12.1 INTRODUCTION

12.1.1 This chapter of the ES has been prepared by Wardell Armstrong LLP (WA) to describe the Proposed Development and consider the potential effects on surface water and groundwater resources associated with the development and reports on the assessment of the development proposals contained within Chapter 2 with regards to flood risk and water quality.

12.1.2 A separate Flood Risk Assessment (FRA) (Wardell Armstrong LLP, 2014) has been prepared in support of the planning application, and is referred to within this chapter. The FRA can be reviewed in Appendix 12.1 of this ES.

12.2 ASSESSMENT METHODOLOGY

Scope

12.2.1 The Wykham Park Farm application Site is located 1.7km south west of Banbury town centre in Oxfordshire and is in the catchment of the Sor Brook– a tributary of the River Cherwell. The proposed application Site covers an area of approximately 52ha and will provide a sustainable mixed-use development comprising up to 1,000 housing units, a local centre and provisions for a primary school and green infrastructure.

12.2.2 The boundary and proposed layout of the development is shown on the Development Framework Plan JJG-35-I (appendix 2.1)

Data Sources

12.2.3 The following publicly-available and published material was compiled in preparation of the desk-based baseline assessment of the Site:

- GroundSure EnviroInsight report (ref: GSWA1-1546718) 2014;
- Environment Agency "What's in Your Backyard" map website;
- British Geological Survey "Geology of Britain Viewer" website;
- EU Water Framework Directive (WFD) 2000/60/EC;
- The EC Groundwater Directive (2006/118/EC) and Groundwater Regulations 2010;
- Flood and Water Management Act 2010;
- Water Act 2003, as amended;
- Water Industry Act 1991 (as amended by the Water Act 2003);
- Land Drainage Act 1991, as amended;
- Water Resources Act 1991;
- Environment Act 1995, as amended;
- The Conservation of Habitats & Species Regulations 2010;
- National Planning Policy Framework (NNPF) 2012;
- Environmental Permitting (England & Wales) Regulations 2010;
- Control of Pollution: Oil Storage (England) Regulations 2001;

- Environmental Damage (Prevention & Remediation) Regulations 2009;
- Cherwell District Local Plan (1996);
- Draft Cherwell Local Plan (2014);
- The Non Statutory Cherwell District Local Plan (2004);
- Thames River Basin Management Plan (2009);
- Cherwell, Thame and Wye Catchment Abstraction Licensing Strategy (2012).

Assessment Approach

12.2.4 This assessment takes the form of a desk-based study focussing on the effects of the Proposed Development on the hydrology and hydrogeology, including water levels and quality and incorporates the following:

- An assessment of the baseline conditions at the Site and the immediate surrounding areas;
- Identification of significant hydrological and hydrogeological receptors, their value and sensitivity;
- An Assessment of potential impacts of the Proposed Development during construction and post-construction on the identified receptors;
- Determination of the nature, magnitude and significance of potential impacts;
- Identification of any cumulative impacts (i.e. impacts of the Proposed Development on an identified receptor when combined with the impacts of existing developments or other Proposed Developments upon the same receptor;
- Mitigation measures to reduce impacts on hydrology and hydrogeology;
- Identification any residual effects likely to arise as a consequence of the development.

12.2.5 AFlood Risk Assessment (FRA) (Wardell Armstrong LLP, 2014) has been prepared in support of the planning application, and is referred to within this chapter at appended to the ES at 12.1.

12.2.6 The FRA assesses the potential flood risk to the existing Site and identifies the potential impacts the Proposed Development may have upon flood risk, and sets out mitigation measures to reduce the identified potential impacts and manage the associated risk.

Significance Criteria

12.2.7 The tables below outline the criteria for determining the magnitude of identified impacts, the sensitivity of receptors and the significance of the resulting effects.

12.2.8 Examples of typical classification of impact magnitude are shown in Table 12.1

Table12.1: Indicative Criteria for the Definition of Impact Magnitude

Magnitude	Example Hydrological and Hydrogeological Impacts
Large	• Wholesale changes to watercourse channel, route, hydrology, or hydrodynamics; • Changes to site resulting in an increase in runoff and/or flood risk, and significant changes to erosion and sedimentation patterns; or • Major changes to either groundwater or surface water chemistry.
Moderate	• Some fundamental changes to the watercourse, hydrology or hydrodynamics; changes to site resulting in an increase in runoff within system capacity; • Moderate changes to erosion and sedimentation patterns; or • Moderate changes to the water chemistry of surface runoff and groundwater.
Small	• Minor or slight changes to the watercourse, hydrology or hydrodynamics; • Changes to site resulting in slight increase in runoff well within the drainage system capacity; • Minor changes to erosion and sedimentation patterns; or • Minor changes to the water chemistry.
Negligible	• Very minor changes to watercourses, Hydrology, Hydrodynamics, erosion and sedimentation patterns; with negligible potential to alter flow mechanisms (including groundwater recharge); or • Very minor changes in either groundwater or surface water chemistry.

12.2.9 Receptors in the water environment are identified during the baseline assessment. Value can be assigned to each receptor based on the sensitivity of the receptor.

12.2.10 The sensitivity of environmental receptors is typically determined as shown in 12.2.

Table 12.2: Receptor Sensitivity Indicative Classifications

Sensitivity	Example Type of Habitat/Environment
High	RAMSAR site, Special Protection Area (SPA) Special Area of Conservation (SAC) (i.e. international importance) or Site of Special Scientific Interest (SSSI).
	A highly sensitive aquatic ecosystem.
	Inner Source Protection Zone (SPZ) (Zone 1) on a Principal Aquifer (i.e. national Importance)
	A water body of very good chemical or ecological quality including designated bathing waters, shellfish and salmonid fisheries.
	A receptor used for water supply
	Flood plain or flood storage area necessary to protect vulnerable development/valued resources from flooding
Medium	A Local Nature Reserve (LNR).
	A Secondary A Aquifer or Secondary B Aquifer.
	A water body of high amenity value including areas of bathing
	A water body of 'good or fairly good' chemical and ecological quality and/or non-public water supply or cyprinid fishery.
	A water body of nature conservation importance at the regional level or a moderately sensitive aquatic ecosystem.
	A floodplain or flood storage area protecting medium vulnerability developments/resources
Low	Principal or Secondary Aquifer with low permeability drift cover.
	A water body of 'fair' chemical or ecological quality.
	A receptor in close proximity to a source protection zone or abstraction point.
	A water body of moderate amenity value including public parks, boating or where footpath passes adjacent to a watercourse, or where receiving water passes through a housing development or town centre.
	A water body of low amenity value with casual access, e.g. along a road.
	A floodplain or flood storage area with limited or no flood protection value.
Negligible	An unproductive Aquifer.
	A low sensitivity aquatic ecosystem.
	Water of 'poor' or 'bad' chemical or ecological quality.

12.2.11 On the premise that impacts are consequences of the development, having established the potential magnitude of the impact and sensitivity of the receptors, the criteria for determining the significance of those impacts is based upon the following method:

Magnitude of impact x sensitivity of receptor = significance of potential impacts

12.2.12 The significance of potential impacts on identified receptors is as defined in Table 12.3

Table 12.3: Matrix for the Determination of Significance of Potential Effects

Sensitivity of Receptor	Magnitude of Impact upon Receptor			
	Large	**Moderate**	**Small**	**Negligible**
High	Major	Moderate	Minor	Minor
Medium	Moderate	Moderate	Minor	Negligible
Low	Minor	Minor	Negligible	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

12.2.13 If the significance of the potential impact is moderate or higher, then mitigation measures will be required to prevent adverse effects and minimise residual adverse effects.

Uncertainties and Limitations

12.2.14 It is assumed that EA data sources reflect the true nature of flooding conditions across the Site. While all reasonable checks have been made on data sources and the accuracy of data, Wardell Armstrong LLP Ltd accepts no liability for same.

12.3 RELEVANT LEGISLATION

National Planning Policy Framework (March 2012)

12.3.1 The NPPF sets out 12 planning principles as guidance for local councils; the following principles are directly applicable to the water environment:

- 10. Meeting the challenge of climate change, flooding and coastal change –taking account of climate change over the longer term including factors such as flood risk, coastal change, water supply and changes to biodiversity and landscape;
- 11. Conserving and enhancing the natural environment – development should minimise pollution and other adverse effects on the local and natural environment and should plan positively for the creation, protection, enhancement and management of networks of biodiversity and green infrastructure.

12.3.2 Allocation and planning of development must be considered against a risk based search sequence, as provided by the National Planning Policy Framework. In terms of fluvial flooding, the guidance categorises flood zones in three principal levels of risk, as follows:

Table 12.4: Flood Risk Parameters

Flood Zone	Flood zone Classification	Description
Flood Zone 1	Low Probability	This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any one year (<0.1%).
Flood Zone 2	Medium Probability	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.
Flood Zone 3a	High Probability	This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
Flood Zone 3b	Functional Floodplain	The zone comprises land where water has to flow or be stored in times of flood.

12.3.3 According to the NPPF guidance, residential and educational development at the proposed Site, being designated as "More Vulnerable" classifications, should lie outside the envelope of the predicted 1 in 100 year (1%) flood, with preference given to sites lying outside the 1 in 1,000 (0.1%) year event and within Flood Zone 1.

NPPF requires that developments covering an area of greater than one hectare prepare a Flood Risk Assessment (FRA). The FRA is required to be proportionate to the risk and appropriate to the scale, nature and location of the development. A comprehensive Flood Risk Assessment has been prepared to support this Environmental Statement (Appendix 12.1 of this ES).

12.3.4 The relevant paragraphs within the NPPF that support this assessment are:
"Local planning authorities should adopt proactive strategies to mitigate and adapt to climate change, taking full account of flood risk, coastal change and water supply and demand considerations". (Paragraph 94):

"Local Plans should take account of climate change over the longer term, including factors such as flood risk, coastal change, water supply and changes to biodiversity and landscape. New development should be planned to avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure". (Paragraph 99).

The planning system should contribute to and enhance the natural and local environment by: 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 (Paragraph 109). In preparing plans to meet development needs, the aim should be to minimise pollution and other adverse effects on the local and natural environment. Plans should allocate land with the least environmental or amenity value, where consistent with other policies in this Framework. (Paragraph 110).

To prevent unacceptable risks from pollution and land instability, planning policies and decisions should ensure that new development is appropriate for its location. The effects (including cumulative effects) of pollution on health, the natural environment or general

amenity, and the potential sensitivity of the area or Proposed Development to adverse effects from pollution, should be taken into account. Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner. (Paragraph 120).

National Planning Practice Guidance

12.3.5 The National Planning Practice document provides advice regarding how planning can ensure water quality and the delivery of adequate water and wastewater infrastructure. These are produced to be in line with the National Planning Policy Frameworks which are described in Section 12.3.1.

- Paragraph 001 - Adequate water and wastewater infrastructure is needed to support sustainable development. A healthy water environment will also deliver multiple benefits, such as helping to enhance the natural environment generally and adapting to climate change.
- Paragraph 005 - Identifying suitable sites for new or enhanced infrastructure. In identifying sites it will be important to recognise that water and wastewater infrastructure sometimes has particular locational needs (and often consists of engineering works rather than new buildings) which mean otherwise protected areas may exceptionally have to be considered where consistent with their designation. Plan-making will also need to take into account existing and proposed development in the vicinity of a location under consideration for water and wastewater infrastructure. In two tier areas there will need to be close working between the district and county councils.
- Paragraph 006 - How to help protect and enhance local surface water and groundwater in ways that allow new development to proceed and avoids costly assessment at the planning application stage. For example, can the plan steer potentially polluting development away from the most sensitive areas, particularly those in the vicinity of potable water supplies (designated source protection zones or near surface water drinking water abstractions)?
- Paragraph 009 - Water supply and quality are considerations in strategic environmental assessment and sustainability appraisal which are used to shape an appropriate Local Plan, for example by establishing the ‘baseline’ and appropriate objectives for the assessment of impacts and proposed monitoring. Sustainability

appraisal objectives could include preventing deterioration of current water body status, taking climate change into account and seeking opportunities to improve water bodies.

Cherwell District Local Plan (1996)

12.3.6 Saved Policy ENV7 is relevant to this assessment and states:
A development which will adversely affect to a material level, 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.

The Non-Statutory Cherwell District Local Plan 2011 (2004)

12.3.7 The Non Statutory Cherwell Local Plan 2011 was intended to review and update the local plan adopted in 1996. Due to changes introduced in the planning system, work on the plan was discontinued prior to adoption. The Non Statutory Local Plan 2011 is not part of the statutory development plan but has been approved as interim planning policy for development control purposes.

Saved policies relevant to this study are:

In determining planning applications the council will take into account the likely impact of a proposal on the natural and built environment and will seek to enhance the environment whenever possible. Development which would have an unacceptable environmental impact will not be permitted. (Policy EN1)

A development which is likely to cause materially detrimental levels of noise, vibration, smell, smoke, fumes or other type of environmental pollution will not be permitted. (Policy EN3)

A development will only be permitted where adequate water resources exist, or can be provided without detriment to existing use. (Policy EN11).

A development which will adversely affect to a material level, 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. (Policy EN12)

A new development generating increased surface water run-off likely to result in an adverse impact to surface drains and watercourses, such as an increased risk of flooding, river channel instability or damage to habitats, will not be permitted unless the proposals include appropriate source control and/or attenuation measures. (Policy EN15).

Draft Cherwell Local Plan

12.3.8 The Draft Cherwell Local Plan (2006-2031) was submitted to the Secretary of State for Communities and Local Government for formal Examination on 31st January 2014. The public examination hearings into the Submission Local Plan were suspended on 4 June 2014 for six months to enable the Council to put forward proposed modifications to the Plan.

12.3.9 Policies relevant to this assessment are:

Policy ESD1: Mitigating and Adapting to Climate Change
Measures will be taken to mitigate the impact of development within the district on climate change. At a strategic level, this will include:

Designing developments to reduce carbon emissions and use resources more efficiently, including water.

Policy ESD7: Sustainable Drainage Systems (SUDS).
All development will be required to use sustainable drainage systems (SUDS) for the management of surface water run-off…..Where possible, SUDS should seek to reduce flood risk, reduce pollution and provide landscape and wildlife benefits.

Policy ESD8: Water Resources:
The Council will seek to maintain water quality, ensure adequate water resources and promote sustainability in water use….Development will only be permitted where adequate water resources exist, or can be provided without detriment to existing uses.

12.4 BASELINE CONDITIONS

Topography and Land Use

12.4.1 The Site comprises arable land with the maximum elevation of approximately 133m AOD in the north of the Site, falling south east and south west to approximately 125m AOD.

Hydrology

Surface Water Features

12.4.2 The principal watercourse in the vicinity of the Site is the Sor Brook, approximately 1km south of the Site, flowing southeast to the River Cherwell approximately 5km downstream.

12.4.3 Ordnance Survey (OS) 1:50,000 maps show a drainage ditch at the southern Site boundary running in an easterly direction. A previous site inspection referred to in the 2013 ES report found the ditch to be overgrown and dry. Further downstream, still within the Site boundary, a 375mm diameter pipe in culverted section of the ditch was almost 100% blocked.

12.4.4 From the Site boundary, the ditch flows and discharges to a small unnamed pond behind the Wykham Farm cottage, before continuing in a southerly direction under Wykham Lane and discharging to a reservoir. An unnamed watercourse flows in a southerly direction from the reservoir, joining the Sor Brook approximately 1km south of Site.

12.4.5 OS maps and the previous site inspection note no further surface water receptors within the Site boundary.

12.4.6 The Sor Brook is classified as being of “good” ecological quality by the Environment Agency (EA) and is predicted as being of “good” ecological quality by 2015. The EA does not require or undertake an assessment of chemical quality. Table 12.5 summarises the current ecological quality for the section of Sor Brook closest to Site as outlined on the EA “What’s in Your Backyard” website.

Table 12.5 – Summary of Current Ecological Quality of the Sor Brook

Waterbody Name	Sor Brook (Broughton to Adderbury)
Waterbody ID	GB106039037260
Management Catchment	Cherwell
River Basin District	Thames
Overall Biological Quality	Good
Overall Physico Chemical Quality	Good
Hydro Morphological Quality	Not High
Overall Specific Pollutants Quality	High

12.4.7 EA records do not contain historical chemical or biological water quality data for the Sor Brook within 1.5km of Site.

12.4.8 The Thames River Basin management plan[1] identifies the section of the Sor Brook as being within a Drinking Water Protected Area and to be protected under the Freshwater Fish Directive and Nitrates Directive as detailed on What's in Your Backyard.

12.4.9 The unnamed ditch and watercourse described in Section 12.4.4 is an Ordinary Watercourse and is not maintained or monitored by the EA or included in the Thames River Basin Management Plan. It is assumed the water quality of the ditch and water course will be relatively poor with the use of agricultural chemicals and runoff from adjacent agricultural land.

Nitrate Vulnerable Zones

12.4.10 The EA "What's in Your Backyard" website shows the proposed Site to be within a "Surface Water" Nitrate Vulnerable Zone (NVZ), which is confirmed in the Thames River Basin Management Plan. A "Ground Water" NVZ is located approximately 2km west of Site.

12.4.11 A NVZ is designated where land drains and contributes to nitrate found in "polluted" waters.

[1] River Basin Management Plan Thames River Basin District Annex B: Water body status objectives (December 2009)

This is a likely indicator of local watercourses being affected by runoff from arable land. Polluted waters are defined as surface or ground waters:

- Containing >50mg/l of nitrate;
- Containing >50mg/l of nitrate if no action is taken; and
- Eutrophic, or likely to become eutrophic if no action is taken.

12.4.12 Elevated levels of nitrogen can damage the water environment, ecology and is harmful to human health and must be removed before water can be supplied for human consumption.

Surface Water Abstractions and Discharges

12.4.13 The GroundSure EnviroInsight report[2] contains details of one licensed surface water abstraction within 2,000m of the Site boundary. The license is for two abstraction points, approximately 300m south west and 570m south of Site and allows a maximum annual abstraction of 27,276m^3, with water used for spray irrigation and general agriculture.

12.4.14 The report contains details of one potable surface water abstraction licence within 2,000m of the Site boundary. The Thames Water Utilities Ltd Bodicote pumping station, located 1,150m south east of the Site boundary is licensed to abstract a maximum daily volume of 4,546m^3 and an annual volume of 1,663,836m^3.

12.4.15 The report also details one active surface water discharge licence within 500m of the Site, discharging to the Sor Brook. The discharge point is upstream of Site and is identified in the GroundSure report as “sewage discharges” from a water company pumping station.

12.4.16 Details of smaller surface water abstractions and discharges are not held the Local Authority.

Hydrogeology

12.4.17 British Geological Survey (BGS) records the majority of the application Site is underlain by Whitby Mudstone formation and is designated an unproductive aquifer by the EA. The eastern and south western section of the Site however is underlain by the Marlstone Rock Formation

[2]GroundSure EnviroInsight report, July 2014 (ref: GSWA1-1546718) – attached within Appendix 13.1 in this ES

– designated as a Secondary A aquifer by the EA. Secondary A aquifers are permeable layers capable of supporting water supplies at a local rather than a strategic level in addition to forming an important source of baseflow to rivers. The aquifer could be classed as a potential receptor for any potential contaminative activities on Site.

12.4.18 The Marlstone Rock Formation is between 2 and 4m thick, located 3 to 4m below ground level, based on BGS borehole records in the vicinity of Site. Groundwater level data is unavailable and no springs are mapped, however groundwater is likely to be present towards the base of the formation perched above the Dyrham Formation based on geology as detailed on borehole records.

12.4.19 There are no Groundwater Source Protection Zones within 1km of the Site boundary, with the nearest being approximately 18km south east which is assumed of sufficient distance to be unaffected by the Proposed Development.

Groundwater Quality

12.4.20 The EA "What's in Your Backyard" website classifies the underlying groundwater as being of "good" chemical quality. 12.6 summarises the current chemical quality of groundwater based on EA monitoring data.

Table 12.6 – Summary of Current Chemical Quality of Groundwater

Waterbody Name	Banbury Jurassic
Waterbody ID	GB40602G600200
River Basin District	Thames
Current Chemmical Quality	Good
Upward Chemical Trend	No
General Chemical Assessment	Good
Saline or Other Intrusions	Good
Groundwater Dependent Terrestrial Ecosystems (Chemical Impacts)	Good
Impact on Surface Water Chemical/Ecological Status	Good
Drinking Water Protected Area Status	Good

12.4.21 That the groundwater body is currently achieving a good status for all water quality parameters tested, would mean that Drinking Water Protected Area (DrWPA) objectives are met and that groundwater pollutants are below threshold values as set by the WFD and Groundwater (Daughter) Directive (2006/118/EC). It is likely that the good water quality is having a beneficial impact on the water quality of receiving surface waters such as the River Sor.

Groundwater Abstractions and Discharges

12.4.22 The GroundSure EnviroInsight report contains details of three licensed groundwater abstractions within 1km of the Site boundary. Details of the maximum annual abstraction limit are not supplied for two licences, with the third allowing a maximum annual abstraction of 13,636m^3, with water used for spray irrigation, general agriculture and domestic use (assumed non-potable). No potable groundwater abstraction licences were identified within 2km of Site.

12.4.23 The report also details two groundwater discharge licences within 500m of the Site, with one described as discharging to the Marlstone Formation and into land. Both effluent types are identified as sewage discharge. With no groundwater level data available, it cannot be confirmed if the licensed discharges are up or down gradient of Site.

Flood Risk

12.4.24 The flood map for the site shows that the development is located in an area defined as having a low risk of flooding from rivers (i.e. Flood Zone 1). An extract of the Environment Agency's Flood Map is shown in Figure 1 in Appendix 12.1. The annual probability of flooding is, therefore, less than 1 in 1000 years.

12.4.25 The proposed mixed use development of the site falls into a number of vulnerability classifications as defined in Table 2 of the NPPF Technical Guidance. The highest vulnerability use proposed is residential development which is classified as 'More Vulnerable' development. Table 3 of the NPPF Technical Guidance shows that 'More Vulnerable' development is appropriate in Flood Zones 1 and 2.

12.5 WATER RESOURCES

12.5.1 The EA manages water resources at a local level through the use of Catchment Abstraction Management Strategies (CAMS). Water supplied to the application Site is subject to the policies set out within the Cherwell CAMS[3]. The document outlines how the EA will manage water, where water is available and how it will licence the abstraction of this water. The application Site and the entire length of the Sor Brook fall within the EA's Water Resource Management Unit (WRMU) 2, which has been classified as 'No Water Available'. This means that there is no water available for further licensing at low flows but may be available at higher flows.

12.5.2 The CAMS document makes reference to Thames Waters' licence for potable water supply abstracted from the Sor Brook (see Section 12.4.13) which is located within WRMU 2. This licence is constrained by a 'hands off' flow condition where if the rate of flow in the Sor Brook drops beyond a prescribed level, abstractors are notified by the EA to cease all abstraction of water. If the Proposed Development is to be supplied via water abstracted from the Sor Brook, then the status of the WRMU and conditions on the existing abstraction licence could potentially have an impact on how the development is supplied by water and the reliability of that water supply.

12.5.3 WA requested information regarding a "detailed hydraulic model analysis" from Thames Water on 9th July 2014 with a view to assessing the proposed approach Thames Water would take towards providing water for the development. Thames Water responded stating that the modelling approach they would take to supply water for the Wykham Park Farm development would involve transferring water from the Bretch Reservoir.

12.5.4 The Water Resource Management Plan4 produced by Thames Water contains data on the balance between supply and demand of water within each of its regions over time based on anticipated population growth and the effects of climate change. In 2011 the water available

[3] Cherwell, Thame and Wye Catchment Abstraction Licensing Strategy, December 2012
[4] Thames Water Revised Draft Water Resources Management Plan 2015 – 2014

for supply exceeded the demand for water in all Thames Water "Water Resource Zones" (WRZ).

12.5.5 In 2011 available supply exceeded demand by 37.3Ml/d in the "Swindon and Oxfordshire" (SWOX) WRZ in which the Wykham Park Farm Site is located, and is predicted to be 27.1Ml/d in 2015.

12.5.6 A water cycle study (WCS) covering the Banbury Catchment has not been carried out by Cherwell District Council and therefore could not be used to determine the baseline conditions in relation to how the Banbury Catchment is supplied with water, where that water is sourced and the condition of that water source.

12.6 POTENTIAL EFFECTS

Sensitivity of Receptors

12.6.1 Table 12.7 summarises the sensitivity of receptors identified in the baseline study, based on criteria detailed in Table 12.1

Potential Impacts and Significance

Table 12.7 – Summary of Identified Receptors and Their Sensitivity

Receptor	Features	Sensitivity
On-site watercourse/ditch	• Classified as an "Ordinary Watercourse"; • Water quality likely to be moderate or poor due to agricultural runoff; • Located within a NVZ; • Receives runoff from a relatively small catchment area; • Water source for downstream reservoir; • Important for land drainage and reducing local flood risk.	Low
Sor Brook	• Classified as of "good" ecological status; • Supports abstraction for public potable water supply; • Protected area as designated by Fresh Water Fish Directive 2006/44/EC, Drinking Water Directive 98/83/EC and Nitrates Directive 91/676/EEC; • Classified as "No Water Available" within the EA WRMU and designated as being highly sensitive to further abstraction; • Supports a number of local licensed water abstractions used for potable and agricultural purposes.	High

Receptor	Features	Sensitivity
Secondary A Aquifer	• A groundwater body of "good" chemical and qualitative status; • Currently meets drinking water standards; • Provides baseflow to watercourses of "good" water quality; • Located within a WRMU classified as 'No Water Available and designated as being highly sensitive to further abstraction; • Supports a number of local licensed water abstractions used for agricultural and domestic purposes • Not located within a GWPZ.	Medium

12.6.2 The interaction of the Proposed Development on the key receptors identified in the baseline assessment have been considered, as have the impacts considered in the absence of mitigation measures. Based on the matrix in Table 12.3, the significance of potential impacts were assessed.

12.6.3 Any impacts will occur in two stages – the construction stage and the post-completion stage, defined as follows:

- Construction stage impacts are those relating to works and plant operations during the construction phases of the Proposed Development, most construction phase impacts are likely to be short term; and
- Post-Completion stage impacts are those relating to the operations of the development itself such as increased impermeable areas and anthropogenic impacts. Most post-completion stage impacts are likely to be long term.

Construction Stage

12.6.4 The construction stage of the Proposed Development will present short-term impact upon water quality and water availability in surface water and groundwater receptors.

Surface Water Quality

12.6.5 Potential impacts and associated activities are as follows:

- Mobilisation of sediment into surface water receptors through runoff from the Site following exposure of bare ground, earth movement and run-off from construction access tracks within the Site;
- Mobilisation of nitrate-rich sediment, a result of previous agricultural activities, into surface water receptors;
- Pollution due to vandalism of stores or plant;
- Inappropriate storage of materials and chemicals/fuels and wastes such as on permeable surfaces, adjacent to watercourses or without sufficient bunding capacity;
- Accidental spillages of fuels and polluting materials;
- Creation of preferential pathways via piling operations, drainage schemes and services corridors; and
- Pumping of silt-laden surface water or groundwater accumulated on the application Site or via de-watering directly into controlled waters.

12.6.6 Without mitigation the risk of such events occurring is high, with the magnitude dependent upon the location, quantities of contaminant or sediment released and the sensitivity of the receiving watercourse. As a worst case, the magnitude of impact would be major, if no mitigation was proposed. The receiving watercourse would be the ditch/minor watercourse – a receptor of low sensitivity, with impacts unlikely to effect the high sensitivity Sor Brook due to the reservoir sufficiently slowing flows to allow suspended sediment to settle out prior to reaching the brook. Based on the matrix in Table 12.3, this would result in an overall minor significant impact, if no mitigation was proposed.

Surface Water Flows and Availability

12.6.7 Activities with the potential to cause impacts on surface water flows are as follows:

- Earth movement causing depressions or bunding effects, causing ponding, reducing runoff and ultimately flow to surface water receptors; and
- Removal of crop cover and vegetation will expose topsoil leading to increased ponding and water logging. However during more severe rainfall events, overland flow is likely to occur in greater quantities. The flood risk is discussed further in the FRA in **Appendix 12.1**.

12.6.8 The receiving water course will be the ditch/minor watercourse, and as a worst case the magnitude of the impact will be major. Therefore based on the matrix in Table 12.3 this would result in an overall minor significant impact, if no mitigation was proposed. The ditch/minor watercourse is not considered as significant source of flow in the Sor Brook, therefore there is likely to be no impact upon the brook.

Groundwater Quality

12.6.9 Activities with the potential to impact upon groundwater quality are as follows:

- Inappropriate storage of materials and chemicals/fuels and wastes such as on permeable surfaces or without sufficient bunding capacity, resulting in the leakage of such materials; and
- Accidental spillages of fuels and polluting materials.

12.6.10 Any impact would be upon a Secondary A aquifer of medium sensitivity, with the magnitude of such impact major as a worst case. Therefore the magnitude of impact, with no mitigation would be moderate based on Table 12.3.

Groundwater Levels/Flows

12.6.11 Activities with the potential to cause impacts on groundwater levels and flows are as follows:

- Construction dewatering may be required for any excavations extending below water table which may have the potential to reduce the water available for abstraction and the provision of base flows to local watercourses. As discussed in Section 12.4.17 groundwater may be encountered in the Marlstone Rock Formation within 3m of surface and excavation below this depth may require dewatering ; and
- Excavation and ground profiling at the application Site could potentially affect the hydrogeology of the underlying bedrock and Secondary A aquifer, affecting the hydraulic continuity between ground and surface water receptors and the water supply to local groundwater abstractors. Any major ground reprofiling may result in groundwater flows being interrupted causing localised flooding and low levels elsewhere. This also applies to the construction of uninterrupted foundations which can act as a physical barrier to the conveyance of groundwater.

12.6.12 There have been no investigations into the depth of groundwater at the Site and it is therefore unknown, however any impact will be on a Secondary A aquifer – a receptor of **medium sensitivity**. The magnitude of any impact is likely to be **moderate**, resulting in a **moderate significant impact**, if no mitigation was proposed.

Post-Completion Stage

12.6.13 Post-completion stage impacts are those occurring following the completion of the development. The magnitude of any impacts is difficult to quantify due to the timescales over which they may occur and the ability of the environment to adapt to future changes. There is potential for impacts upon the quality and availability of water in surface water and groundwater receptors.

12.6.14 The development site is currently a greenfield site with no hard surfacing, however, the proposed development will result in an increase in the impermeable area of the site, which could result in increased surface water runoff rates and volumes. Mitigation measures, however, to ensure that flood risk is not increased will be implemented. This will include surface water management to restrict runoff rates from the proposed development to pre-development rates. In the first instance, it is proposed that surface water runoff from the development will be discharged to ground using infiltration based Sustainable Drainage

(SuDS) methods. This, however, will be subject to suitable ground conditions, which will be confirmed at detailed design stages. Should ground conditions prove to be unsuitable for infiltration, surface water will be restricted and discharged to nearby local watercourses at a rate equivalent to the pre-development runoff rate of 2 litres/second/hectare, which has been confirmed as acceptable by the Environment Agency. Any flows in excess of this will be attenuated on site for events up to and including the 1 in 100 year event, including an allowance for climate change.

12.6.15 The calculation for greenfield runoff and the Environment Agency's acceptability for pre-development rates of 2 litres/second/hectare are documented within Section 4.3 'Flood Risk Mitigation Measures' of the FRA.

On Site flooding

12.6.16 Various measures to account for the residual flood risk are described within Section 4.5 'Residual Risk' of the FRA.

Surface Water Quality

12.6.17 Changes to the drainage regime at the Site may result in preferential pathways for the movement of potential contaminants and pollutants at the Site. New sources, or the increased significance of existing sources of potential contaminants, may also occur and may include:

- Sediment within surface water runoff;
- Contaminants from vehicle movements within the Site – such as pollutants within the runoff from hard standing areas such as roads and parking areas
- Accidental spillages; and
- Discharge of wastes, chemicals or foul water to surface water sewer drains.

12.6.18 There is a potential for these contaminants to enter the proposed installed surface water drainage system, discharging to the Sustainable Drainage Systems (SuDS) features within the Site, to the receiving watercourse/ ditch system and ultimately to the Sor Brook. Over time this could have the potential to degrade the surface water receptors.

12.6.19 The magnitude of this adverse impact would be **minor** on the local ditch, resulting in a **minor significant effect.** However, a major pollution event could cause the long term degradation of local water quality and would have a **major impact** on downstream surface water abstractors and the Sor Brook itself – a receptor of **high sensitivity**. Any impacts of this would result in an impact of **major significance** without mitigation.

12.6.20 The current land use of the Site is agriculture which is the predominant source of nutrients such as phosphates and nitrates which can lead to deterioration in water quality of either receiving watercourses. The removal of the application Site from agricultural production will reduce the level of agricultural chemicals discharged into the ditch/minor watercourse. This would have a beneficial effect on the ditch/minor watercourse system. This beneficial impact is likely to be negligible for the Sor Brook due to the size of its contributing catchment and surrounding agricultural land use.

12.6.21 It is proposed that the existing ditch along the southern boundary of the Site be incorporated into the sustainable surface water drainage of the development. Proposals include the ditch being extended and enhanced to improve the water quality of surface water runoff, giving a beneficial impact upon surface water.

Surface Water Flows and Availability

12.6.22 The increase in impermeable area will result in increased surface water runoff to surface water receptors. The risk of flooding is detailed further in Section 4.0 of the FRA.

12.6.23 The receiving water course will be the ditch/minor watercourse, and as a worst case the magnitude of the impact will be major. Therefore based on the matrix in Table 12.3 this would result in an overall minor significant impact. The ditch/minor watercourse is not considered as significant source of flow in the Sor Brook, therefore there is likely to be no impact upon the brook.

12.6.24 The proposed mixed use development could potentially significantly increase pressure on local water resources classed as being highly sensitive to abstraction and located within an area classified as 'No Water Available' by the EA.

12.6.25 This is based on the assumption that the development will be supplied by water from local sources, such as the Sor Brook. An increase in water abstracted from such resources wouldhave a **major impact** on resources of **high sensitivity** such as the Sor Brook resulting in an effect of **major significant impact**.

12.6.26 The Thames Water Water Resources Management Plan4 outlines a "Preferred Supply Demand Plan" for the Swindon and Oxfordshire (SWOX) WRZ to address the supply-demand deficit referred to in para 12.5.420. Along with other measures such as the installation of water meters in houses and revised tariffs to promote behavioural changes, the plan proposes the transfer of water from the Slough/Wycombe/Aylesbury (SWA) WRZ to balance supply and demand between the zones. The SWA WRZ is not predicted to be in deficit during dry years until 2035. If the plan sufficiently caters for future requirement in the SWOX WRZ, the impact of the Proposed Development on a high value water resource will be negligible. This would result in an effect of **negligible**.

Groundwater Quality

12.6.27 Changes to the drainage regime at the Site may result in preferential pathways for the movement of potential contaminants and pollutants at the Site. New sources, or the increased significance of existing sources of potential contaminants, may also occur and may include:

- Contaminants from vehicle movements within the Site – such as pollutants within the runoff from hard standing areas such as roads and parking areas
- Accidental spillages; and

- Discharge of wastes and chemicals to groundwater.

12.6.28 Any impact would be upon a Secondary A aquifer of **medium sensitivity**, with the magnitude of such impact **major** as a worst case. Therefore the magnitude of impact would be **moderate** based on **Error! Reference source not found.**.

Groundwater Levels

12.6.29 The increase in impermeable area is likely to cause increased runoff and so reduced groundwater recharge. Any impact will be on a Secondary A aquifer – a receptor of **medium sensitivity**. The magnitude of any impact is likely to be **moderate**, resulting in a **moderate significant impact**.

Summary of Impacts Upon Water Environment Receptors

12.6.30 Table 12.8 summarises the impacts of the proposed construction and post-completion activities upon identified surface water receptors, unmitigated.

Table 12.8: Impacts of Proposed Construction and Post-Completion Activities

Description of impact	Geographical level of importance of issue					Impact Beneficial / Adverse	Nature St / Lt /	Significance Major / minor / negligible
	I	N	R	D	L			
Construction Stage								
Sediment pollution from construction activities					✓	Adverse	St	Minor (surface water) Moderate (groundwater)
Release of contaminating materials during construction					✓	Adverse	St	Minor (surface water) Moderate (groundwater)
Increased overland flow increasing flood risk within the Site during construction					✓	Adverse	St	Minor (surface water) Moderate (groundwater)
Post-Completion Stage								

Description of impact	**Geographical level of importance of issue**					**Impact Beneficial / Adverse**	**Nature St / Lt /**	**Significance Major / minor / negligible**
	I	**N**	**R**	**D**	**L**			
Polluting materials from the development (i.e. vehicles movements etc)					✓	Adverse	Lt	Major (surface water) Moderate (groundwater)
Decreased input of nutrients as land no longer used for agriculture					✓	Beneficial	Lt	Minor
Creation of Preferential pathways and derogation of water quality					✓	Adverse	Lt	Major (surface water) Moderate (groundwater)
Increase pressure on limited water resource if sourced locally				✓		Adverse	Lt	Minor (surface water) Negligible (groundwater)
Creation of new ditch/watercourse					✓	Beneficial	Lt	Minor

Key: I = International. N = National. R = Regional. D = District. L = Local.

St = Short term. Lt = Long Term.

12.7 MITIGATION MEASURES

Construction Stage

12.7.1 To protect water quality during construction, the Construction Environmental Management Plan (CEMP) will incorporate, as appropriate, the water pollution prevention measures set out in the Environment Agency's Pollution Prevention Guidelines (PPG) and will set out an emergency response plan in the case of a pollution incident. The guidelines relating to the Proposed Development include:

- EA PPG01: General guide to the prevention of pollution;
- EA PPG02: Above ground oil storage tanks;
- EA PPG03: The use and design of oil separators; surface water drainage systems;
- EA PPG05: Works and maintenance in or near water;
- EA PPG06: Working at construction and demolition sites;
- EA PPG08: Safe storage and disposal of used oil;
- EA PPG13: Vehicle washing and cleaning;
- EA PPG18: Managing firewater and major spillages;
- EA PPG20: Dewatering underground ducts and chambers;
- EA PPG21: Pollution incident and response planning;
- EA PPG22: Incident response- dealing with spills;
- EA PPG 26: Drums and intermediate bulk containers (containing oil, chemicals or potentially polluting substances).

12.7.2 This list of guidelines is not exhaustive and the CEMP will also accord, as appropriate, with the CIRIA guidance documents, including 'Report 156: Control of water pollution from construction sites – a guide to good practice', which provides additional detail on reducing the impact of construction works on the water environment. Other relevant CIRIA reports include C522, C523 and C532.

12.7.3 The CEMP will define the pollution prevention methods for preventing entry of contaminants into water bodies.

12.7.4 The following mitigation measures will also be addressed, as appropriate, as part of the CEMP and construction contract documents to ensure that good practice is adopted:

- High risk activities will be undertaken away from sensitive receptors (i.e. watercourses and connections to surface water sewers), where practicable (e.g. re-fuelling area). Any drainage within a refuelling area will incorporate an isolation facility such that the outlet could be sealed in the event of a spill;
- An emergency spillage response plan will be produced, including location and types of spill kits and will also provide a full list of protocols and communications channels with the Environment Agency in the event of an accidental pollution incident;
- Appropriate equipment such as booms and absorption mats will be made available and easily accessible for the event of an accidental spillage or pollution incident;
- Site signage will be erected showing who to contact in the event of a spillage or emergency;
- Monitoring of works areas to identify spills or possible leaks will be undertaken daily;
- Bunded compounds for storage of fuel, refuelling and handling of chemicals will comply with current regulations for the safe storage of fuels, lubricants and other chemicals and will be sited to prevent leakage;
- Plant used during the works will be modern, inspected as suitable for use appropriately on Site, inspected daily for leaks and damage, and stored overnight in fuelling areas away from excavations or drainage;
- Drip trays will be used beneath all static plant or semi-static plant to prevent leakage and these will be checked daily and emptied of rainwater as hazardous waste;
- All construction-stage routine maintenance of vehicles and machinery will be conducted off site and post-completion stage maintenance work will be conducted in areas designed to prevent the pollution of surface waters;
- There will be appropriate designation of site parking and delivery waiting areas to minimise the potential for contamination of receiving surface waters by uncontrolled releases (i.e. leaks and drips);
- There will be protocols for vehicle washing activities and wash water management;
- The Site will be appropriately secured and monitored to prevent vandalism;
- Development of an erosion and sediment control plan, or drain isolation, will consider the management of stock piles to limit runoff and potential pollution and minimise the movement of materials around the construction site (i.e. minimise double-handling);

- Any de-watering works will be appropriately managed to prevent entry of contaminants into surface waters and surface water sewers and any de-watered waters will be appropriately handled and disposed of. Sediment-laden waters will be pre-treated (settled) to remove suspended sediment prior to discharge. Pumped water will be disposed of to grassed land or into an infiltration/settlement basin. Offline settling tanks or settling basin may need to be installed for some of the works; and
- Any temporary discharges to ordinary watercourse or sewer will be appropriately consented and approved by the Lead Local Flood Authority or the sewerage undertaker. Water will be pump-returned to the watercourse at a slow rate or the energy of water dissipated to avoid disturbing and eroding the channel bed.

Post-Completion Stage

12.7.5 Many of the long term potential impacts a development can impose on the water environment can be avoided or prevented through the implementation of effective and sustainable project design proposals, these include:

- Provision of a storm water SuDS management system; to include permeable paving, detention and conveyance features;
- Connection to a point of adequacy on the foul water drainage network;
- Management Train approach of pre-treatment prior to discharge into the water course;
- Provision of ongoing maintenance for SuDS features, ordinary watercourse and existing artificial water bodies; and
- Adoption and associated ongoing maintenance of development storm and foul drainage system.

12.8 RESIDUAL EFFECTS

Construction Stage

12.8.1 The assessments reported above do not identify any significant adverse residual effects.

Post-Completion Stage

Water Flows

12.8.2 Surface water runoff will be generated at both an increased rate and volume than occurs at present due to an increase in the area of impermeable surface within the application Site. Groundwater recharge may be reduced as a result.

12.8.3 A Drainage Strategy and FRA to manage increased runoff and reduced recharge are included in Appendix 12.1. With this adhered to any residual impact will be **negligible**.

12.8.4 Excessive pressure on water resources and derogation of surface flows will not occur as a result of EA strategies to limit abstraction – the 'hands off' flow condition, described in Section para 12.5.2. Planning by Thames Water will also reduce the impact of Site upon water resources. With these measures employed, the resulting residual impact will be **negligible.**

Surface Water Quality

12.8.5 The prevention or mitigation of the creation of preferential pathways is difficult to achieve as this is an inevitable persistent long term impact associated with any urban development and long term anthropogenic use.

12.8.6 Mitigation of this impact may be offered in the form of increasing public awareness of potential domestic pollution sources and changing and improving public behaviour. However such changes in public behaviour and culture are often difficult to introduce and slow to take effect unless some form of enforcement or penalty system is introduced.

This impact however could be further mitigated by ensuring the development incorporates SuDS treatment before surface water is discharged off site. If such mitigation measures are employed as part of the development then the resulting residual impact will be **negligible**.

Summary of effects

12.8.7 The effects identified are summaries in Table 12.9 below.

TABLE 12.9: Summary of residual effects following Mitigation processes.

Potential effect	Significance (pre-mitigation)	Mitigation measure	Significance of residual effect
Construction stage			
Sediment pollution from construction activities	Minor (surface water) Moderate (groundwater)	The CEMP will limit runoff and potential pollution. Any sediment-laden waters will be pre-treated (settled) to remove suspended sediment prior to discharge.	Minor
Release of contaminating materials during construction	Minor (surface water) Moderate (groundwater)	Any water from de-watering works will be appropriately handled and disposed of. Various measurers will be implemented to protect against any possible spills, such as the provision of an isolation facility which can be sealed in the event of a spill; an emergency spillage response plan; appropriate equipment be available in the event of an accidental spillage or pollution incident; suitable signage, monitoring, maintenance and vehicle washing also be undertaken.	Minor
Increased overland flow increasing flood risk within the Site during construction	Minor (surface water) Moderate (groundwater)	Any temporary discharges to ordinary watercourse or sewer will be appropriately consented and approved by the Lead Local Flood Authority or the sewerage undertaker.	Minor
Post-completion stage			
Polluting materials from the development (i.e. vehicles	Major (surface water) Moderate	Various measurers will be implemented to protect against any possible spills, such as the provision of an isolation facility which can	Minor

Potential effect	Significance (pre-mitigation)	Mitigation measure	Significance of residual effect
movements etc.)	(groundwater)	be sealed in the event of a spill; an emergency spillage response plan; appropriate equipment be available in the event of an accidental spillage or pollution incident; suitable signage, monitoring, maintenance and vehicle washing also be undertaken.	
Decreased input of nutrients as land no longer used for agriculture	Minor	None required	Minor
Creation of Preferential pathways and derogation of water quality	Major (surface water) Moderate (groundwater)	Use of SUDS will control water pathways.	Minor
Increase pressure on limited water resource if sourced locally	Minor (surface water)	None required	Minor
Creation of new ditch/watercourse	Minor	Any temporary discharges to ordinary watercourse or sewer will be appropriately consented and approved by the Lead Local Flood Authority or the sewerage undertaker. Water will be pump-returned to the watercourse at a slow rate or the energy of water dissipated to avoid disturbing and eroding the channel bed.	Minor

12.9 CUMULATIVE EFFECTS

12.9.1 Along with the proposed Wykham Park Farm development, an additional development "Land East of Bloxham Road" is consented on the north western boundary of Site. The proposal for up to 145 houses was submitted in January 2012[5] and outline planning permission was granted on 23rd September 2013.

12.9.2 The development of this scheme, along with that of Wykham Park Farm could have a significant "cumulative effect" relating to pressures on water resources and supply infrastructure. However, Thames Water have a responsibility to manage water resources effectively and strategic plans include water transfers from adjacent Water Resource Zones. If developed responsibly and in line with EA guidance any water transfers associated with these potential developments will have a negligible cumulative impact.

[5] "Planning Supporting Statement, Land East of Bloxham Road, Banbury" Savils (L&P) Ltd January 2012 (Application Number 12/00080/OUT)