

LINDHURST
MANSFIELD

9. WATER, HYDROLOGY, DRAINAGE AND FLOOD RISK

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9.0 WATER, HYDROLOGY, DRAINAGE AND FLOOD RISK

9.1 Introduction

9.1.1 This Chapter considers the effects of the proposed development on surface water and groundwater resources. The proposed development is detailed on the Framework Plan included as Figure 2.1. The assessment also considers the potential for flood risk associated with alterations in the surface water regime and from adjacent watercourses. Potential impacts during the construction period are also identified and assessed.

9.1.2 The Chapter describes the policy context and methods used to assess the proposed development. It reviews the Site's hydrology (including groundwater) and flood risk prior to development and the baseline conditions currently existing at the Site. The potential impacts of the proposed development are assessed, taking into account the measures which have been adopted to prevent, reduce, mitigate or offset the impacts. The significance of the residual effects is also presented.

9.1.3 Potential impacts to ground and surface water from existing ground conditions are assessed in Chapter 10: Land Contamination, whilst potential impacts on aquatic flora, fauna and protected sites are addressed in Chapter 6: Ecology Resources. This Chapter draws on the findings of a Flood Risk Assessment (FRA) and a Desk Study, August 2008 undertaken by Waterman Transport and Development Limited.

9.1.4 This Chapter has been written by Waterman Transport and Development Limited.

9.2 LEGISLATION AND PLANNING POLICY CONTEXT

Legislation

9.2.1 The principal statutes relating to protection of water resources in the context of the proposed Development are the Water Resources Act 1991 (Ref 9.1), the Groundwater Regulations 1998 (Ref. 9.2), the Water Industry Act 1991 (Ref. 9.3), the Water Framework Directive as implemented by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 (Ref 9.4); and the Water Quality (Water Supply) Regulations 1989, 2000 (Ref. 9.5).

The Water Resources Act (1991)

9.2.2 The Water Resources Act 1991 regulates water quality and quantity in England and Wales. Under Section 161 of the Act, the Environment Agency can serve an Anti-Pollution Works Order on a person or persons who cause, or knowingly permit, pollution of controlled waters (including both surface waters and groundwater). Consents to discharge to controlled waters are also applied for under this legislation.

9.2.3 In respect of land drainage and flood risk, the relevant parts of the Water Resources Act and the Land Drainage Byelaws are the requirement of consent from the Environment Agency for any works affecting, or within 16 metres (m) of any tidal flood defence structure.

9.2.4 In order to discharge surface run-off to a Main River or tidal water, land drainage consent is required for the outfall.

The Groundwater Regulations (1998)

9.2.5 The Groundwater Regulations 1998 aim to prevent entry of List I substances into groundwater and prevent groundwater pollution by List II substances as defined by the EU Groundwater Directive. The Act also places a duty on Planning Authorities to promote the sustainable use of water.

Water Industry Act (1991)

9.2.6 The Water Industry Act 1991 covers a wide-range of activities of the privatised water companies that were created in 1989. The main provisions relate to trade effluent discharges made to sewer for which water companies act as the regulatory authorities.

Water companies control the nature and composition of the effluent, the maximum daily volume allowed, the maximum flow rate and the sewer into which the effluent is discharged.

Water Environment (Water Framework Directive) (England and Wales) Regulations 2003

- 9.2.7 These regulations implement the EU Water Framework Directive and make provision for a framework for implementing water policy in river basin districts, and require a new strategic planning process to be established for managing, protecting and improving the quality of water resources. The Environment Agency must carry out detailed monitoring and analysis. Certain waters used for the abstraction of drinking water must be identified and a register established of those waters and certain other protected areas.

Water Quality (Water Supply) Regulations, 1989 and 2000

- 9.2.8 The 1989 Water Quality Regulations, superseded by the Water Supply (Water Quality) Regulations 2000 which were made in response to the introduction of European Drinking Water Directive (98/83/EC), set down statutory standards for drinking water quality and present legal requirements for water undertakers in the UK.
- 9.2.9 The standards are generally based on the 1993 World Health Organisation guidelines for drinking water quality. These guideline values represent the concentration of a constituent, such as Benzene or 1, 2-dichloroethane that does not result in any significant risk to the health of a consumer (over a lifetime of consumption). Maximum Admissible Concentrations are set down (these are also referred to as Prescribed Concentrations or Values) for the majority of these parameters. A small number have guidance levels which are not health related. Short-term deviations above the guideline value do not necessarily mean that the water is unsuitable for consumption.

National Planning Policy

Planning Policy Statement 25: Development and Flood Risk, 2006

- 9.2.10 Planning Policy Statement 25 (PPS 25) covers the potential for proposed development to be affected from flooding and also to increase flood risk elsewhere. This policy aims to reduce flood risk to people, developments and the natural environment and highlights the importance of planning in the management and reduction of flood risk.

9.2.11 PPS 25 advocates a risk-based approach, and states that a source – pathway - receptor model should be applied to planning for development in areas of flood risk. This requires:

- Avoiding the causes or “sources” of flood risk, by such means as avoiding inappropriate development in flood risk areas and minimising run-off from new development onto adjacent and other downstream property and into the river systems;
- Managing flood “pathways” to reduce the likelihood of flooding by ensuring that the design and location of the development maximises the use of sustainable drainage systems, the performance of river/coastal systems and flood defence infrastructure, and takes account of the likely routes and storage of floodwaters and places where it can influence flood risk downstream; and
- Reducing the consequences of flooding on the “receptors” (i.e. people, property and infrastructure) by avoiding inappropriate development in areas at high risk of flooding.

9.2.12 The PPS states that the overall aim of decision-makers should be to steer all new development to Flood Zone 1 (land assessed as having a less than 1 in 1000 chance of river and sea flooding in any year (<0.1%)).

Planning Policy Statement (PPS) 23: Planning and Pollution Control, 2004

9.2.13 Planning Policy Statement 23 (PPS 23) advises that any consideration of the quality of land, air or water and potential impacts arising from development, possibly leading to impacts on health, is capable of being a material planning consideration. The planning system plays a key role in determining the location of development which may give rise to pollution, either directly or indirectly, and in ensuring that other uses and developments are not, as far as possible, affected by major existing or potential sources of pollution.

Regional Planning Policy

East Midlands Regional Plan – March 2009

9.2.14 The East Midlands Regional Plan provides a broad development strategy for the East Midlands upto 2026, and provides the following regional policy priorities relevant to Flood Risk and Drainage:

- Policy 1 – Regional Core Objectives states “To reduce the impacts of climate change, in particular the risk of damage to life and property from flooding and sea level change and the decline in water quality and resources. New development should provide sustainable drainage and manage flood water.
- Policy 2 – Promoting Better Design states “new development should be continuously improved by providing sustainable drainage and managing flood water”.
- Policy 32 – A Regional Approach to Water Resources and Water Quality states “local authorities, developers, water companies, the Environment Agency and other relevant public bodies should work together to: use sustainable drainage techniques wherever practical to help mitigate diffuse pollution and support groundwater recharge”.
- Policy 35 – A Regional Approach to Managing Flood Risk “Development should not be permitted if, alone or in conjunction with other new development, it would:
 - Be at unacceptable risk from flooding or create such an unacceptable risk elsewhere;
 - Inhibit the capacity of the floodplain to store water;
 - Impede the flow of floodwater in a way which would create an unacceptable risk elsewhere;
 - Have a detrimental impact upon infiltration of rainfall to ground water storage;
 - Otherwise unacceptably increase flood risk; and
 - Interfere with coastal processes.

9.2.15 However, such development may be acceptable on the basis of conditions or agreements for adequate measures to mitigate the effects on the overall flood regime, including provision for the maintenance and enhancement of biodiversity, any such measures must accord with the flood management regime for that location.

9.2.16 The East Midlands Regional Flood Risk Appraisal, that informed the Regional Plan, recommends that where local SFRA's are available they should be used as the principal reference document.

Local Planning Policy

Mansfield District Council's Local Plan – 1998.

9.2.17 The Local Plan sets out a policy framework to guide and encourage development in the District whilst enhancing its environment in the period up to 2006.

9.2.18 The Local Plan is to be replaced by the Local Development Framework (LDF) over the next few years. Most of the policies in the Local Plan have been 'saved' until they are replaced by policies in the LDF. All 'unsaved' policies no longer form part of the development plan, including Policy U6 Developments in floodplains.

9.2.19 The Local Plan Chapter 9 – Utilities and Energy contains policies relevant to flood risk and drainage at the Site:

- Policy U1 - Energy consumption / efficiency.
- Policy U2 - Water supply / discharge.
- Policy U3 - Sewerage and sewage disposal.
- Policy U4 - Cordon sanitaires.
- Policy U5 - Water discharge and flooding.
- ~~Policy U6 – Developments in floodplains.~~

9.2.20 Mansfield District Council's Strategic Flood Risk Assessment June 2008 Technical Report and associated Guide for Planners and Developers aims to inform and advise prospective developers and planning applicants on the flood risk and biodiversity concerns within the Mansfield District.

Newark and Sherwood Local Plan – 1999

9.2.21 The Newark and Sherwood Local Plan sets out the District Council's policies and proposals for the future development of the District. The following policies are relevant to flood risk and drainage of the Site:

- Policy – PU2 Land Drainage and Surface Water Disposal states “Planning permission will not be granted for development which fails to make adequate provision for land drainage and surface water disposal.”
- Policy – PU4 Aquifer Protection states “Planning permission will not be granted for development proposals which could lead to the infiltration of harmful pollutants into groundwater or that will adversely affect groundwater movement. This restriction is particularly important to aquifers from which public water supplies are drawn.”
- Policy - PU5 Water Environment states “Planning permission will not be granted for development which could have an adverse effect on water quality and associated wildlife habitats”
- Policy – PU6 Sewerage and Sewage Treatment states “Planning permission will not be granted for development which fails to make adequate provision for sewerage and sewage treatment”

9.2.22 The Newark and Sherwood District Council Water Cycle Study document outlines the implications of delivering development and growth targets on water-related infrastructure and the wider water environment in the Newark and Sherwood area.

9.3 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

Assessment Methodology

9.3.1 Baseline conditions relating to the water resources and flood risk of the Site have been established using a combination of published information and site surveys. Main sources of information included:

- Environment Agency Web Pages;
- An Envirocheck Report from Landmark Information Group Ltd, see Volume 2 Appendix 10.1.
- Desk top study into ground conditions and geology conducted by Waterman Transport and Development Limited in August 2008; see Volume 2 Appendix 10.1.
- A Flood Risk Assessment and Drainage Strategy Report conducted by Waterman Transport and Development in September 2008; see Volume 2 Appendix 9A.
- A Topography Plan of the Site, see Figure 5.2.

9.3.2 The assessment of potential impacts of the proposed development on water resources has considered the following:

- Surface water resources
- Groundwater resources

9.3.3 The FRA undertaken followed the approach set out in PPS 25: Development and Flood Risk and examined:

- Site hydrology, hydrogeology and the drainage network;
- Potential sources of flooding;
- Impact of development on flood risk; and
- Mitigation measures to reduce flood risk to the proposed development and elsewhere.

9.3.4 The FRA is based on information received from the Environment Agency, Severn Trent Water, Mansfield District Council, Nottinghamshire County Council, a Site inspection, a topographical survey and the following references:

- Planning Policy Statement 25: Development and Flood Risk, (PPS25) 2006.
- Planning Policy Statement 25: Development and Flood Risk Practice Guide 2009.

- Building Act 1984. Building (amendment) regulations 2001 Part H
- Sewers for Adoption – a design and construction guide for developers 6th edition
- Mansfield District Council – Strategic Flood Risk Assessment June 2008: Technical Report and Guide for Planners and Developers.
- Newark & Sherwood District Council – Water Cycle Strategy September 2009;
- Ciria C697 – The SUDS Manual.
- The Manual of River Restoration Techniques

Significance Criteria

9.3.5 This assessment determines the relative significance of water resource issues and flood risk effects. The assessment of potential and residual effects/ risks has therefore used the following seven-point scale of significance which has been based upon professional judgement and experience:

Substantial Beneficial: Significant local-scale / moderate to significant regional scale improvement to the quality of potable groundwater, surface water resources or reduction in flood risk.

Moderate Beneficial: Moderate local-scale / minor regional improvement to the quality of potable groundwater or surface water resources or reduction in flood risk. Moderate improvement to the quality of groundwater or surface water resources used for commercial or industrial abstraction only.

Minor Beneficial: Minor local-scale improvement to the quality of potable groundwater or surface water resources or reduction in flood risk. Minor improvement to the quality of groundwater or surface water resources used for commercial or industrial abstraction only.

Negligible: No appreciable impact on groundwater, surface water resources or flood risk.

Minor Adverse: Minor local-scale reduction in the quality of potable groundwater or surface water resources of local, regional or national importance, reversible with time. Minor increase in flood risk. Reversible widespread reduction in the quality of groundwater or surface water resources used for commercial or industrial abstractions. Minor short term detrimental effect on animal or plant populations.

- 9.3.6 Moderate Adverse: Moderate local-scale / minor regional detrimental effect to human health and increase in flood risk. Severe temporary or permanent reduction in the quality of a potable groundwater or surface water resource of local, regional or national importance. Moderate or temporary detrimental effect on animal or plant populations.
- 9.3.7 Substantial Adverse: Moderate to severe detrimental effect to human health and increase in flood risk. Severe temporary or permanent reduction in the quality of a potable groundwater or surface water resource of local, regional or national importance. Moderate to severe local-scale change in flow of groundwater underneath the Site and/or modest changes in off-site groundwater flows. Permanent or severe temporary detrimental effect on animal or plant populations.

9.4 BASELINE CONDITIONS

Topography

- 9.4.1 The undulating Site, as shown on the Topography Plan included as Figure 5.2, generally slopes from the west, at approximately 140m and 154m AOD, down towards the south and east. At Boggs Cottages on Lindhurst Lane ground levels are at approximately 119m AOD. Land to the east of Lindhurst Lane, between the A617 and Old Newark Road is undulating between 115m and 125m AOD.
- 9.4.2 FoulEvil Brook flows in an easterly direction adjacent to the southern boundary of the Site with Harlow Wood and within the Site between Black Scotch Lane and Lindhurst Lane. Foulevil Brook leaves the Site at Boggs Cottages on Lindhurst Lane, and flows towards Rainworth Lakes further to the south east. Rainworth Lakes, including Bradder's Pond and L Lake, is a designated Site of Special Scientific Interest (SSSI) located approximately 1.5km to the south east of the Site.

Water Resources

Groundwater

- 9.4.3 The Environment Agency Groundwater Vulnerability Map, as shown in Figure 3 of Appendix 9A - The Flood Risk Assessment and Drainage Strategy Report, classifies the strata below the Site as a Major Aquifer with soils of high leaching potential.
- 9.4.4 The majority of the Site lies within the Total Catchment Groundwater Source Protection Zone (Zone III), as defined by the Environment Agency and as shown in Figure 2 of Appendix 9A - The Flood Risk Assessment and Drainage Strategy Report. However, the western extremity of the Site falls within the Outer Groundwater Source Protection Zone (Zone II) associated with Rushley Pumping Station.

Groundwater Abstractions

- 9.4.5 There are 3 groundwater abstraction licenses within the Site. Two are associated with boreholes at Firs Farm. The third licence (serial number 03/28/70/0111/G) is held by Severn Trent Water. This is for the purpose of abstracting water from a borehole into the Sherwood Sandstone aquifer and discharging it into the Foul Evil Brook for compensation during low flow periods.

9.4.6 Two groundwater abstractions were reported within the vicinity of the Site. These licenses relate to Rushley Pumping Station, located adjacent to the south west perimeter of the Site. They are for potable water supply and operated by Severn Trent Water Limited.

9.4.7 In addition, nine groundwater abstractions are located within 1 kilometre of the Site.

Table 9.1: Summary of Groundwater Abstractions associated with the Site and within the vicinity of the Site

Operator	Licence No., Version and date	Abstraction Type and Use	Location
Severn Trent Water Ltd	03/28/70/0111 Start: 28 th Nov 2006	Borehole Augmentation	On-site, north of site, 457210,359000.
TWA &AS Cundy Ltd	03/28/70/0082/1 Start 16 th Mar 2005	Borehole General Agriculture	On-site, Firs Farm, 455480,358410.
TWA &AS Cundy Ltd	03/28/70/0082 Start 04 th July 1996	Borehole General Agriculture	On-site, Firs Farm, 455480,358410.
Severn Trent Water Ltd	03/28/70/0069 Start: 21 st Aug 1989	Well (A) at Rushley pumping Station	Off-site, adjacent to south west perimeter of site.
Severn Trent Water Ltd	03/28/70/0069 Start: 21 st Aug 1989	Well (B) at Rushley pumping Station	Off-site, adjacent to south west perimeter of site.

Groundwater Discharges

9.4.8 There is one Environment Agency Discharge Consent within 500m from the site. The consent (reference WQ/72/1150/1) was issued on 04th May 1977, for the discharge of sewage effluent to groundwater from a detached dwelling.

Surface Water

9.4.9 The nearest surface water is the Foulevil Brook that flows in an easterly direction adjacent to the southern boundary of the Site towards Rainworth Lakes, approximately 1.5km to the south east of Boggs Cottages on Lindhurst Lane. Cauldwell Brook flows northwards, approximately 1.5km west of the Site. This joins the River Maun, a tributary of the River Trent, in the centre of Mansfield.

9.4.10 The Environment Agency publishes the results of regular water quality surveys of rivers and canals in England and Wales. Surface watercourses are classified in accordance with the General Quality Assessment (GQA) scheme. This scheme is based on both chemical and biological characteristics of a subject watercourse, monitored at regular sampling points. The chemical classification includes parameters such as chemical

and biochemical oxygen demand (COD/BOD), ammonia and dissolved oxygen. Biological parameters include species diversity and the abundance of pollution tolerant or sensitive species. However, the Environment Agency confirmed that the Foulevil brook is not in the GQA Network and therefore no water quality data was available for this Brook.

Surface Water Abstractions

- 9.4.11 There are no licensed surface water abstractions within the Site.

Surface Water Discharges

- 9.4.12 There are no active discharge consents to surface water within the Site. There were 2 discharge consents within a 250m radius of the Site. These related to discharges to the River Idle, a tributary of the River Maun. Both revoked in April 2000.

Pollution Incidents

- 9.4.13 There are two recorded pollution incidents to controlled waters relating to the Site. These have been categorised as minor incidents. There are two further recorded pollution incidents to controlled waters immediately adjacent to the Site. The first of these is a petrol spillage relating to a road traffic accident, on the 17th October 1996 on Blidworth lane, running along the eastern boundary of the Site. The second relates to the spillage of 200 gallons of transformer oil at Rushley Pumping Station, on the 4th March 1997, adjacent to the south west corner of the Site.

Table 9.2: Summary of Pollution Incidents to Controlled Waters associated with the Site

Pollutant	Incident ref., date and classification	Receiving Water	Location
Chemicals – 400 litres of Alkali substances	1800370 11 th October 1995. Minor incident	Watercourse	South eastern corner of Site.
Organic wastes – pig slurry	2801627 23 rd November 1996 Minor incident	Not Given	Firs Farm

Flood Risk

Risk from Fluvial Flooding

- 9.4.14 The Environment Agency's indicative floodplain map, as shown in Figure 4 of Appendix 9A - The Flood Risk Assessment and Drainage Strategy Report, indicates that the Site

is mainly within Flood Zone 1 an area with a low or less than 0.1% annual probability of flooding and lies outside the 1 in 1000 year floodplain.

- 9.4.15 The Environment Agency's indicative floodplain map also indicates that a narrow corridor of low lying ground following the line of the Foulevil Brook between Lindhurst Lane and Black Scotch Lane is affected by Flood Zones 2 & 3. Flood Zone 3 comprises land classified as an area with a high or greater than 1 in 100 (1%) annual probability of flooding. Flood Zone 2 comprises land classified as an area with a medium or between a 1 in 100 and 1 in 1000 (1%-0.1%) annual probability of fluvial flooding
- 9.4.16 The Environment Agency does not hold modelled flood level information for the Foulevil Brook or any of the surrounding watercourses.
- 9.4.17 The Environment Agency has no records of historic flooding at this location. This does not mean there has never been historic flooding in this location.

Risk from Groundwater Flooding

- 9.4.18 Groundwater is likely to be present within the permeable strata of the Nottingham Castle and Lenton Sandstone Formations of the Sherwood Sandstone Group at depth. BGS Borehole data suggests that the rest groundwater level is at a depth of approximately 25m in the central and eastern areas of the Site, with no water strike information available in the western area of the Site.
- 9.4.19 Environment Agency records associated with the Sherwood Sandstone indicate a relatively stable seasonal groundwater level, although a significant fall in levels over time is likely to have been caused by over abstraction. The over abstraction of the sandstone aquifer as identified in the Environment Agency's Idle and Torne CAMS may result in groundwater rebound. However, if abstraction rates were to subside in the future, the available information suggests that it is unlikely that such rebound will have a significant impact on the Mansfield area.

Risk from Sewerage Flooding

- 9.4.20 Existing public combined and surface water sewers cross the Site, just to the west of Lindhurst Lane, draining from Old Newark Road in a south easterly direction. A public foul water sewer crosses the Site, further to the west of Lindhurst Lane, draining from Old Newark Road in a south easterly direction.
- 9.4.21 STW have confirmed that both systems can be assumed to be running close to full capacity. The systems drain extensive residential and employment areas on the

southern outskirts of the urbanised areas of Mansfield, and their routes through the proposed development are indicated in the Mansfield District Council SFRA as being “indicative areas of concentrated run off”.

- 9.4.22 An existing highway drainage system associated with the A617 crosses within the Site. This consists of a system of carrier and filter drains, drainage ditches, and attenuation ponds that ultimately discharge flows to Foulevil Brook.

Risk from Overland Flow

- 9.4.23 The risk of surface water run off is generally associated with large areas of impermeable or low permeability surfaces. The likelihood and severity of surface run off is increased where topography tends to concentrate flows, such as natural valleys or at the base of hills. Even areas that are positively drained through the sewer network may be subject to a risk of surface run off if the sewer capacity is exceeded.
- 9.4.24 Given the topography to the eastern half of the Site falls to the south, and this combined with the flood risk associated with the existing sewers in Old Newark Road and crossing the Site, suggests that overland flow could pose a flood risk to the proposed development.

9.5 DESIGN

9.5.1 To minimise the potential environmental effects of the proposed development on water, hydrology, drainage and flood risk at the Site and surrounding area, the following specific measures are incorporated in the design:

- Implementation of a Sustainable Urban Drainage strategy (SUDS) to attenuate surface water discharges from the proposed development to the baseline site characteristics and to provide passive treatment of water quality to ensure no material deterioration of water quality in receiving bodies.
- Collection, conveyance, and treatment of foul water discharges generated by the proposed development.
- Design of the proposed development to comply with PPS25: Development and Flood Risk, including careful consideration of built development to accord with PPS25 flood compatibility recommendations in terms of land use.
- Design of the proposed development to meet with the objectives of the Mansfield District Council SFRA.

9.5.2 The proposed development has been designed to avoid significant adverse effects resulting during the operational and construction phases, and is detailed in section 9.6 – Assessment of Effects.

9.5.3 Cumulative Effects (i.e. the combined effect of more than one project) are also detailed in section 9.6 – Assessment of Effects, due to the fact that a potential college extension & employment development is proposed immediately to the west of the Site and a windfarm is proposed to the south east of the Site as shown on the Framework Plan included as Figure 2.1.

9.6 ASSESSMENT OF EFFECTS

Construction Effects

9.6.1 **Direct and Indirect contamination of surface water or ground water due to the mobilisation of soils, existing contamination and accidental spillages associated with construction.**

9.6.2 Proposed mitigation measures are summarised in this section. The detailed design of the mitigation measures would be informed by further development-specific ground investigation following granting of Outline Planning Permission.

9.6.3 These measures would be agreed in consultation with the Local Planning Authority and the Environment Agency:

- Monitoring of groundwater quality in the Sherwood Sandstone is required;
- Appropriate water discharge rates and volumes will be agreed with the Environment Agency prior to any dewatering taking place;
- Monitoring of surface waters is also required;
- Designing and implementing any piling strategy so as to avoid the creation of pollution pathways between any residual contamination which may be present in Made Ground or mobilisation of contamination in the Sherwood Sandstone and controlled waters. This should be developed in consultation with the Environment Agency with a foundation risk assessment completed, where appropriate;
- Chemical testing of groundwater on the site is currently being undertaken. The results of the testing and any potential groundwater contamination and proposed mitigation measures will be reported in a Phase II Site Investigation. The implementation of any mitigation measures recommended by the report and the removal any Made Ground during the development will result in a reduced risk of surface and groundwater pollution from the Site.

9.6.4 Throughout the construction works contractors would be required to comply with a Site specific Environmental Management Plan (EMP). The EMP would reflect relevant legislative requirements and best practice guidance of the relevant statutory authorities including the Environment Agency. The EMP would include for the implementation of:

- Careful siting and bunding of fuel storage facilities and any areas used for the storage of hazardous materials;
- Existing sewers and other services within the Site would be surveyed and demarcated for the avoidance of construction traffic routes and the potential for damage, for example the leakage of foul water flows. Existing ground levels along the route of services should not be altered.
- Managed demolition and removal of any tanks associated with farm buildings at Firs Farm.
- Management of the Site drainage to prevent sediment laden/contaminated runoff entering Foulevil Brook. Control measures given in the guidance from CIRIA and the Environment Agency;
- Best practise pollution prevention measures, in accordance with Environment Agency Guidance, to be detailed in the Environment Management Plan and implemented to isolate potential contaminants and prevent their release;
- All work would be completed in accordance with Environment Agency documents; PPG6 - Working at Construction and Demolition sites and PPG21 – Pollution Incident Response.
- All surface water run-off from hardstanding areas will pass through interceptors and be filtered or treated prior to discharge to controlled waters, subject to appropriate licensing by the Environment Agency;
- Provision for the safe disposal of waste waters including surface water and sewage. Monitoring undertaken prior to dewatering will be used to determine suitable disposal options under statutory licensing arrangements; and
- An emergency plan to be followed in the instance of any accidents involving spillages, flood, fire and contamination, including the notification of the Environment Agency.

9.6.5 Best practise pollution prevention measures, in accordance with Environment Agency Guidance and as detailed in the Environment Management Plan will be put in place to isolate potential contaminants and prevent their release. The proposals will result in short term temporary environmental effects assessed as **minor adverse**.

Direct flooding and changes to baseline drainage and hydrology due to construction related disturbances.

9.6.6 All existing flow routes across the Site and along the Foulevil Brook would be appropriately maintained throughout the construction works.

9.6.7 During the works proposed to Foulevil brook, consisting of new headwalls and reprofiling of the brook, there is the potential for increased flood risk due to impedance

of flows. Where a temporary diversion of the watercourse is proposed, the contractor should implement an alternative flow route, as close to the source as possible, which will be designed to have no lesser capacity than the original brook. The proposals for such diversions shall be agreed with the Environment Agency and implemented in the shortest possible time to progress the works.

- 9.6.8 Limit working activities and storage of materials to areas outside the 1 in 100 year floodplain unless for essential construction works to the watercourse.
- 9.6.9 Borehole data suggests that the rest groundwater level is at a depth of approximately 25m in the central and eastern areas of the Site, with no water strike information available in the western area of the Site. The proposed earthworks do not include any deep areas of cut, therefore interaction with the regional groundwater is unlikely. However, perched water was encountered in as part of the recent Site Investigation at one of the trial pits in the centre of the Site at a depth of approximately 3.5m. This water is thought to be localised, however, there is a potential for some seepage into excavations.
- 9.6.10 Any proposed dewatering will be designed to have no material effect on potential receptors.
- 9.6.11 Temporary storage of materials and excavation of borrow pits or the like in areas that may affect drainage flow paths will not be permitted
- 9.6.12 Temporary site drainage associated with earthworks, construction traffic routes and temporary car parks all have the potential to give rise to changes in surface water run-off regimes, including peak flows and low flows. With the adoption of best practice construction techniques, it is considered that the increased flood risk would be low. Temporary site drainage proposals, including discharge locations and flow rates, will be agreed with the Environment Agency.
- 9.6.13 Existing sewers within the Site would be surveyed and demarcated for the avoidance of construction traffic routes and the potential for damage causing surcharging due to collapse or blockage. Existing ground levels along the route of the sewers should not be altered. Temporary or permanent diversion of flows would be agreed with the relevant authorities.
- 9.6.14 Implementation of appropriate working practices will ensure that negligible environmental effects will result in terms of flooding and baseline drainage and hydrology due to construction activities.

Operational Effects

Direct contamination or deterioration of surface water or ground water quality due to leakages, general spillages and other contaminants from within the proposed development, and the associated collection of surface water drainage from hard surfaced areas.

- 9.6.15 In assessing the environmental effect of the proposed development in terms of contamination of water, hydrology and drainage, Chapter 10 – Land Contamination considers the sources, pathways and receptors for contamination. Of prime concern are the receptors Foulevil Brook and Rainworth Lakes SSSI, and the Sherwood Sandstone major aquifer.
- 9.6.16 Water quality across the catchment has been, and will continue to be, improved in time through the implementation of various guidance and national objectives. Accordingly, to avoid potential effects, surface water discharged from the proposed development will be treated to improve water quality prior to discharge from the site.
- 9.6.17 Direct contamination of surface and ground water may arise from accidental spillages of chemicals, sometimes used in commercial and industrial development. Such spillages can result in major pollution incidents. Protection of the environment through the usage of chemicals in industry is rigorously defended through much environmental legislation, requiring statutory registration of such use and implementation of appropriate means of control. In such circumstances, products that present the most risk are controlled with measures such as double lined tanks, bunded areas and protected cells. To protect the immediate ground and surface water adjacent to such installations, it is normal to provide fully hard covered areas discharging to drainage systems that provide for emergency isolation of such spillage. Where such installations are proposed at the site, the full protection of the ground and surface water environment will be ensured through appropriate installations. The volumes of chemicals stored in development areas being of residential end usage represent no material pollution risk as long as the proposed development follows normal good practice in the design of site drainage systems.
- 9.6.18 Nonetheless, surface water run-off from development sites routinely contains a series of contaminants, including petrochemical compounds, heavy metals and suspended solids, being predominant in industrial service yards and large car parks. In residential development the small volumes of fuels and oil washed from cars represents a far lower pollution risk to surface and ground water quality. The direct discharge of

development drainage to adjacent watercourses potentially leads to a degradation of water quality with associated ecological effects.

- 9.6.19 To minimise the risk of silts, chemicals and oil products being conveyed to surface and ground water, it is proposed to implement measures from current best practice surface water management guidance. All service yards, parking areas, roadways and garaging within the proposed development will have hard paved surfaces to avoid the direct spillage of materials to ground. Water discharged from such areas will be collected efficiently and receive passive treatment to improve water quality as part of a sustainable urban drainage system before discharge to any watercourse. The system for the collection, conveyance, treatment and disposal of surface water will be designed in accordance with latest recommendations to avoid the risk of leaching potentially contaminated materials to the soil and ground water. This approach is recommended in the Environment Agency Pollution Prevention Guidelines.
- 9.6.20 Preliminary drainage proposals also maximise direct discharge into Foulevil Brook where possible, rather than the use of infiltration SUDS, thus reducing the potential impacts on local groundwaters. The groundwater table is thought to be approximately 25mbgl and at a such depth that contaminants entering from the surface will have undergone a high degree of degradation by the time they reach the water table.
- 9.6.21 The preliminary drainage proposals contained in Appendix 9A - The Flood Risk Assessment and Drainage Strategy Report demonstrate compliance with current guidance in providing appropriate sustainable drainage features in passively treating water prior to discharge to receiving watercourses. Attenuation ponds and wetlands planted with purifying plants would be prioritised within the SUDS strategy, and as well as providing passive treatment would also act as pollution prevention facilities able to isolate any spillages before reaching the Foulevil Brook.
- 9.6.22 Guidance published in CIRIA 697 - The SUDS Manual recommends that roof water from development have at least one stage of treatment through an appropriately sized sustainable drainage feature. Two levels of treatment are recommended for residential roads, parking areas and commercial areas. In any higher polluting areas, at least three stages of treatment are recommended. For larger sites, with a receiving watercourse of high sensitivity, an increased number of treatment stages will be required, and generally a large catchment should be split into sub-catchments and several treatment features incorporated prior to final discharge.
- 9.6.23 CIRIA 697 states that the incorporation of a treatment train as part of a sustainable urban drainage system provides the most effective method of removing polluting materials from surface water run-off. Removal of between 80-95% of the suspended

solids, heavy metals and oils can be achieved. Corresponding reductions in Chemical oxygen demand (COD) and Biological oxygen demand (BOD) can also be achieved.

9.6.24 As a result of the planned implementation of sustainable drainage techniques, the environmental effect on surface and ground water quality is assessed as **negligible**.

9.6.25 Regulatory control of other development within the catchment to dictate that equivalent mechanisms are implemented at site level will ensure that potential cumulative environmental effects are **negligible**.

Direct flooding of the proposed development due to inadequate flood resilience in design

9.6.26 Potential flood risks are discussed in Appendix 9A - The Flood Risk Assessment and Drainage Strategy Report, and are assessed as

- fluvial flooding from Foulevil Brook,
- pluvial flooding from existing drainage systems, where sewer capacity is exceeded by rainfall events
- overland flow of surface run off from existing impermeable areas

9.6.27 Fluvial flooding to Foulevil Brook is limited to a narrow corridor of low lying ground between Lindhurst Lane and Black Scotch Lane. All built development and construction activities would take place wholly outside the 1 in 100 and 1 in 1000 year floodplains. Detailed development proposals for land adjacent to the Foulevil Brook, would make provision for finished plateau levels of 600mm minimum above the 1 in 100 year +20% flood level. The Flood Risk Assessment demonstrates the proposed development is able to comply with PPS25: Development and Flood Risk, and as a result the environmental effect is assessed as **negligible**.

9.6.28 Pluvial flooding from existing drainage systems and overland flow of surface run off would be considered as part of the detailed development proposals. Providing defined routes through the proposed development to convey any sewer flooding or overland flows away from buildings, as well as setting all adjacent building floor slab levels sufficiently above the level of these overland flow routes would be implemented along with other associated recommendations.

9.6.29 Drainage strategies for the development as detailed in Appendix 9A - The Flood Risk Assessment and Drainage Strategy Report would not exacerbate pluvial flooding from

existing drainage systems. Drainage strategies are to be agreed with Severn Trent Water Ltd.

9.6.30 It is considered the proposed development will have **negligible** environmental effect through adequate design of proposed infrastructure and through consultation with Severn Trent Water to show that the proposed development has no detrimental effects on their existing sewerage network.

9.6.31 Negligible cumulative effects will result from the flood resilience measures that are to be implemented as part of the proposed development.

Direct and indirect flooding of watercourses, the wider catchment, adjacent land and property due to increases in surface water run off from positively drained hard surfaced areas.

9.6.32 Hydrological effects in terms of flooding and the like arise from changes in the catchment drainage characteristics. Urbanisation of a catchment can increase peak surface water discharges due to accelerated run off and reduced times of concentration associated with hard surfaced areas, with a resulting increase in flood risk.

9.6.33 To minimise the effect of the proposed development on the baseline hydrological characteristics, the site drainage provision would be designed to reflect the requirements of PPS25 - "surface water arising from a developed site should, as far as practical, be managed in a sustainable manner to mimic the surface water flows arising from the undeveloped site".

9.6.34 A surface water drainage strategy to mitigate the potential environmental effects of the proposed development is detailed in Appendix 9A - The Flood Risk Assessment and Drainage Strategy Report.

9.6.35 The Environment Agency's requirements are that there should be no increase in the rate of runoff emanating from the development site up to a 1 in 100 year (+ allowance for climate change) return period, than that from the existing site. The proposed development will incorporate a new site drainage system, remote from the existing sewers crossing the Site.

9.6.36 Main sewerage infrastructure would be designed and constructed in accordance with the adoptable requirements of Sewer for Adoption 6th Edition.

9.6.37 The proposed development would incorporate a new highway drainage system, remote from the existing A617 system crossing the Site.

- 9.6.38 The Mansfield District Council SFRA, recommends that where direct discharge into Rainworth Water is possible, then use of infiltration SUDS should be discouraged in order to maximise the volume of water discharging into Foulevil Brook, albeit at controlled rates. In such situations, discharge up to the peak run-off rate from the existing site during a 1 in 2 year return period rainfall event could be permitted, with run-off from events in excess of the 1 in 2 year event attenuated and controlled to prevent an increased risk of fluvial flooding. Non infiltration SUDS such as lined swales, drainage ditches, attenuation ponds and wetlands would be acceptable.
- 9.6.39 The restoration of flows and the extension of Foulevil Brook upstream of Boggs Cottages has a number of biodiversity benefits including habitat creation and enhancement, water quality and public amenity.
- 9.6.40 The preferred method of reducing surface water run-off lies with the implementation of a range of SUDS which aim to reduce and attenuate the amount of run-off as close to the source as possible. Mansfield District Council recommends that Green SUDS are prioritised within the proposed development to provide a notable ecological benefit through the creation of wildlife habitats, the use of subsurface devices are discouraged in favour of retention ponds and wetlands and to a lesser extent infiltration basins and swales. Retention ponds and wetlands would form an integral part of the surface water management proposals providing attenuation of flows during periods of high rainfall, and with careful design the opportunities for creation of new habitats for flora and fauna.
- 9.6.41 It is anticipated that the SUDS features would be adopted and maintained by the Local Authority as part of the public open spaces within the proposed development, although alternative private management may be employed where the Local Authority are unable to fulfil this role.
- 9.6.42 In maintaining the baseline hydrological conditions with no increase in flows discharged from the proposed development, surface water drainage proposals will not exacerbate flood risk at the site or elsewhere within the catchment. In addition to this and as a result of the biodiversity benefits to Foulevil Brook and Rainworth Lakes and the amenity benefits of the introduction of Green SUDS within the proposed development, the environmental impact is assessed as **minor beneficial**.
- 9.6.43 It is anticipated that regulatory control will ensure that developments within the Foulevil Brook catchment will be required to implement similar sustainable drainage measures, that will ensure that potential cumulative effects are **negligible**.

Direct contamination of surface water or ground water and soil due to surcharging of the foul water network or the discharge of untreated foul flows.

- 9.6.44 When assessing potential effects of the foul water drainage system, it is important that the proposed system is designed to convey foul water discharges from the site to a suitable treatment facility, without overloading the existing sewerage systems. Furthermore, the treatment facility must have capacity to accommodate flows generated by the proposed development and achieve discharge quality that does not impact on water quality standards in receiving watercourses. Accordingly the sewerage undertaker, Severn Trent Water, have been consulted regarding the effects of the proposed development on their existing sewerage network and treatment facilities.
- 9.6.45 A foul water drainage strategy to mitigate the potential environmental effects of the proposed development is detailed in Appendix 9A - The Flood Risk Assessment and Drainage Strategy Report. The strategy proposes that a network of foul water sewers will collect discharges from the various development areas and drain to a proposed pumping station located on Lindhurst Lane, immediately to the south of the A617 Sherwood Way.
- 9.6.46 Main sewerage infrastructure would be designed and constructed in accordance with the adoptable requirements of Sewer for Adoption 6th Edition. The pumping station would also be designed in accordance with the adoptable requirements of Sewer for Adoption 6th Edition including a duty/ standby pump arrangement with requisite emergency storage provision in cases of power or pump failure.
- 9.6.47 Severn Trent Water have confirmed that the existing public combined and foul water drainage systems in the vicinity of the Site do not have adequate capacity to cater for flows generated by the proposed development.
- 9.6.48 In response to a sewer requisition application, Severn Trent Water have made a formal offer, as detailed in Appendix 9A - The Flood Risk Assessment and Drainage Strategy Report to provide a satisfactory outfall for domestic foul and trade effluent flows generated at the proposed development. The works required are:
- A sewage pumping station and 400mm diameter rising main discharging to the public sewers local to the proposed development incorporating real time control to interrupt pumping during times that the sewerage system is overloaded in storm conditions.

- Provision of approximately 1600m³ storage at the pumping station to balance inflows during the conditions where pumping is interrupted.

9.6.49 Severn Trent Water have confirmed that any reinforcement works at the treatment works due to flows generated at the proposed development would be undertaken as part of their own capital works programme.

9.6.50 It is considered the proposed development will have a negligible environmental effect through adequate design of the site foul water drainage system, and through provision of a satisfactory foul water drainage outfall that has no detrimental effects on their existing sewerage network and treatment facilities.

9.6.51 It is anticipated that regulatory control will ensure that developments within the foul drainage catchment area will no detrimental effects on their existing sewerage network and treatment facilities and ensure that potential cumulative effects are negligible.

9.7 STATEMENT OF EFFECTS AND CONCLUSIONS

9.7.1 Information forming the baseline site conditions, when considered in the context of the proposed development, does not identify any significant environmental effects as a result of the proposed development.

9.7.2 The following tables summarise the drainage and flooding related effects:

Effects of Construction	None	Low	Moderate	High	Minor adverse	Negligible	Minor beneficial
Contamination		•			•		
Flooding	•					•	

Table 9.3 Matrix of Construction Effects

Effects of Development	None	Low	Moderate	High	Minor adverse	Negligible	Minor beneficial
Surface Water	•						•
Ground Water	•					•	
Flooding	•					•	
Foul Drainage	•					•	

Table 9.4 Matrix of Development Effects

9.7.3 It can be summarised that a minor beneficial environmental effect on future surface water management in the South Mansfield area will result from the proposed development at Lindhurst. Other environmental effects will be negligible in relation to water, hydrology, drainage and flood risk, with the exception of a temporary minor adverse effect during construction.

9.7.4 Cumulative environmental effects of the proposed development on water, hydrology, drainage and flood risk will be negligible in relation to a potential college extension & employment development located immediately to the west of the Site and also a windfarm proposed to the south east of the Site.