

Plot SGR 1, Bicester

Water Cycle Strategy

On behalf of

SGR (Bicester 1) Limited

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1 Introduction

- 1.1.1 Peter Brett Associates LLP (PBA) has been commissioned by SGR (Bicester 1) Limited to prepare a Water Cycle Strategy to support its proposals for development known as Plot SGR 1, Bicester.
- 1.1.2 The proposed development which is bounded to the north and west by Bicester Eco-Town Exemplar site, will provide up to 75 residential dwellings with associated car parking, pedestrian and cycle routes, public open space and allotments/orchards.
- 1.1.3 This report seeks to understand the conditions pertaining to water on and around Plot SGR 1, Bicester. It also provides a summary of how water supply and waste water treatment services will be procured for the development.
- 1.1.4 This report should be read in conjunction with the developments Sustainability Statement (41436/3002/Rev1, dated March 2018, PBA), Preliminary Utilities Appraisal (41436/2003/R001/Rev01, dated March 2018, PBA) and Flood Risk Assessment (41436/2002/R001/Rev01, dated March 2018, PBA).



2 Site Information

- 2.1.1 The Plot SGR 1, Bicester site is approximately 5.03ha in size and lies to the north of Bicester town centre adjacent to Banbury Road (B4100). The site is formed from open pasture.
- 2.1.2 The site is bounded by Banbury Road to the northeast, the consented Bicester Eco-Town Exemplar site that is currently under construction to the northwest and southwest, and The Bure ordinary watercourse and Home Farm to the southeast. Refer to **Figure 2.1** below.



Figure 2.1: Site Location Plan

- 2.1.3 Two ordinary watercourses, The Bure and an Unnamed Tributary of The Bure, are located to the southeast and southwest of the site respectively.
- 2.1.4 The proposed development will provide up to 75 residential dwellings with associated car parking, pedestrian and cycle routes, public open space and allotments/orchards. The proposed access road is via the Exemplar site to the west.
- 2.1.5 A copy of the 'Illustrative Master Plan' (Drawing Number RCP001/016, dated March 2018, David Lock Associates) is contained in **Appendix A**.



3 Policy and Legislation

3.1 Introduction

- 3.1.1 The development opportunities and engineering solutions that are required to serve the development must comply with legislation, policy and guidance at the national, regional and local level. Ultimately there is a compendium of authorities and organizations with an interest in the proposals and before development options can be approved, they must first be shown to be compliant with relevant legislation
- 3.1.2 Below is a list of each piece of legislation that influences the Water Cycle Strategy for the development.

3.2 National Planning Policy Framework (NPPF)

- 3.2.1 'The NPPF sets out the Government's planning policies for England and how these are expected to be applied. It sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so.' A founding principle of the NPPF is that the interpretation of the policy is to lead to sustainable development, which is defined as achieving a balance between economic, social and environmental benefits.
- 3.2.2 With regards to managing flood risk the NPPF states:

'When determining planning applications, local planning authorities should ensure flood risk is not increased elsewhere, and only consider development appropriate in area at risk of flooding, where informed by a site-specific flood risk assessment following the Sequential Test, and if required the Exception Test, it can be demonstrated that:

- within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location; and
- development is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed, including by emergency planning; and it gives priority to the use of sustainable drainage systems.'
- 3.2.3 In their response to draft Local Plan Consultation, the Environment Agency (EA) requested evidence to ensure compliance with the following paragraphs of the NPPF.

Paragraph 109: (Conserving and Enhancing the Natural Environment)

- 3.2.4 The planning system should contribute to and enhance the natural and local environment by:
 - Protecting and enhancing valued landscapes, geological conservation interests and soils;
 - Recognising the wider benefits of ecosystem services;
 - Minimising impacts on biodiversity and providing net gains in biodiversity where possible, contributing to the Government's commitment to halt the overall decline in biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures;
 - Preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability; and
 - Remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.



Paragraph 158 (Using a Proportionate Evidence Base)

3.2.5 Each local planning authority should ensure that the Local Plan is based on adequate, up-todate and relevant evidence about the economic, social and environmental characteristics and prospects of the area, Local planning authorities should ensure that their assessment of and strategies for housing, employment and other uses are integrated, and that they take full account of relevant market and economic signals.

Paragraph 165 (Environment)

3.2.6 Planning policies and decisions should be based on up-to-date information about the natural environment and other characteristics of the area including drawing, for example, from River Basin Management Plans. Working with Local Nature Partnerships where appropriate, this should include an assessment of existing and potential components of ecological networks. A sustainability appraisal which meets the requirements of the European Directive on strategic environmental assessment should be an integral part of the plan preparation process, and should consider all the likely significant effects on the environment, economic and social factors.

Paragraph 173 (Ensuring Viability and Deliverability)

3.2.7 Pursuing sustainable development requires careful attention to viability and costs in planmaking and decision-taking. Plans should be deliverable. Therefore, the sites and the scale of development identified in the plan should not be subject to such a scale of obligations and policy burdens that their ability to be developed viably is threatened. To ensure viability, the costs of any requirements likely to be applied to development, such as requirements for affordable housing, standards, infrastructure contributions or other requirements should, when taking account of the normal cost of development and mitigation, provide competitive returns to a willing land owner and willing developer to enable the development to be deliverable.

3.3 Water Framework Directive (WFD)

- 3.3.1 The WFD was transposed into law in England and Wales by the Water Environment Regulations 2003. These Regulations implement a holistic approach to the management, protection and monitoring of the water environment. The aim of the WFD is to prevent further deterioration in water resources (volume and quality); protect and enhance the status of aquatic ecosystems and associated wetlands; promote sustainable water consumption; and, contribute to mitigating the effects of floods and droughts.
- 3.3.2 The key objectives of the WFD are to prevent deterioration in the status of water bodies and aim to achieve good ecological and chemical status/potential (including quantitative status in groundwater bodies) by 2027. Water bodies must also comply with standards and objectives of Protected Areas (i.e. an area designated under another European Directive, such as a Special Area of Conservation or Special Protection Area), where these apply. In addition, discharges, emissions and losses of priority substances to surface water bodies must be progressively reduced and emissions of priority hazardous substances prevented. Finally, action must be taken to reverse any identified sustained upward trend in pollution concentrations in groundwater bodies.
- 3.3.3 The framework for delivering the WFD is through River Basin Management Planning. The Thames River Basin District River Basin Management Plan (RBMP) 2015 update, is the applicable management plan for the area and has been used to assess the impacts of the proposals.
- 3.3.4 The EA publish the status and objectives of each surface water body on the Catchment Data Explorer (refer to http://environment.data.gov.uk/catchment-planning) and detail the status of each waterbody as contained in **Figure 2.1** below.



Status	Definition
High	Near natural conditions. No restriction on the beneficial uses of the water body. No impacts on amenity, wildlife or fisheries.
Good	Slight change from natural conditions as a result of human activity. No restriction on the beneficial uses of the water body. No impact on amenity or fisheries. Protects all but the most sensitive wildlife.
Moderate	Moderate change from natural conditions as a result of human activity. Some restriction on the beneficial uses of the water body. No impact on amenity. Some impact on wildlife and fisheries.
Poor	Major change from natural conditions as a result of human activity. Some restrictions on the beneficial uses of the water body. Some impact on amenity. Moderate impact on wildlife and fisheries.
Bad	Severe change from natural conditions as a result of human activity. Significant restriction on the beneficial uses of the water body. Major impact on amenity. Major impact on wildlife and fisheries with many species not present.

Figure 2.1: Definition of Status in WFD

3.4 Habitats Directive (92/443/EEC) (Updated 2010)

3.4.1 The Habitats Directive was adopted in 1992 and sets out the framework by which the European Union achieves its obligations under the Bern Convention.

3.5 Wildlife and Countryside Act (1981)

3.5.1 The Act tackles the problem of species protection and loss of habitat. The Act identifies Sites of Specific Scientific Interest (SSSIs) as being critical to this process.

3.6 Flood Risk Regulations (2009)

3.6.1 The Flood Risk Regulations transpose the Floods Directive 2007/60/EC into domestic law.

3.7 Flood and Water Management Act (2010)

3.7.1 The Flood and Water Management Act takes forward some of the proposals in three previous strategy documents published by the UK Government - Future Water, Making Space for Water and the UK Government's response to the Sir Michael Pitt's Review of the Summer 2007 floods.

3.8 Water Resources Act (1991)

3.8.1 The Water Resources Act 1991 (WRA) sets out the responsibilities of the EA in relation to water pollution, resource management, flood defence, fisheries, and in some areas, navigation. The WRA regulates discharges to controlled waters, namely rivers, estuaries, coastal waters, lakes and groundwater.

3.9 Environmental Permitting Regulations (2016) as amended

3.9.1 Business activities including manufacturing, waste activities or discharge of waste water that could have an impact on the environment or human health need an environmental permit. Environmental permitting replaced and simplified various environmental regulation systems, including pollution prevention and control, waste licensing and discharge consenting.

3.10 Water Industry Act (1991)

3.10.1 The Water Industry Act 1991 established the Office of the Water Regulator (OFWAT) which has the responsibility for licensing water suppliers and sewerage undertakers.



3.11 Land Drainage Act (1994)

3.11.1 There have been various updates to the Land Drainage Act, but essentially the Act consolidates the enactments relating to internal drainage boards, and to the functions of such boards and of local authorities in relation to land drainage.

3.12 Water Supply (Water Fittings) Regulations (1999)

3.12.1 These replaced all water bye laws put in place by each of the water supply companies and provide a national common standard.

3.13 Drinking Water Regulations 2000 and 2007 [Water Supply (Water Quality) Regulations] (2016)

3.13.1 Set out the standards and procedures for meeting the Drinking Water Directive (DWD) for the provision of "wholesome" water.

3.14 Building Regulations Part G 2010 (amended 2016)

3.14.1 The most relevant change to the recent revision of the Building Regulations stipulates the requirement for a "wholesome" water supply to key appliances in the home, notably excluding the toilets and washing machines.

3.15 Interim Code of Practice for Sustainable Drainage Systems (2004)

3.15.1 This Code of Practice provides support for developers in promoting and implementing a sustainable approach to water management and in particular Sustainable Drainage Systems (SuDS), to ensure their long-term viability and to promote consistent use.

3.16 The SuDS Manual C753 (2015)

3.16.1 This guidance provides best practice guidance on the planning, design, construction, operation and maintenance of Sustainable Drainage Systems (SuDS) to facilitate their effective implementation within developments.

3.17 Sewers for Adoption 7th Edition (2012)

3.17.1 Sewers for Adoption is the standard in England and Wales for the design and construction of sewers to adoptable standards.

3.18 Water Resources Planning Guideline, EA (November 2016)

3.18.1 This guideline document provides guidance for water companies on the EA's preferred approach to adopt in the development of water resource plans, to ensure that their plans meet the requirements of the Water Industry Act 1991.

3.19 Benefits of Green Infrastructure Report, Forest Research (October 2010)

3.19.1 This report by Forest Research provides generic explanations of the various benefits of green infrastructure along with lists and references to relevant case studies and reports.

3.20 Sustainability Appraisal and Habitats Regulations Assessment of the Draft Eco-Towns PPS and the Eco-Towns Programme (2009)

3.20.1 This document provides a description of the appraisal of the Eco-Towns programme in the context of sustainability and habitat regulations.

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3.21 Cherwell Local Plan 2011 – 2031 (Part 1)

- 3.21.1 Local planning policy relevant to the site is currently contained within the Cherwell Local Plan (adopted July 2015), which forms part of the Local Plan and sets out the Council's overall planning strategy to the year 2031.
- 3.21.2 Policy ESD 3: 'Sustainable Construction' emphasises the requirement to reduce water demand and states the following:

'Cherwell District is in an area of water stress and as such the Council will seek a higher level of water efficiency than required in the Building Regulations, with developments achieving a limit of 110 litres/person/day.'

3.21.3 Policy ESD 8: 'Water Resources' is concerned with water quality, adequate resources and sustainable use and states the following:

'Water quality will be maintained and enhanced by avoiding adverse effects of development on the water environment. Development proposals which would adversely affect the water quality of surface or underground water bodies, including rivers, canals, lakes and reservoirs, as a result of directly attributable factors, will not be permitted.

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



4 Water Environment

4.1 Hydrogeological Catchments

4.1.1 The site is located at the bottom of a hydrogeological catchment that sheds towards The Bure which is an ordinary watercourse located adjacent to the site's southeast boundary. The site itself falls over 6m from north to south towards The Bure as illustrated in **Figure 4.1** below.

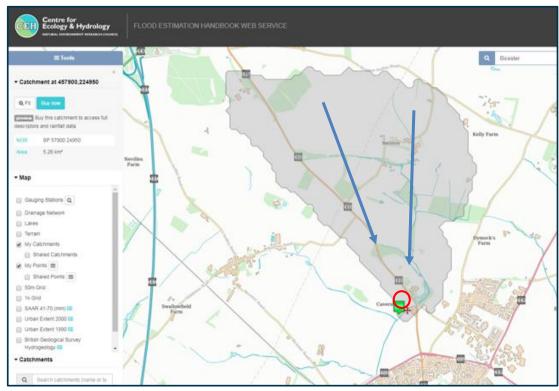


Figure 4.1: Hydrogeological Catchment taken from Flood Estimation Handbook Web Service

- 4.1.2 The Bure is a tributary of the Town Brook which the EA's River Basin Catchment online data explorer describes as heavily modified. The Town Brook is currently classed as 'Moderate' with an objective to retain this classification.
- 4.1.3 According to 'Part 1: Thames River Basin District River basin management plan' (updated: December 2015, Defra/EA), within the wider Cherwell catchment the EA are currently prioritising issues affecting both surface water and groundwater. These are described as diffuse pollution from agricultural run-off, pollution from waste-water (including from sewage treatment works) and heavily modified channels.

4.2 Hydrogeology

- 4.2.1 The geology of the site comprises superficial deposits underlain by Interbedded Limestone and Clays. As a consequence the soil has the potential to have varied drainage characteristics which will be investigated though intrusive investigations and soakage testing during detailed design.
- 4.2.2 The site is underlain by a Secondary A bedrock aquifer (**Figure 4.2**) with a high groundwater vulnerability (**Figure 4.3**). This means that the ground conditions above the aquifer have the potential to be permeable indicating that there is a potential for the movement of contaminants through the strata and subsequently pollution of the aquifer.



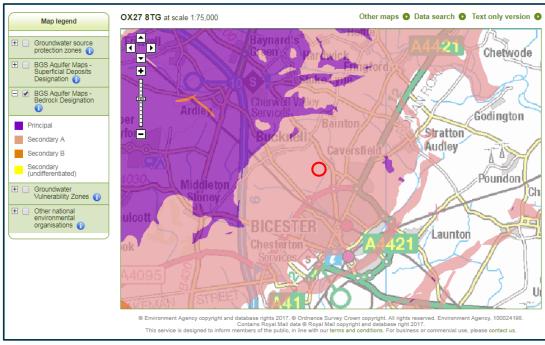


Figure 4.2: Extract from BGS Aquifer Map from EA website

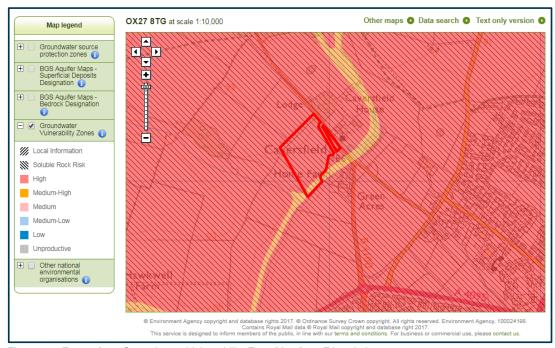


Figure 4.3: Extract from Groundwater Vulnerability Zone Map from EA website

4.3 Surface Water

- 4.3.1 The site is currently laid to arable crops with no formal drainage networks on the site. Surface water runoff generally flows overland from north to south towards The Bure. This could allow fertilisers to enter the watercourse.
- 4.3.2 The main concern with respect to pollution of the receiving waters, of the Town Brook and wider River Cherwell, lies in the run-off from the existing agricultural land increasing the nutrient load from nitrates and the discharge of effluent from treatment works increasing the phosphate load in receiving waters. As previously mentioned (Section 4.1) there are projects underway to improve the quality of surface water within the Cherwell catchment.



4.4 Rainwater - Hydrological Regime

- 4.4.1 The Standard Annual Average Rainfall (SAAR) for the site is 635mm based on the Flood Estimation Handbook.
- 4.4.2 The effects of climate change as illustrated from the UKCP09 assessment, shown in **Figure 4.4** below, indicate a reduction of about 20-30% in summer rainfall and a similar increase in winter, i.e. drier summers and wetter winters. The overall quantity of rainfall may stay much the same but the seasonal difference will increase the volumes of storage required.

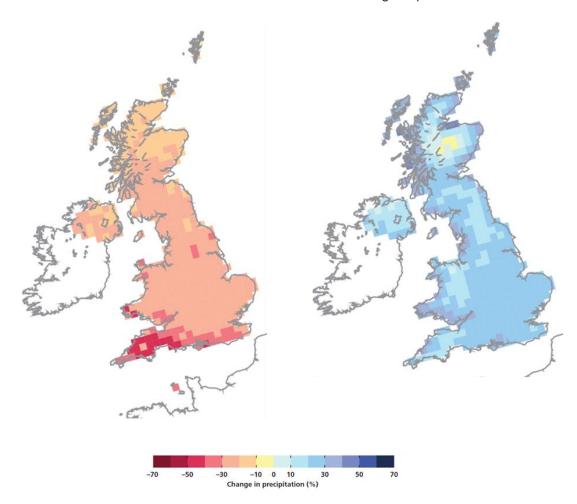


Figure 4.4: Seasonal Mean Precipitation Trends (at 50th Percentile) by 2080s (Source: UKCIP 09

4.5 Development Impact on the Water Environment

4.5.1 Plot SGR 1, Bicester, forms only a small part of the Cherwell catchment, 5.03ha out of 1,500ha, therefore while it's conversion from agriculture to residential development will reduce the discharge of nitrate pollution in run-off water its effect on overall water quality of The Bure will be negligible.



5 Potable Water

5.1 Demand

- 5.1.1 The CDC Local Plan Policy ESD 3 (refer to **Section 3.21**) states that the water usage for developments should be limited to 110 l/p/d which is more stringent than the 125l/p/d outlined in the Building Regulations. This is due to the Cherwell District being in an area of water stress.
- 5.1.2 Measures to significantly reduce the water usage have been set out in Section 4.2 of the Sustainability Statement. These include but are not limited to:
 - Flow restrictors on kitchen sink and bathroom basin taps;
 - Dual flush toilets:
 - Low capacity baths; and
 - Water efficient kitchen appliances.
- 5.1.3 Table 4.1 in the Sustainability Statement (41436/3002/Rev1, dated March 2018, PBA) gives an example specification which meets the limit of 110 l/p/d.

5.2 Supply

- 5.2.1 Thames Water Utilises Limited (TWUL) are responsible for maintaining the public water supply across the catchment area. Every five years, in conjunction with their business plan submission, TWUL are required to set out how they plan to maintain the balance between supply and demand for water for the next 25 years in a Water Resource Management Plan (WRMP).
- 5.2.2 TWUL's Water Resources Management Plan 14 (WRMP14) places the development within their Swindon and Oxfordshire (SWOX) Water Resource Zone (WRZ).



Figure 5.1: Thames Water Supply Area and Water Resource Zones (taken from TWUL WRMP 14)

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5.2.3 WRMP14 states:



'Swindon and Oxfordshire: we predict a deficit on a dry year critical period growing from -1 Ml/d in 2020 to -32 Ml/d by 2040. These changes are principally driven by the impact of climate change on groundwater sources and therefore a reduction in available deployable output.'

- 5.2.4 To overcome this deficit TWUL proposes 'a programme of demand reduction in the medium-term (2020-2030), which is achieved through a combination of progressive metering, water efficiency and leakage control measures. In the long-term a small aquifer storage and recovery scheme is required in Guildford WRZ to facilitate a water transfer to Affinity Water in 2036 as part of the WRSE (Water Resources in the South East) regional water strategy. The preferred plan also supports a bulk supply export of 10 Ml/d from SWA WRZ in 2030 to South East Water, as included in the WRSE plan.'
- 5.2.5 In September 2016 TWUL published a feasibility report for the period 2020-2045 which will form the basis for WRMP19. This report sets out two main categories to address the sustainable management of water resources:
 - *Addressing water quality constraints: specific catchment management actions targeted at water sources (mostly groundwater sources) where the reliable output of the source is constrained by water quality issues (notably pesticides or nitrates), or the source is currently unable to be used. By reducing or eliminating the water quality constraint, potentially more water could be reliably supplied from the source.
 - Measures to capture and store more catchment runoff to increase base river flows or enhance groundwater recharge. Such measures help to slow down the rate of catchment runoff during wet weather so it can be stored within the catchment to support abstraction in drier conditions.'
- 5.2.6 The NW Bicester Eco-Town Exemplar site 'Detailed Water Cycle Study' (5010-UA005241, dated March 2014, Hyder Consulting (UK) Limited) states that:

'According to TWUL, the majority of the supply for Bicester is sourced from near Oxford. Raw water is abstracted from the River Thames to the west of Oxford, stored and treated at Farmoor, and then transmitted northwards with the assistance of a large pumping station near the A44 to the west of Bicester. Potable water is stored in a Distribution Service Reservoir (DSR) to the north west of Bicester, and the town is then supplied from here via a 450mm main which runs through the NW Bicester development site along the existing bridleway.

TWUL advise that they have recently upgraded the capacity of the pumping station, and the main from the DSR to Bicester. Additionally, TWUL completed the Bicester ring main in 2012, which allows increased resilience in supplying the town, and is designed to cater for the next 40 years of development as assessed by TWUL.'

- 5.2.7 TWUL are aware of the issues that have a detrimental effect on water resources and the possible measures to maintain sustainable supply and demand within the catchment area. However, it should be noted that the site can only be potentially supplied with adequate potable water as the required supply cannot be guaranteed at this stage.
- 5.2.8 TWUL have confirmed that the Plot SGR 1, Bicester development lies within the Ardley water pressure zone, and will be supplied from the Ardley reservoir approximately 6km to the north west of the site.



6 Foul and Surface Water Drainage

6.1 Surface Water Discharge

- 6.1.1 To mimic the greenfield run-off from the site, surface water discharge from the development will be restricted to the practical minimum of 5 l/s for all storm events up to and including the 1 in 100 year event plus climate change allowance. To account for potential future domestic development on the site, for example extensions, 10% has been added to the proposed development's impermeable area within the surface water drainage strategy. In accordance with current guidance a +30% allowance for increases in peak rainfall intensity resulting from climate change has also been included.
- 6.1.2 Sustainable Drainage Systems (SuDS) in the form of a detention basin, and where practicable permeable pavements, will be utilised to provide attenuation and water quality benefits prior to discharge to The Bure. At the detailed planning stage, once intrusive geotechnical testing has been undertaken, an assessment of the site ability to utilise infiltrating features will be undertaken and the use of SuDS reassessed.
- 6.1.3 This is discussed further within the Plot SGR 1, Flood Risk Assessment report (41436/2002/R001/Rev01, dated March 2018, PBA).
- 6.1.4 Surface water discharge from the development will be controlled through the use of SuDS to the practical minimum of 5 l/s, for all storm events up to and including the 1 in 100 year event plus climate change allowance, prior to discharge to The Bure.
- 6.1.5 To account for potential future domestic development on the site, for example extensions, 10% has been added to the proposed development's impermeable area and in accordance with current guidance a +30% allowance for increases in peak rainfall intensity has been included.
- 6.1.6 A detention basin and permeable pavements will be utilised to provide attenuation and water quality benefits prior to discharge to The Bure. At the detailed planning stage, once intrusive geotechnical testing has been undertaken, an assessment of the site ability to utilise infiltrating features will be undertaken and the use of SuDS reassessed.
- 6.1.7 This is discussed further within the Plot SGR 1, Bicester, Flood Risk Assessment report (41436/2002/R001/Rev01, dated March 2018, PBA).

6.2 Foul Water Discharge

- 6.2.1 Foul water will be transported to the Bicester Waste Water Treatment Works (WWTW) via a connection to TWUL sewer within the adjacent Eco-Town site. TWUL have stated that the WWTW is nearing capacity and a growth study is currently being undertaken to understand how the load from the overall Eco-Town can be treated. This includes the option to construct a new WWTW on the Eco-Town site to serve the 6,000 unit development, but with the recent changes to the Water Industry Act TWUL are unable to provide an update at this time.
- 6.2.2 The changes to Water Industry Act, mean that from 1st April 2018, TWUL are required to fund and deliver all required reinforcement to enable development. As such even if there is found to be inadequate capacity in the network TWUL will reinforce the network in line with the development programme.
- 6.2.3 This is discussed further within the Plot SGR 1, Bicester, Preliminary Utilities Appraisal (41436/2003/R001/Rev01, dated March 2018, PBA).



7 Summary

- 7.1.1 The development of the site will decrease the discharge of nitrate pollution from the existing site due to the reduced use of fertilisers. Through the use of SuDS sediment and buoyant materials will be reduced/removed from surface water run-off through filtration and biodegradation. This is combined with the controlled discharge to The Bure, will ensure that the development will not have a detrimental effect to the quality or quantity on the existing water environment. At the detailed planning stage, once intrusive geotechnical testing has been undertaken, an assessment of the site ability to utilise infiltrating features will be undertaken and the use of SuDS reassessed.
- 7.1.2 TWUL have confirmed that the Plot SGR 1, Bicester development lies within the Ardley potable water pressure zone, and will be supplied from the Ardley reservoir approximately 6km to the north west of the site.
- 7.1.3 TWUL have stated that the Bicester Waste Water Treatment Works (WWTW) is nearing capacity and a growth study is currently being undertaken to understand how the load from the overall Eco-Town can be treated. This includes the option to construct a new WWTW on the Eco-Town site to serve the 6,000 unit development. However, the changes to the Water Industry Act 1991, with regards to potable and waste water mean that from 1st April 2018, TWUL are required to fund and deliver all required reinforcement to enable development. As such even if there is found to be inadequate capacity in the network TWUL will reinforce the network in line with the development programme.
- 7.1.4 This report therefore demonstrates that the Plot SGR 1, Bicester, proposals have been developed in accordance with Cherwell Local Plan (adopted July 2015) policies ESD 3: 'Sustainable Construction' and ESD 8: 'Water Resources'.

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Appendix A Illustrative Master Plan, Drawing Number RCP001/016, dated March 2018, David Lock Associates

