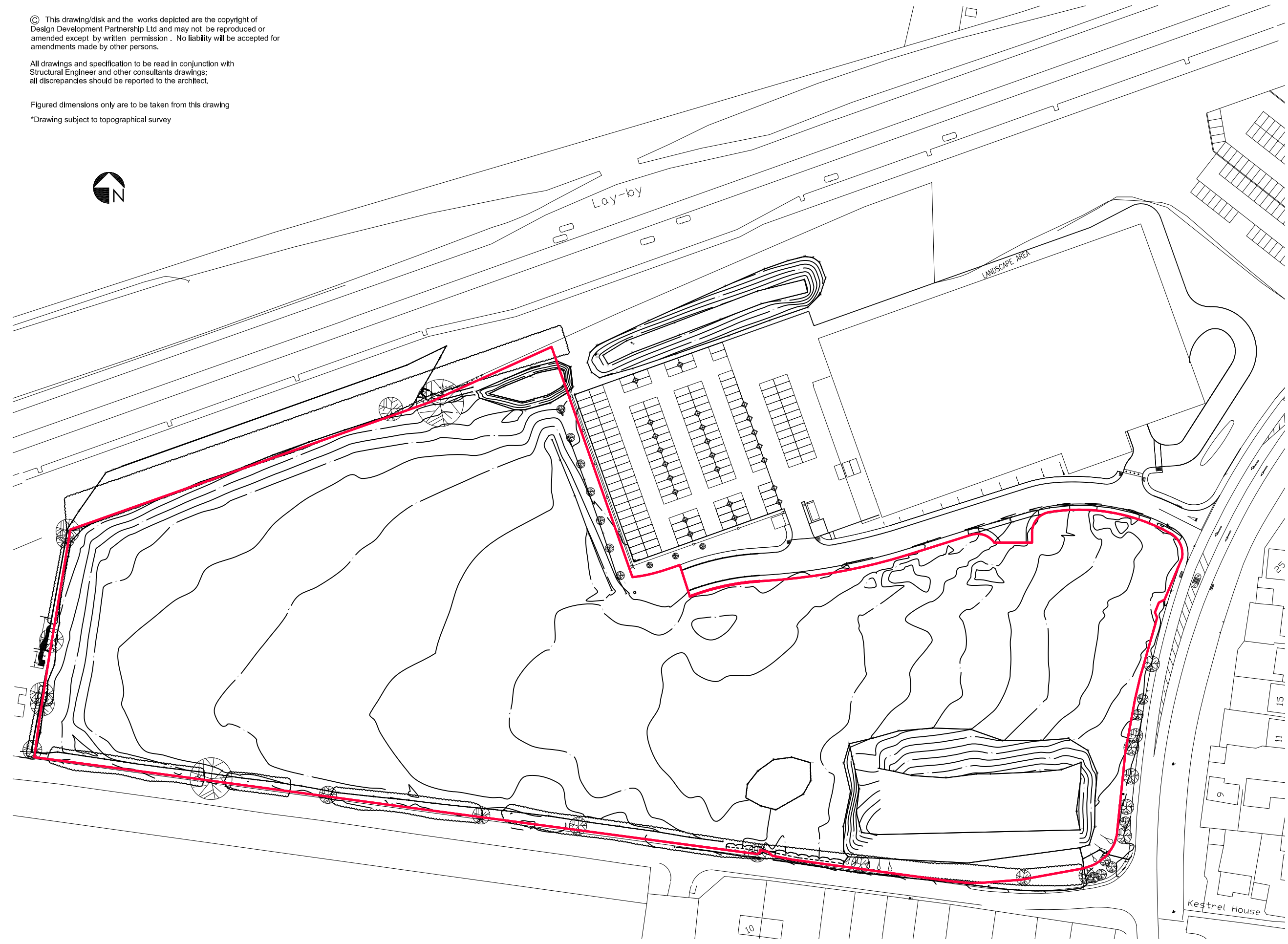
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\*Drawing subject to topographical survey



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CLIENT **HG HINTON GROUP**

PROJECT Phase 2  
Corinthian Park  
Grovefield Way  
Cheltenham

TITLE Existing Site Plan

SCALE @ A3 1:1250    DATE 24-11-16

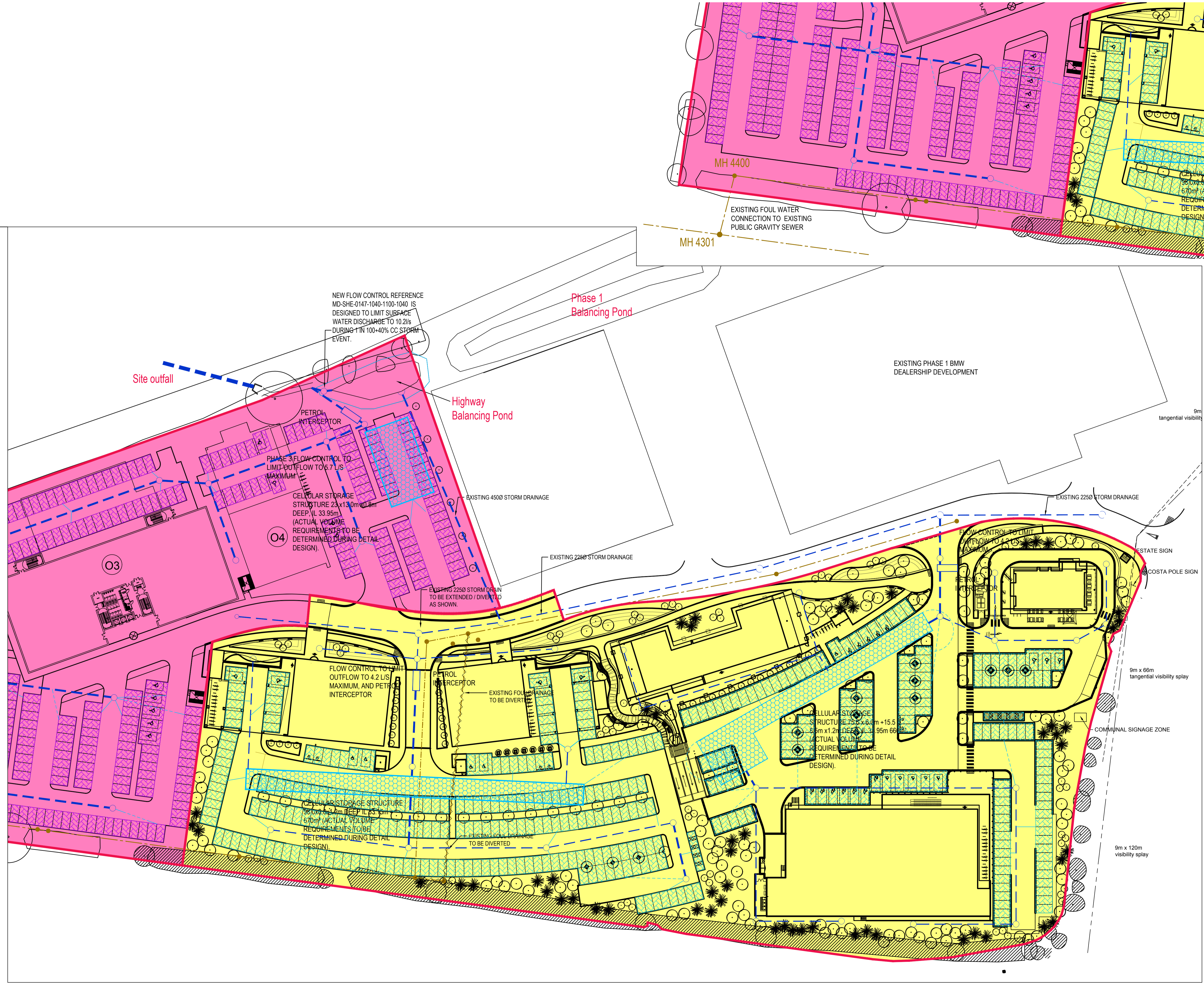
DRAWING 178-71    REV

DRAWN BY R.D    CHECKED BY D.W

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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.

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.

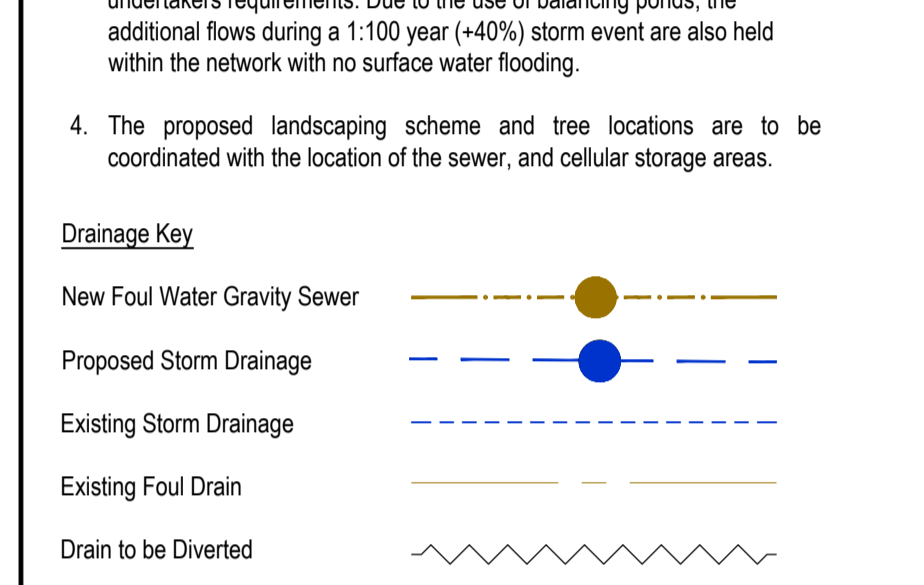
Drainage Notes:

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 July 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.



Client: Hinton Properties Ltd.

Project: Corinthian Park Cheltenham - Phase 2 & 3

Drawing Title: Drainage Strategy

Consulting Civil & Structural Engineers: COMPLETE DESIGN PARTNERSHIP LTD

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Revisions:

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)

Date: Nov 16	Drawing No. 16-6953-100	Issue Rev. P 2
Scale: 1/500 @ A1		
Drawn: MB		
Chkd:		

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## **Appendix B: TPA Phase 1 and highway works FRA & Drainage Strategy's**