

10 Drainage & Flood Risk

10.1 Introduction

- 10.1.1 This Chapter of the ES assesses the likely significant environmental effects of the Proposed Development in respect of the water resources, flood risk and the wider water environment.
- 10.1.2 This Chapter should be read in conjunction with the Flood Risk Assessment (reference: 5116695-R.001) in Volume 3 of the ES, which has been produced by Atkins Limited.

10.2 Assessment Approach

Methodology

- 10.2.1 The following issues have been addressed within this chapter:
- Flood risk
 - Foul and surface water drainage
 - Water quality
 - Water supply
- 10.2.2 The assessment methodology of these issues has primarily involved a desk study to collate relevant information, and applying appropriate analytical methods to predict the impact of the Proposed Development. Details of the specific assessment methodology and significance criteria for each issue stated above are given below.

Flood Risk

- 10.2.3 The assessment of the impact of flood risk is based on the Flood Risk Assessment prepared for the Application Site in accordance with the National Planning Policy Framework. A copy is included in Appendix 2 . This document identifies and quantifies the risk from the various sources of flood risk to the Site. It also addresses how the Proposed Development will impact on flood risk in the surrounding environment. The Flood Risk Assessment draws on information obtained from the Environment Agency, Coventry City Council, the Coventry Level 1 and 2 Strategic Flood Risk Assessments, the Coventry Preliminary Flood Risk Assessment, site observations and local residents at a public consultation event.
- 10.2.4 Following an initial review to determine the likely significance of the various sources of flooding that could affect the Application Site, the flood risk associated with fluvial and artificial sources has been assessed using hydraulic modelling techniques. The risk associated with surface water, groundwater and sewers has been assessed qualitatively using available information.
- 10.2.5 A summary of the significance criteria used to assess the flood risk impact is given in Table 12.1. Assessment of tidal flood risk is not relevant to this site as it is remote from any tidally influenced waters hence it has been omitted from this table.

Table 10.1 Flood risk impact significance criteria

Impact significance	Fluvial	Surface water	Groundwater	Sewers	Artificial sources
Substantial	Change of risk resulting in a change of more than one Flood Zone e.g. Zone 1 – 3 or 3 – 1.	Significant change in surface water run-off.	Significant change in groundwater levels affecting the whole annual variation.	Significant change in surface water run-off.	Change in flood extents that affects properties.
Moderate	Change of risk resulting in a change of a single Flood Zone.	Moderate change in surface water run-off.	Significant change in groundwater levels affecting maximum levels only.	Moderate change in surface water run-off.	Change in the extents of flooding that affects external areas in developed zones.

Impact significance	Fluvial	Surface water	Groundwater	Sewers	Artificial sources
Minor	Change in risk of insufficient magnitude to change the Flood Zone.	Small change in surface water run-off.	Minor change in groundwater levels with annual variation left largely unchanged.	Small change in surface water run-off.	Change in the extents of flooding that affects undeveloped land only.
Negligible	No change in flood risk.	No change in surface water run-off.	No change in groundwater levels	No change in surface water run-off.	No change in flood risk.

Foul and Surface Water Drainage

- 10.2.6 Severn Trent Water has been consulted regarding the impact of the Application Site on the local foul water sewerage system. It has been identified through the consultations that there may be potential issues associated with the availability of capacity for the Proposed Development; therefore a Sewer Capacity Assessment is currently being undertaken.
- 10.2.7 The Environment Agency, Coventry City Council and Severn Trent Water have been consulted regarding the surface water drainage strategy for the Site. The Flood Risk Assessment provides details of the existing conditions and the proposed surface water drainage strategy thus enabling the impact of the Proposed Development on the local surface water drainage and sewerage system to be assessed.
- 10.2.8 A summary of the significance criteria used to assess the impact of and from the local foul and surface water sewerage systems is shown in Table 12.2.

Table 10.2 Foul and surface water sewerage impact significance criteria

Impact significance	Foul and surface water sewerage	Surface water drainage (excluding sewers)
Substantial	System requires large-scale works to operate within recognised standards.	Change in both flow rate and volume of surface water entering the existing system sufficient to require capacity upgrades.
Moderate	System requires localised works to operate within recognised standards.	Change in both flow rate and volume of surface water entering the existing system but insufficient to require capacity upgrades.
Minor	Change in system behaviour not requiring any works to accommodate.	Change in volume of surface water entering the existing system with flow rates maintained.
Negligible	No changes needed to existing system.	No change in flow rates or volumes entering the existing system.

Water Quality

- 10.2.9 The assessment of the likely impact of the Proposed Development on water quality considers both watercourses and groundwater.
- 10.2.10 Surface water flows from the Application Site initially enter the Hall Brook which then discharges into the River Sowe further to the east. The Environment Agency monitors the water quality in the River Sowe; however, information relating to the Hall Brook is limited. The assessment has been based on data obtained from the Environment Agency website. This information is primarily qualitative.
- 10.2.11 To date, there have been no ground investigation works undertaken on the Application Site hence the quality of the groundwater beneath it is currently unknown. The assessment has been based on information obtained from the Environment Agency website regarding the vulnerability of the groundwater to pollution. As with the watercourse quality information, this data is primarily qualitative.
- 10.2.12 The assessment of the likely impact of the Proposed Development on water quality will be qualitative. Details of the corresponding impact significance criteria are given in Table 12.3.

Table 10.3 Water quality impact significance criteria

Impact significance	Watercourses	Groundwater
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Substantial	Change in both ecological and chemical water quality.	Change in both chemical and quantitative water quality.
Moderate	Change in either ecological or chemical water quality.	Change in either chemical or quantitative water quality.
Minor	Minor change in water quality.	Minor change in water quality.
Negligible	No change in quality.	No change in quality.

Water Supply

10.2.13 Water supply in Keresley in Coventry is provided by Severn Trent Water. The assessment of the Proposed Development on the water supply system has been based on information contained within the Warwickshire sub-regional Water Cycle Study and the Severn Trent Water Growth Point Report – Coventry (June 2008). The impact significance criteria to be used for the water supply assessment are given in Table 12.4.

Table 10.4 Water supply impact significance criteria

Impact significance	Water supply
Substantial	Large change in demand requiring large-scale works to accommodate.
Moderate	Change in demand sufficient to require local works on the water supply system.
Minor	Minor change in demand, not requiring works on the existing supply system.
Negligible	No change in demand.

10.3 Policy Framework

National Planning Policy

Water Framework Directive

10.3.1 The Water Framework Directive 2000/60/EC is a European Union directive designed to improve and integrate the way water, from all sources, is managed throughout Europe. In the UK, much of the implementation work is undertaken by competent authorities such as the Environment Agency and Local Authorities. It came into force in December 2000 and was transposed into UK law in 2003. Member States are required to achieve good chemical and ecological status for their inland and coastal waters by 2015.

Making Space for Water

10.3.2 Following the issue of the Water Framework Directive, the UK Government commissioned *Making Space for Water* in 2005. The aim of the document is to manage the risks resulting from flooding and coastal erosion by employing an integrated portfolio of approaches that reflect both national and local priorities. The broad intentions are to:

- Reduce the threat to people and their property;
- Deliver the greatest environmental, social and economic benefit, consistent with the Government's sustainable development principles; and
- Secure efficient and reliable funding mechanisms that deliver the levels of investment required to achieve the vision of this strategy.

National Planning Policy Framework

10.3.3 The National Planning Policy Framework (NPPF) were introduced in March 2012, and included the government's spatial planning policy with regard to development and flood risk. These documents superseded a broad range of Planning Policy Statements including PPS25 *Development & Flood Risk*.

10.3.4 The NPPF aims to ensure that flood risk is taken into account by all relevant statutory bodies from regional to local authority planning departments to avoid inappropriate development in areas at risk of flooding and to direct development away from areas of highest risk. Where new development is,

exceptionally necessary in high risk areas, the policy framework aims to make it safe, ensure that it will not increase flood risk elsewhere and, where possible, reduce overall flood risk in the local area.

- 10.3.5 Local authorities should only consider development in flood risk areas as appropriate where it is informed by a site-specific Flood Risk Assessment, based upon the Environment Agency's Standing Advice on flood risk. The Assessment should identify and assess the risks of all forms of flooding to and from the development and demonstrate how flood risks will be managed so that the development remains safe throughout its lifetime, taking climate change into account.

Flood and Water Management Act 2010

- 10.3.6 The Flood and Water Management Act sets out how flood and coastal risk management in England and Wales will be managed in the future, and provides the basis for a new legislative framework supporting a more integrated approach to water and drainage management.

- 10.3.7 The intentions of the Act are summarised below:

- Deliver improved security, service and sustainability for people and their communities;
- Clarify responsibilities for managing all sources of flood risk;
- Protect essential water supplies by enabling water companies to control more non-essential uses of water during droughts;
- Modernise the law for managing the safety of reservoirs;
- Encourage more sustainable forms of drainage in new developments through new arrangements for adoption and future operation of such features; and
- Make it easier to resolve misconnections to sewers.

Local Planning Policy

Coventry Development Plan, 2001

- 10.3.8 The Coventry Development Plan (CDP) was adopted by Coventry City Council in December 2001. It is intended that majority of saved policies within the CDP will be superseded by the Core Strategy within the Local Development Framework (LDF). The LDF is yet to be completed and adopted. Policies relevant to the Site are highlighted below:

- *EM 3: Water Resources and Quality* – proposals will only be permitted if it is certain that the risk from the following will be kept to an acceptable level:
 - Reducing quantity of water in watercourses/ponds where harm is caused to ecology,
 - Damaging quality and ecology of water environment,
 - Compromising achievement of water quality objectives, or
 - Causing damage/preventing use of groundwater resources.
- *EM 4: Flood Risk and Development* – development should be designed and located to minimise the risk of flooding and to maximise the absorption of surface water run-off by the ground.

Strategic Flood Risk Assessment – Coventry County Council

- 10.3.9 A Level 1 Strategic Flood Risk Assessment (SFRA) for the Coventry City Council area was published in January 2008. This document collated information on the various flooding sources across the region and provided details of predicted future flooding due to climate change.
- 10.3.10 A Level 2 SFRA was published in July 2008 assessing the flood risk on 19 allocated sites within Coventry County Council. Three sites are located close to but do not include the Application Site. The Hall Brook runs through one of the allocated sites and the Council has advised that modelling of the watercourse be undertaken to determine the floodplain and flood risk to the site.

10.4 Baseline Conditions

Site Description and Context

- 10.4.1 The proposed development site is located on the south-western side of Keresley in Coventry. The eastern boundary of the site is formed by Bennetts Road South and the rear gardens of properties fronting onto this road. The southern boundary is formed by Sandpits Lane. The Tamworth Road, a hotel and a golf driving range comprise the south-western site boundary. Field boundaries following

the Hall Brook delineate the northern boundary of the site while an area of woodland and open farmland bound the north-western boundary.

Baseline Survey Information

Flood Risk

- 10.4.2 This section summarises the existing flood risk situation on the Application Site and how the surrounding area is impacted upon by the Site in its current condition. Further details regarding flood risk are provided in the Flood Risk Assessment included in Appendix 2.

Fluvial Flooding

- 10.4.3 The Application Site is surrounded by and contains a number of field drains and watercourses. The Environment Agency Flood Map and the Level 1 Strategic Flood Risk Assessment indicate that the entire site is within Flood Zone 1; however, the catchment area of all the watercourses within the Site is less than 3km² hence these are not included on the Flood Map. To address this and establish the floodplain extents within the Site, modelling of the Hall Brook was undertaken. This is described in section 5.3.1 of the Flood Risk Assessment. The results show that the floodplain of the Hall Brook within the site boundary is limited to a narrow strip along the northern boundary; the majority of the floodplain is located beyond the site boundary on adjacent land north of the watercourse. Drawing number 5116695/002 in Appendix C of the Flood Risk Assessment illustrates the flooding extents with numerical results and longitudinal sections included in Appendix D of the Flood Risk Assessment.
- 10.4.4 Local residents have reported, during a public consultation event, flooding on Watery Lane, Bennetts Road South and Penny Park Lane, partly as a result of water escaping from the culverted section of the Hall Brook to the east of the Application Site.

Surface Water Flooding

- 10.4.5 Ground levels within the Application Site primarily fall in a northerly direction towards the Hall Brook. The south-eastern section of the site falls to the south and the junction between Sandpits Lane and Bennetts Road South.
- 10.4.6 The entire Application Site is currently undeveloped agricultural land used for crops and pasture. The field boundaries within the Site are established hedgerows, some of which contain substantial trees. There are also trees along parts of the southern and eastern boundaries. These surface features in conjunction with the field drains are anticipated to interrupt the free movement of overland flows. The flows from the majority of the Application Site will drain directly into the Hall Brook. There are no apparent ditches or watercourses collecting flows from the south-eastern section of the Site hence any run-off is anticipated to flow onto the adjacent highways and enter the surface water system draining the road.
- 10.4.7 The topography of the Application Site is such that it is not subject to surface water flooding generated either internally or from adjacent land. Surface water flooding maps included in section 5.3.2 and Appendix B of the Flood Risk Assessment show the impact of surface water flooding on the Application Site to be minimal; however, land beyond the Site boundary is more significantly affected. According to information supplied by Coventry City Council and reports from local residents, Bennetts Road South and Watery Lane are both subject to flooding.

Groundwater Flooding

- 10.4.8 No information is currently available regarding groundwater levels beneath the Application Site. There are anecdotal reports of the Site being very wet and observations during a site visit confirmed that there were isolated areas of saturated ground and standing water. The Coventry City Council Preliminary Flood Risk Assessment shows the Site to be in an area assessed to have a 25% risk of groundwater flooding.
- 10.4.9 According to Soilscales, there are two soil types present within the Application Site. The soils covering the majority of the Site are described as freely draining slight acid loamy soils. The remainder of the Site, immediately adjacent to the Hall Brook, are described as slightly acid loamy and clayey soils with impeded drainage.

10.4.10 The topography of the Application Site, in conjunction with the freely draining soils and the underlying aquifer, is such that, if groundwater levels were sufficiently high, groundwater emergence is possible. The Site does not have any isolated depressions or flat areas where emerging groundwater could accumulate. The natural topography of the land is such that water would tend to flow over the ground surface and enter the Hall Brook either directly or via the existing field drainage system.

10.4.11 Further details associated with groundwater flooding are provided in section 5.3.3 of the Flood Risk Assessment.

Sewer Flooding

10.4.12 Coventry City Council Level 1 Strategic Flood Risk Assessment states that the Severn Trent Water DG5 register identifies four properties within the same postcode area as the Application Site (CV7 8) as having been affected by sewer flooding in the past. The Site is located at the southern end of this postcode area with the majority of the area beyond the northern boundary of Coventry. Sewer flooding that affects properties is more likely to occur in the more urbanised, low-lying areas of Keresley further to the north and not impact upon the Application Site.

Flooding from Artificial Sources

10.4.13 There is an old fish pond located approximately 500m north-west of the Application Site on the Hall Brook. The water is retained within the pond by a low earth embankment running across the valley. Information relating to the origin and history of the fish pond is unavailable; however old Ordnance Survey maps show that the pond and its associated impounding embankment were present before 1888. No information relating to any previous flooding resulting from a failure of the fish pond is available.

10.4.14 A model developed using MicroDrainage FloodFlow shows that the flood extents in the event of a failure of the embankment are similar to the 1 in 100-year +20% flood extents from the Hall Brook. There is a small amount of encroachment into the Application Site on the western section of the northern boundary; however, this does not reach the area proposed for development. Further details of the model and the results are included in section 5.3.5 of the Flood Risk Assessment.

Infrastructure

Foul Water Sewerage

10.4.15 Severn Trent Water sewer records show that there are 150mm diameter combined sewers within both Bennetts Road South and Sandpits Lane. The combined sewer within Sandpits Lane provides an outfall for the hotel and driving range to the south-west of the Application Site. A short section of this sewer runs within the Application Site. Severn Trent Water has advised that there is a 5m wide easement associated with this sewer (2.5m on each side). The sewer within Sandpits Lane also receives flow from a foul water sewer that serves properties on Tamworth Road.

10.4.16 Consultation responses from Severn Trent Water indicate that the local foul water sewerage system is operating close to or at its effective capacity. A Sewer Capacity Assessment is currently being undertaken to establish whether capacity for the Proposed Development is available and the extents, if required, of any off-site improvement works. Sewage treatment capacity is available at the Finham Sewage Treatment Works.

Surface Water Sewerage

10.4.17 The Application Site is divided into two distinct surface water drainage catchments. The largest catchment, encompassing the majority of the Site with the exception of the south-eastern corner, drains north directly to the Hall Brook. The remainder of the Site drains south towards the junction of Sandpits Lane and Bennetts Road South. The outfall from this latter area is unclear. An examination of the topographical survey suggests that run-off will either infiltrate into the ground or flow over the surface onto the adjacent roads. Sewer records show surface water sewers within Sandpits Lane and at the junction with Bennetts Road South. Any run-off flowing onto the roads is anticipated to enter these sewers before being discharged into the watercourse adjacent to the junction.

10.4.18 There is a 600mm diameter public surface water sewer shown along part of Sandpits Lane. At the junction with Bennetts Road South this is joined by a further 375mm diameter surface water sewer from the south. The sewer records show that the sewer becomes 1050mm diameter before discharging into a watercourse adjacent to the junction. This watercourse is a tributary of the Hall Brook.

10.4.19 The surface water flow rates from the Application Site in its current condition for a range of return periods are provided in Table 12.6. Details of the calculation methodology for these flow rates are provided in section 6.1 of the Flood Risk Assessment.

Table 10.6 Existing surface water run-off rates

Return period	Run-off rate (l/s/ha)	Run-off flow rate (l/s)	
		North	South
1 in 1-year	3.6	112.3	24.6
1 in 2-years	3.9	121.7	26.7
QBAR (1 in 2.33-years)	4.4	137.3	30.1
1 in 30-years	8.6	268.3	58.8
1 in 100-years	11.3	352.5	77.3

Water Quality

Watercourses

10.4.20 The Hall Brook is the receptor of the majority of the surface water flows from the Application Site. It remains in open channel, with the exception of the culverts beneath Manor Farm and Bennetts Road South, until it reaches Watery Lane whereupon it is culverted. A tributary of the Hall Brook flows in an easterly direction from a point close to the junction between Sandpits Lane and Bennetts Road South, also flowing through a number of culverts.

10.4.21 According to the Environment Agency website, the Water Framework Directive assessment of the Hall Brook states that the current and predicted ecological and chemical status is *poor* and *good* respectively.

Groundwater

10.4.22 According to Environment Agency mapping for the area including the Application Site, the quantitative quality and chemical quality of the groundwater is classed as *poor* both now and in the future.

10.4.23 The whole of the Application Site is located within Source Protection Zone 3 (Total Catchment). There are no specific restrictions on the use of infiltration within such zones; however, Environment Agency guidance must be considered if infiltration is believed to be viable.

Water Supply

10.4.24 Severn Trent Water provides the public water supply for the area including the Application Site. The Site lies within the Severn Water Resource Zone 3 (WRZ3). Within this area, 40% of water is supplied from direct river abstraction, 30% from groundwater boreholes or wells and 30% from surface water reservoirs.

10.4.25 It is likely that the water supply for the proposed development would be from Meriden Service Reservoirs and the River Severn Aqueduct. Capacity is available within both of these resources to accommodate the development proposals. There are currently capacity issues associated with the distribution system; however, modelling has shown that the removal of a pressure reducing valve is likely to resolve this.

10.5 Key Impacts & Likely Significant Effects

10.5.1 The impacts predicted within this section are based on a pre-mitigation scenario. Mitigation measures are described later in this chapter. Both the construction and post-development scenarios are considered.

To the Proposed Development Site

Fluvial Flooding

Construction

- 10.5.2 There is a risk of fluvial flooding from the Hall Brook during the 1 in 100-year +20% flood event. Modelling shows that the flood water will by-pass significantly undersized culverts and is split between the channel and slightly lower land at the bottom of the valley. A narrow strip along the northern edge of the site is potentially at risk of flooding during the 1 in 100-year +20% flood event. The depth of flooding is low; however, if construction activities were being undertaken or material or plant stored in this area, they would be adversely affected by the flooding.
- 10.5.3 The size of the area potentially affected by fluvial flooding is relatively small in comparison with the wider site hence the risk of construction activities is low; therefore, the pre-mitigation impact significance for fluvial flooding during construction is considered to be **Minor Adverse**.

Post-Development

- 10.5.4 The Proposed Development does not change the floodplain boundary hence the 1 in 100-year +20% flood extents will be the same as the existing, baseline situation. The development proposals include a landscaping strip along the Hall Brook which wholly encompasses the area that will be flooded hence no properties will be affected by flooding.
- 10.5.5 The post-development, pre-mitigation impact significance for fluvial flooding is considered to be **Negligible**.

Surface Water Flooding

Construction

- 10.5.6 While the Application Site in its current condition is not significantly affected by surface water flooding, during construction the natural ground surface and drainage routes may be disrupted. This could lead to the creation of alternative flow paths or areas where water can accumulate, with the consequence that parts of the Site could become flooded during a rainfall event. This could have an adverse impact on construction activities.
- 10.5.7 Surface water flooding from beyond the Application Site boundary is unlikely to occur due to the topography of the local area; however, a disruption in the existing overland drainage route from the south-eastern corner of the site could cause localised flooding within the site boundary. Should this occur, construction activities could be disrupted.
- 10.5.8 The pre-mitigation impact significance for surface water flooding during construction is considered to be **Moderate Adverse**.

Post-Development

- 10.5.9 Due to the local topography, the risk of surface water flooding originating from beyond the Application Site affecting the Proposed Development is considered minimal. On completion, the Proposed Development will feature a substantially higher impermeable area than is currently present on the Site. Any rainfall on the Site will tend to run-off the surface rather than have the opportunity to infiltrate into the ground. The run-off will follow the natural fall of the ground surface towards either the Hall Brook or the south-eastern corner of the Site.
- 10.5.10 Run-off from the Proposed Development could result in new properties becoming flooded; therefore, the post-development, pre-mitigation impact significance for surface water flooding is considered to be **Substantial Adverse**.

Groundwater Flooding

Construction

- 10.5.11 Construction activities are likely to disrupt the existing ground surface and may involve some reductions in ground levels, which could increase the likelihood of groundwater emergence. High groundwater levels will cause saturation of the ground which could disrupt certain activities. Excavations or other depressions formed on the Application Site may also fill with water. The rate of groundwater emergence is anticipated to be low; however, the volume is unknown and the time for it to drain away may be prolonged.

- 10.5.12 The pre-mitigation impact significance for groundwater flooding during construction is considered to be **Moderate Adverse**.

Post-Development

- 10.5.13 The risk of groundwater flooding on the Application Site has been assessed by Coventry City Council to be 25%. The Proposed Development will reduce the areas where groundwater can emerge as areas of the site will be rendered impermeable. Any groundwater that emerges will follow the fall of the ground, accumulate if depressions are present and/or flow via the drain network to the Hall Brook. The rate of emergence is anticipated to be low; however, the duration of the flooding could be prolonged thereby affecting the Proposed Development for a longer period of time than other flooding sources.

- 10.5.14 The post-development, pre-mitigation impact significance of groundwater flooding is considered to be **Moderate Adverse**.

Sewer Flooding

Construction

- 10.5.15 According to sewer records, there is a short length of 150mm diameter combined sewer from the hotel and driving range running within the Application Site. The risk of flooding associated with the sewer within the Site is considered to be minimal assuming that no blockages occur. There are other existing sewers within Sandpits Lane and Bennetts Road South that, if these were to flood, are considered unlikely to affect the Site due to local topography.

- 10.5.16 Sewer flooding during construction would only affect a small part of the Application Site with a limited volume of flood water; therefore, the pre-mitigation impact significance for sewer flooding during construction is considered to be **Minor Adverse**.

Post-Development

- 10.5.17 The development proposals introduce new sewerage systems onto the Application Site. Failure of any part of the new or existing systems could result in flooding that could adversely affect the Proposed Development. There is less space for any flood water to disperse once the Site is developed. The risk of flooding from existing sewers adjacent to the Application Site is considered to be minimal by virtue of the local topography directing flows away from the Site.

- 10.5.18 The post-development, pre-mitigation impact significance for sewer flooding is considered to be **Moderate Adverse**.

Flooding from Artificial Sources

Construction

- 10.5.19 As shown in section 5.3.5 of the Flood Risk Assessment, failure of the embankment impounding the fish ponds will release water that could affect an area of land equivalent to the 1 in 100-year +20% flood extent from the Hall Brook. This release of water could cause flooding along the western section of the northern boundary of the site. If construction activities were being undertaken or material or plant stored in this area, they would be adversely affected by the flooding.

- 10.5.20 The likelihood of such an event occurring is low and the duration of the flooding is expected to be short; therefore, the pre-mitigation impact significance for flooding from artificial sources during construction is considered to be **Minor Adverse**.

Post-Development

- 10.5.21 The development proposals do not change the ground levels in the immediate vicinity of the Hall Brook hence the flood extents resulting from a failure of the fish pond embankment will be the same at the existing, baseline situation. The Proposed Development includes a landscaping strip along the Hall Brook which wholly encompasses the area that would be flooded during a flood event hence no properties will be affected by flooding.

10.5.22 The post-development, pre-mitigation impact significance for flooding associated with artificial structures is considered to be **Negligible**.

Surface Water Sewerage

Construction

10.5.23 There is no existing surface water sewerage infrastructure within the Application Site. The nearest surface water sewers are located in Sandpits Lane beyond the site boundary. These are at a level below that of the Application Site; therefore any flooding associated with these will not affect the Site.

10.5.24 The pre-mitigation impact significance of the local surface water sewerage infrastructure on construction activities is considered to be **Negligible**.

Post-Development

10.5.25 As described above, the existing surface water sewerage system is located in areas beyond the site boundary that are below the adjacent level of the Application Site hence any flooding from these systems will not affect the Proposed Development. The south-eastern section of the Proposed Development drains via the existing surface water sewerage system into a tributary of the Hall Brook. If there are problems with this part of the existing system, there is a risk that this will adversely affect the performance of the on-site drainage systems serving the Proposed Development with some consequential localised flooding.

10.5.26 While the existing surface water sewerage infrastructure will not adversely directly affect the Proposed Development, there may be indirect localised flooding impacts in the event of a failure that blocks the outfall from the Site; therefore, the post-development, pre-mitigation significance associated with the local surface water sewerage infrastructure is considered to be **Moderate Adverse**.

Foul Water Sewerage

Construction

10.5.27 The construction site compound will generate foul water flows from its welfare facilities. The means of disposal is dependent on the compound location: A gravity connection into the local foul water sewerage system may be viable; however, it is possible that sewage may be collected, stored and tankered away for disposal.

10.5.28 The foul water flow rates generated during construction are anticipated to be very low; therefore, if a temporary connection into the local foul water sewerage system is used, the limited availability of capacity is unlikely to adversely affect construction activities. On this basis, the pre-mitigation impact significance of the local foul water sewerage infrastructure during construction is considered to be **Negligible**.

Post-Development

10.5.29 The development proposals introduce a significant number of dwellings with a consequential increase in the foul water flows entering the local foul water sewerage system. There are known issues with the availability of capacity within the local system.

10.5.30 Under the current situation, the Proposed Development will only be permitted to discharge limited foul water flows as there is insufficient capacity available to adequately serve the development. The post-development, pre-mitigation impact significance of foul water sewerage infrastructure is considered to be **Substantial Adverse**.

Water Quality – Watercourses

Construction

10.5.31 The water quality within the local watercourses will not affect the Application Site during construction; therefore, the pre-mitigation impact significance is considered to be **Negligible**.

Post-Development

10.5.32 The water quality within the local watercourses will not affect the Application Site once it has been completed; therefore, the pre-mitigation impact significance is considered to be **Negligible**.

Water Quality – Groundwater

Construction Phase

- 10.5.33 The groundwater quality beneath the Application Site will not affect construction activities; therefore, the pre-mitigation impact significance is considered to be **Negligible**.

Post-Development

- 10.5.34 The groundwater quality beneath the Application Site will not affect the Proposed Development; therefore, the pre-mitigation impact significance is considered to be **Negligible**.

Water Supply

Construction

- 10.5.35 Based on available information, there is no existing water supply infrastructure within the Application Site that could affect construction activities; therefore, the pre-mitigation impact significance of water supply during construction is **Negligible**.

Post-Development

- 10.5.36 The Proposed Development will not be adversely affected by existing water supply infrastructure; therefore, the post-development, pre-mitigation impact significance of water supply is considered to be **Negligible**.

From the Proposed Development Site

Fluvial Flooding

Construction

- 10.5.37 During construction, the ground surface of the site may become disrupted and compacted which could lead to a temporary increase of run-off from the Application Site into the Hall Brook. This may increase the risk of fluvial flooding for properties downstream on Watery Lane and the residential area to the east.
- 10.5.38 As run-off from the Application Site during construction could result in existing properties being flooded, the pre-mitigation impact significance for fluvial flood risk during construction is considered to be **Substantial Adverse**.

Post-Development

- 10.5.39 On completion, the Proposed Development will include a significant amount of impermeable surfacing when compared to the existing situation resulting in an increase in run-off to the Hall Brook. This will increase the risk of fluvial flooding associated with the watercourse particularly within the residential areas to the east of the Application Site.
- 10.5.40 As the increase in run-off to the Hall Brook is likely to result in an increased level of flood risk experienced by existing properties, the post-development, pre-mitigation impact significance for fluvial flood risk is considered to be **Substantial Adverse**.

Surface Water Flooding

Construction

- 10.5.41 During construction, the natural ground surface and drainage routes within the Application Site may be disrupted. This could lead to the creation of new or more effective flow paths for surface run-off. The topography of the site is such that run-off from the majority of the site will be directed north towards the Hall Brook; however, run-off from the south-eastern area will tend to flow onto Sandpits Lane and potentially towards existing residential properties to the east.

10.5.42 The pre-mitigation impact significance for surface water flood risk during the construction phase is considered to be **Moderate Adverse**.

Post-Development

10.5.43 The increased area of impermeable surfacing on the Site as a result of the Proposed Development will increase the volume and rate of the surface water run-off that is generated. The majority of the Application Site falls towards the Hall Brook; however, the south-eastern area drains towards Sandpits Lane. Uncontrolled run-off from this area could affect existing residential properties both immediately adjacent to the Site and further to the east.

10.5.44 The post-development, pre-mitigation impact significance for surface water flood risk is considered to be **Moderate Adverse**.

Groundwater Flooding

Construction

10.5.45 The construction phase is likely to disrupt the existing ground surface within the Application Site, and may involve some reductions in ground levels. This could increase the likelihood of groundwater emergence. The topography of the site is such that any emerging groundwater would flow over the ground surface either towards the Hall Brook or towards Sandpits Lane. The rate of emergence is anticipated to be low; however, the volume is unknown. Emerging groundwater that reaches the Hall Brook will not affect any properties beyond the site boundary; however, any water that flows towards Sandpits Lane could affect a limited number of properties in the immediate area before it is intercepted by the highway drainage system.

10.5.46 The pre-mitigation impact significance for groundwater flood risk during the construction is considered to be **Moderate Adverse**.

Post-Development

10.5.47 The Proposed Development will limit the area available for groundwater emergence due to additional paved areas; however, modifications to ground levels and the inclusion of features for the management of surface water may create preferential routes for any emerging groundwater. This will mean that groundwater can be controlled and managed before it adversely affects any off-site receptors. It is possible that groundwater levels in the immediate area could be slightly lowered; however, this cannot be quantified.

10.5.48 The post-development, pre-mitigation impact significance for groundwater flood risk is considered to be **Negligible**.

Sewer Flooding

Construction

10.5.49 Construction activities may mobilise sediment that could be washed into the local sewerage system. This will progressively reduce capacity and may eventually cause a blockage. Under such circumstances, flooding could occur. The sewers generally run through the residential area to the east of the site; therefore, any flooding could affect private properties. It should be noted, however, that only run-off from the south-eastern corner of the site is likely to wash sediment into the local sewerage system. The remainder of the site does not drain to an area that is currently served by a piped drainage system.

10.5.50 The pre-mitigation impact significance for sewer flood risk during the construction is considered to be **Moderate Adverse**.

Post-Development

10.5.51 The Proposed Development will substantially increase the number of dwellings connected to the local sewerage system. In addition, there will be some additional impermeable area also draining into it. There are known capacity issues on the foul water system; therefore, the Proposed Development could overload the system and cause flooding. The local sewerage system tends to flow in a generally easterly direction through the residential area to the east hence any flooding is likely to affect private properties.

10.5.52 The additional impermeable area will drain into existing surface water sewers with Sandpits Lane which flow in an easterly direction to join other sewers in Bennetts Road South before discharging into a watercourse. The development run-off may increase the flow rates within the sewers sufficiently to cause flooding. Any flooding would tend to affect the area surrounding the junction between Sandpits Lane and Bennetts Road South with the potential for some flooding further to the east. This may affect some private properties.

10.5.53 The post-development, pre-mitigation impact significance for sewer flood risk is considered to be **Moderate Adverse**.

Flooding from Artificial Sources

Construction

10.5.54 Construction activities will not cause a change in risk to areas beyond the Application Site associated with flooding from failure of the fish pond to the north-west. The local topography is such that any obstruction of flows will not cause the flooding to move to an area where it would affect existing properties or other receptors; therefore, the pre-mitigation impact significance for flooding from artificial sources during construction is considered to be **Negligible**.

Post-Development

10.5.55 The Proposed Development is located wholly outside of the area predicted to be affected in the event of a failure of the fish pond embankment. Any water escaping will flow past the site unobstructed so there will be no change in the level of risk experienced by any off-site receptors. On this basis, the post-development, pre-mitigation impact significance for flooding from artificial sources is considered to be **Negligible**.

Surface Water Sewerage

Construction

10.5.56 The primary risk to off-site surface water sewerage during construction is silt being washed into the pipework. The silt will be conveyed to the sewers by run-off flowing over disturbed soil surfaces. The majority of the site drains into the Hall Brook; however, run-off from the south-eastern area drains into surface water sewers within Sandpits Lane. As a result, it is these sewers that are most vulnerable to silt ingress. Silt may accumulate over time and progressively reduce flow capacity within the pipeline which can lead to surcharging of and possible flooding from the upstream system. The section of surface water sewer potentially affected is relatively short as it discharges into a small watercourse immediately adjacent to the junction between Sandpits Lane and Bennetts Road South.

10.5.57 The pre-mitigation impact significance for surface water sewerage infrastructure during construction is considered to be **Moderate Adverse**.

Post-Development

10.5.58 The Proposed Development will result in an increase in surface water run-off due to an increase in impermeable area. A new connection into the local surface water sewerage system from the south-eastern area of the site is proposed. The remainder of the Proposed Development will drain directly into the Hall Brook hence will have no impact on the local surface water sewerage system.

10.5.59 The additional flows entering the existing surface water sewerage system may result in surcharging and possibly flooding. The section of surface water sewer potentially affected is relatively short as it discharges into a small watercourse immediately adjacent to the junction between Sandpits Lane and Bennetts Road South; however, this is potentially a long-term impact.

10.5.60 The post-development, pre-mitigation impact significance for surface water sewerage infrastructure is considered to be **Substantial Adverse**.

Foul Water Sewerage

Construction

10.5.61 The construction site welfare facilities will generate foul water flows. The means of disposal is dependent on the compound location. A gravity connection into the local foul water sewerage system may be viable; however, it is possible that sewage may need to be collected and tankered away for disposal at another location.

10.5.62 These flows will be additional to those already present within the local system but are anticipated to be low in terms of rate and volume. The local foul water sewerage system is known to have limited capacity to accept additional flows. While the flow rates are expected to be low, the limited capacity dictates that the pre-mitigation impact significance on the local foul water sewerage infrastructure during construction is considered to be **Minor Adverse**.

Post-Development

10.5.63 The Proposed Development comprises up to 800 new dwellings, a school and local centre. This is calculated to generate an additional foul water flow rate of approximately 48l/s. The local foul water sewerage system is known to comprise small (150mm) diameter pipework and hence have limited capacity to accommodate additional flows.

10.5.64 The additional development flows will exceed the capacity of the local foul water sewerage system hence the post-development, pre-mitigation impact significance on the local foul water sewerage infrastructure is considered to be **Substantial Adverse**.

Water Quality – Watercourses

Construction

10.5.65 Construction activities on the site have the potential to pollute the Hall Brook. Disturbance of the ground surface and run-off from material storage areas can cause additional silt to be washed into the watercourse. This could cause siltation within the channel if it is able to settle out. In addition, suspended material can adversely impact upon any filter feeding organisms within the channel and have an adverse impact on the appearance of the watercourse.

10.5.66 Other potential pollutants include fuel and oil from construction plant, cement and concrete and other construction-related chemicals. These will have an adverse ecological impact, particularly in terms of the chemical water quality.

10.5.67 The pre-mitigation impact significance for watercourse water quality during construction is considered to be **Substantial Adverse**.

Post-Development

10.5.68 The Proposed Development will introduce new highway and other hardstanding areas onto the Application Site. Run-off from these areas potentially will be polluted by oil and other substances deposited by vehicles. The run-off from all parts of the site will ultimately enter the Hall Brook or one of its tributaries. This will have an adverse impact on the water quality within these watercourses. Over time, pollutants will accumulate hence could have a long-term effect and will affect the aspiration to achieve good water quality, in terms of both ecological and chemical factors, in the Hall Brook.

10.5.69 The post-development, pre-mitigation impact significance for watercourse water quality is considered to be **Substantial Adverse**.

Water Quality – Groundwater

Construction

10.5.70 During construction, there is a potential risk to groundwater quality as a result of pollutants arising from construction operations and materials being able to infiltrate into the ground. The Application Site is located within Source Protection Zone 3 (Total Catchment) and the ground conditions are potentially permeable hence there is a risk that any pollutants could reach an aquifer that is used for water supply. Disruption of the surface during construction may create more direct flow paths for infiltrating contaminants to reach the groundwater.

10.5.71 The pre-mitigation impact significance for groundwater water quality during construction is considered to be **Moderate Adverse**.

Post-Development

- 10.5.72 Once complete, the impermeable areas within the Proposed Development will significantly reduce the area available for water to infiltrate into the ground; however, the run-off from these areas potentially will be polluted by oils and other substances deposited by vehicles. The proposed surface water drainage system serving the Proposed Development is anticipated to include various open storage areas and other features for storing water below ground. These could create more efficient and shorter pathways for pollutants to reach the groundwater.
- 10.5.73 The post-development, pre-mitigation impact significance for groundwater water quality is considered to be **Minor Adverse**.

Water Supply

Construction

- 10.5.74 Some construction activities together with the site welfare facilities will require a water supply. The daily water demand is currently unknown; however, it will be additional to the current demands on the local water supply network. According to Severn Trent Water, there are sufficient water resources available but there may be local distribution network capacity issues that will need to be resolved. Whether these capacity issues require resolution prior to the commencement of construction is subject to confirmation.
- 10.5.75 The pre-mitigation impact significance for water supply during construction is considered to be **Minor Adverse**.

Post-Development

- 10.5.76 The development proposals of up to approximately 800 new dwellings and other facilities will place additional demands on local water resources and the supply network. Severn Trent Water has stated that there is sufficient capacity in both the Meriden Service Reservoirs and the River Severn Aqueduct to supply the Proposed Development. It is known that there are capacity issues present on the local distribution network that require resolution to allow the Proposed Development to be served.
- 10.5.77 The post-development, pre-mitigation impact significance for water supply is considered to be **Moderate Adverse**.

10.6 Mitigation, Enhancement and Residual Effects

To the Proposed Development Site

Fluvial Flooding

Construction

- 10.6.1 Construction activities close to the Hall Brook within the zone identified as being at risk of flooding, as shown on drawing number 5116695/002 in Appendix C of the Flood Risk Assessment, should be kept to a minimum. Materials and plant will not be stored within this area as this will reduce floodplain storage volume. Plant should be moved to an adjacent higher area when work is not being undertaken to protect it from damage in the event of a flood.
- 10.6.2 The proposed mitigation measures described above will reduce the impact of fluvial flooding on construction works; however, flooding still may adversely affect partially completed earthworks and other features. Taking these residual effects into consideration, the post-mitigation impact significance for fluvial flooding during construction is unchanged and remains as **Minor Adverse**.

Post-Development

- 10.6.3 As the post-development, pre-mitigation impact significance of fluvial flooding on the Proposed Development is **Negligible**, no mitigation measures are required.

Surface Water Flooding

Construction

- 10.6.4 During construction, the creation of depressions where surface water run-off could accumulate should be minimised although it is unlikely that this can be avoided altogether. Measures such as temporary cut-off drains will be used to intercept run-off and direct it towards existing drainage ditches in a manner that will not adversely affect construction activities. The materials and plant will not be stored in areas identified as being surface water flow paths or accumulation areas to avoid damage and disruption. Pumps will be available to allow any depressions or excavations filled by surface water flooding to be emptied in a controlled manner.
- 10.6.5 The mitigation measures described above will allow surface water flooding to be controlled in a manner that will limit the impact on construction activities. Surface water flows could still affect partially completed works, in particular earthworks which could be eroded by uncontrolled flows.
- 10.6.6 The proposed mitigation measures, once residual effects have been taken into consideration, all the impact significance of surface water flooding during construction to be reduced from moderate adverse to **Minor Adverse**.

Post-Development

- 10.6.7 The Proposed Development will incorporate a positive surface water drainage system that will intercept run-off from roofs and paved areas in order to mitigate the flood risk from surface water within the development. The drainage system components will be designed to the relevant adoptable standards at that time. It is still possible that some surface water run-off will remain on the surface due to the limited capacity and efficiency of collection systems such as gullies and linear drainage channels. In order to mitigate the impact of this on the Proposed Development, the following mitigation measures are proposed, as described in section 5.4 of the Flood Risk Assessment:
- The finished floor level of all dwellings and other buildings will be at least 0.15m above adjacent external ground levels.
 - Wherever possible, the proposed ground surface should be designed to fall away from any buildings.
 - Surface water overland flow corridors following the natural topography will be provided.
- 10.6.8 A risk remains of a rainfall event that will exceed the capacity of the collection systems and the mitigation measures outlined above; however, the implementation of the mitigation measures should ensure that this is a rare occurrence. The proposed mitigation measures allow the post-development, impact significance for surface water flood risk to be reduced from substantial adverse to **Minor Adverse**.

Groundwater Flooding

Construction

- 10.6.9 Construction activities in areas identified as being prone to groundwater emergence or saturation will be preceded by the implementation of control measures such as pumping to locally reduce water levels. Pumping will be required to ensure that excavations can be undertaken and will remain stable. Construction works should be planned to avoid creating depressions in the ground surface where groundwater could accumulate if it emerges.
- 10.6.10 If groundwater is identified to be a specific issue in particular locations, temporary land drains will be installed to ensure that ground conditions remain suitable for construction activities. These may take the form of buried pipework or a series of ditches to attract groundwater before it can emerge on the surface. All groundwater that is intercepted either by pumps, ditches or land drains will be directed towards the Hall Brook.
- 10.6.11 While the rate of groundwater emergence is anticipated to be low, the volume is unknown and could be considerable. A prolonged period of rainfall could increase groundwater levels sufficiently for it to saturate the ground over a wide area and emerge in volumes beyond what the mitigation measures can manage. Under such circumstances, construction activities are likely to be adversely affected; therefore, the proposed mitigation measures allow the impact significance for groundwater flooding during construction to be reduced from moderate adverse to **Minor Adverse**.

Post-Development

- 10.6.12 On completion of the Proposed Development, the pathways by which water can emerge onto the surface will be restricted by the new paved areas. Groundwater will still be able to emerge within landscaped areas, in particular those which include surface water drainage features such as ponds and open channels. These will tend to act as preferential emergence routes thereby reducing the likelihood of emergence in other locations.
- 10.6.13 Any emerging groundwater will be drained away via the surface water drainage system and not be allowed to accumulate and cause uncontrolled flooding of land or properties. Groundwater flooding is generally a slow process hence it is anticipated that the proposed surface water drainage system will be capable of managing all occurrences. On this basis, the mitigation measures enable the post-development impact significance for groundwater flooding to be reduced from moderate adverse to **Negligible**.

Sewer Flooding

Construction

- 10.6.14 The short length 150mm diameter combined sewer within the Application Site is the only potential source of sewer flooding that could affect construction activities. This is most likely to occur if it were blocked in some way. Precautions will be taken during construction to ensure that works do not result in the pipe being accidentally crushed by construction plant and/or filled with material, such as silt. The sewer and any manholes within the site boundary will be located and marked so that their position is apparent to site operatives and suitable protective measures can be put in place.
- 10.6.15 As the sewer is combined, there is also a risk that, during an extreme rainfall event could exceed the pipe capacity. During such circumstances, flooding in the south-eastern part of the Application Site could occur. While the measures put in place to manage surface water flooding are also likely to be able to control the extents of sewer flooding, there remains a health and safety risk as raw sewage is likely to be involved.
- 10.6.16 While the risk of flooding can be reduced, there remains a possibility that an extreme rainfall event could result in raw sewage flooding onto the site; therefore, the post-mitigation impact significance for sewer flooding during construction is unchanged and remains as **Minor Adverse**.

Post-Development

- 10.6.17 Completion of the Proposed Development will reduce the risk of the existing sewer becoming blocked with material from the site; however, the flooding risks associated with failure due to an extreme rainfall event remain. The positive drainage system serving the Proposed Development will intercept and limit the extents of any flooding that might occur. There is a possibility that the existing sewer could be diverted into the foul water system serving the Proposed Development. If this were to occur, it would provide additional resilience against sewer flooding.
- 10.6.18 The risk of flooding associated with a failure of part of the new drainage systems will be mitigated by ensuring that these are designed in accordance with the version of Sewers for Adoption current at the time this work is undertaken. This ensures that no flooding will occur for all rainfall events up to and including the 1 in 30-year event. In addition, the drainage systems will be offered for adoption to Severn Trent Water. This will ensure that the sewers are adequately maintained against blockages and other faults.
- 10.6.19 A risk remains of an extreme rainfall event that exceeds the capacity of the sewerage system. This will be mitigated by ensuring that there are overland flow paths through the Proposed Development which excess water can use with minimal impact on adjacent properties. However, there is a residual risk to properties from water before it is able to reach these designated areas.
- 10.6.20 In light of the above, the proposed mitigation measures enable the post-development impact significance for sewer flooding to be reduced from moderate adverse to **Minor Adverse**.

Flooding from Artificial Sources

Construction

10.6.21 Construction activities in areas that are potentially at risk of flooding in the event of a failure of the impounding embankment at the fish pond will be minimised where possible. Similarly, construction plant and materials should not be stored in this area. The area affected is almost identical to the 1 in 100-year +20% floodplain of the Hall Brook.

10.6.22 While the risk of flooding from this source is considered to be very low, the area potentially affected is small relative to the overall site area and the duration of the flood event is very short, a risk remains of damage to any partially completed works in the event of a flood. On this basis, the post-mitigation impact significance for flooding from artificial sources during construction is unchanged and remains as **Minor Adverse**.

Post-Development

10.6.23 As the post-development, pre-mitigation impact significance of flooding from artificial sources on the Proposed Development is **Negligible**, no mitigation measures are required.

Surface Water Sewerage

Construction Phase

10.6.24 As the pre-mitigation impact significance of the local surface water sewerage system on the Proposed Development during construction is **Negligible**, no mitigation measures are required.

Post-Development

10.6.25 The proposed surface water drainage system will be designed and simulated to ensure that the effect of surcharging of the surface water drainage outfalls are taken into consideration within the system design. The results of the simulations will be used to identify where additional resilience can be effectively incorporated into the system to manage these circumstances. Surface water storage areas will be designed with sufficient freeboard to allow additional water to be contained above which would be held under normal outfall conditions.

10.6.26 These measures will allow the system to operate normally for a period of time; however, if adverse downstream conditions remain or a subsequent large rainfall event occurs before the system has been able to drain down, this may result in pipework and storage areas being overloaded with consequential flooding. Any flooding that does occur will be managed by the measures implemented to control surface water flooding.

10.6.27 In light of the above, the proposed mitigation measures allow the impact significance of the local surface water sewerage system on the Proposed Development to be reduced from moderate adverse to **Minor Adverse**.

Foul Water Sewerage

Construction

10.6.28 As the pre-mitigation impact significance of the local foul water sewerage system on the Proposed Development during construction is **Negligible**, no mitigation measures are required.

Post-Development

10.6.29 Severn Trent Water is currently undertaking a Sewer Capacity Assessment to establish available capacity within its off-site network, and where upgrade works must be implemented to enable the Proposed Development to be served. It is anticipated that the necessary upgrade works will be undertaken before or during the construction of the first phase of the development. This will ensure that capacity is made available within the local foul water sewerage system in advance of development occupation.

10.6.30 On this basis, the described mitigation measures enable the impact significance of the local foul water sewerage system on the Proposed Development to be reduced from substantial adverse to **Negligible**.

Water Quality – Watercourses

Construction

- 10.6.31 As the pre-mitigation impact significance of watercourse water quality on the Proposed Development during construction is **Negligible**, no mitigation measures are required.

Post-Development

- 10.6.32 As the post-development, pre-mitigation impact significance of watercourse water quality on the Proposed Development is **Negligible**, no mitigation measures are required.

Water Quality – Groundwater

Construction

- 10.6.33 As the pre-mitigation impact significance of groundwater water quality on the Proposed Development during construction is **Negligible**, no mitigation measures are required.

Post-Development

- 10.6.34 As the post-development, pre-mitigation impact significance of groundwater water quality on the Proposed Development is **Negligible**, no mitigation measures are required.

Water Supply

Construction

- 10.6.35 As the pre-mitigation impact significance of the local water supply infrastructure on the Proposed Development during construction is **Negligible**, no mitigation measures are required.

Post-Development

- 10.6.36 As the post-development, pre-mitigation impact significance of the local water supply infrastructure on the Proposed Development is **Negligible**, no mitigation measures are required.

From the Proposed Development Site

Fluvial Flooding

Construction

- 10.6.37 In order to mitigate the risk of exacerbating fluvial flooding during construction, cut off drains and storage areas will be used to intercept any run-off and ensure that it is released into the Hall Brook at a flow rate not exceeding the existing average annual run-off rate for the site (north catchment: 137.3l/s; south catchment: 30.1l/s). These features will either be temporary, existing solely for the duration of the construction phase, or parts of the permanent drainage system that will ultimately serve the whole Proposed Development. The construction programme will ensure that these works are implemented early in the construction process to provide protection as quickly as possible. The design standard of the mitigation measures will depend on whether they are temporary or permanent. Permanent works will be designed to operate correctly for events up to and including the 1 in 100-year +30% rainfall event. Temporary works will exist for a shorter period of time hence will be designed to accommodate the 1 in 30-year event, given the temporary nature of Construction period.

- 10.6.38 There remains a risk of downstream fluvial flooding if a storm event occurs that exceeds the design standard of the mitigation measures potentially causing them to overflow in an uncontrolled manner. The design standards of the mitigation measures have been selected to minimise the probability of such an occurrence over the duration of the works. For this reason, the impact significance of fluvial flooding from the Proposed Development during construction, once mitigation measures are implemented, is reduced from substantial adverse to **Minor Adverse**.

Post-Development

- 10.6.39 The Proposed Development will incorporate a positive surface water drainage system which will limit the flows discharged into the Hall Brook to the existing annual average run-off rate less 20%, which equates to a flow rate of 80.4l/s. This will be achieved through a series of storage areas, including SuDS techniques, and flow controls distributed throughout the Proposed Development.

10.6.40 It should be noted that the flow rate discharged into the Hall Brook for all rainfall events up to and including the 1 in 100-year +30% rainfall event will be limited to the existing average annual discharge rate (1 in 2.33-year event) less 20%. This provides a downstream benefit when compared to the existing situation as the flow rates discharged from the Proposed Development into the Hall Brook will be limited to a lower rate than would be discharged by the Application Site in its current condition for the same rainfall event. Table 12.7 below, taken from the Flood Risk Assessment (Table 6-2), demonstrates the degree of flow rate reduction achieved for increasingly extreme events.

Table 10.7 Comparison between pre- and post-development flow rates into the Hall Brook

Return period (years)	Existing flow rate (l/s)	Post-development flow rate (l/s)	Flow reduction
1	112.3	62.0	44.8%
2	121.7	74.5	38.8%
QBAR (2.33)	137.3	80.4	41.4%
5	168.6	86.7	48.6%
10	204.2	92.8	54.6%
20	243.6	94.2	61.3%
30	268.3	94.5	64.8%
50	301.8	95.7	68.3%
75	331.4	98.2	70.4%
100	352.5	100.1	71.6%
100 + 30%	458.3	109.4*	76.1%

* Existing QBAR less 20%

10.6.41 A risk remains of a rainfall event occurring that exceeds the capacity of the storage and flow controls; however, the reductions in flow rate entering the Hall Brook that will be provided by the proposed drainage strategy will ensure capacity is available within the watercourse to accommodate such an event. This will limit the downstream impact.

10.6.42 In light of the above, the proposed mitigation measures allow the post-development impact significance of fluvial flooding from the Proposed Development to be reduced from substantial adverse to **Substantial Beneficial**.

Surface Water Flooding

Construction

10.6.43 Temporary cut-off drains and bunds will be used during construction to intercept and direct any surface water run-off away from flow routes that could adversely affect properties or cause water to flow onto the public highway. This is specifically applicable in the south-eastern section of the site.

10.6.44 There is a residual risk of the mitigation measures being overwhelmed during an extreme rainfall event. In addition, it is possible that run-off could by-pass any interception measures if these are not progressively changed as construction works proceed. Give the low probability of these events, the proposed mitigation measures enable the impact significance for surface water flooding during the construction phase to be reduced from moderate adverse to **Negligible**.

Post-Development

10.6.45 The Proposed Development will incorporate a positive surface water drainage system that will intercept surface water run-off from roof and paved areas and prevent it from leaving the site in an uncontrolled manner. The system is anticipated to incorporate collection measures such as gullies, linear drainage channels and open ditches. Run-off will also be slowed down through the use of SuDS techniques.

10.6.46 An extreme rainfall event could overwhelm the collection measures; however, any excess run-off will flow over the surface to the next available collection point that has sufficient capacity. On this basis, the mitigation measures enable the post-development significance for surface water flooding to be reduced from moderate adverse to **Negligible**.

Groundwater Flooding

Construction

- 10.6.47 Any emerging groundwater will be intercepted and controlled using similar techniques to those employed to mitigate the impact of surface water flood risk. In addition to ditches and bunds, it may also be necessary to employ pumps and other groundwater lowering techniques in specific areas to reduce the risk of flooding. The anticipated low rate of groundwater flooding is such that mitigation measures could be put in place during the event to prevent any off-site impacts. Therefore, with the proposed mitigation measures, the impact significance for groundwater flooding during construction from the Proposed Development is reduced from moderate adverse to **Negligible**.

Post-Development

- 10.6.48 As the post-development, pre-mitigation impact significance of flooding from groundwater from the Proposed Development is **Negligible**, no mitigation measures are required.

Sewer Flooding

Construction

- 10.6.49 In order to limit the amount of sediment that could be deposited into the local sewerage network the Contractor must implement measures to intercept any mobilised material before it can enter the pipework. It is anticipated that this will involve the use of settlement basins and other sediment control methods within the Application Site. In addition, the amount of soil deposited on the public highway by construction vehicles will be limited by the use of wheel washing facilities at all site access points. Frequent sweeping of the highway adjacent to the site access will remove any deposited material before it is mobilised by run-off.

- 10.6.50 These mitigation measures mean that the impact significance of sewer flooding from the Proposed Development during construction is reduced from moderate adverse to **Negligible**.

Post-Development

- 10.6.51 Severn Trent Water is currently undertaking a Sewer Capacity Assessment to establish the location and extents of any off-site upgrade works on the local foul water sewerage system. The implementation of the findings of this study will prevent the additional foul water flows from the Proposed Development causing flooding on any part of the foul water network.

- 10.6.52 Surface water flows from the south-eastern section of the Proposed Development into the local surface water sewerage network will be limited to the existing average annual run-off rate from this part of the Application Site, less 20%. This equates to a flow rate of 24.1l/s. As the proposed outfall from the south-eastern section of the site will be directly into a public sewer, the flow limit applies to all rainfall events up to and including the 1 in 30-year event. By limiting the discharge rate from the 1 in 30-year rainfall event to the annual average flow rate there will be downstream benefits as the flow rates entering the system from more extreme events will still be limited to a lower flow rate. This represents an improvement on the current situation.

- 10.6.53 On the basis of the above, the mitigation measures reduce the post-development impact significance of sewer flooding from the Proposed Development from moderate adverse to **Negligible**.

Flooding from Artificial Sources

Construction

- 10.6.54 As the pre-mitigation impact significance of flooding from artificial sources from the Proposed Development during construction is **Negligible**, no mitigation measures are required.

Post-Development

- 10.6.55 As the post-development, pre-mitigation impact significance of flooding from artificial sources from the Proposed Development is **Negligible**, no mitigation measures are required.

Surface Water Sewerage

Construction

- 10.6.56 The control of sediment entering the local surface water sewerage system is the primary mitigation measure required to limit the impact of construction activities on the system. The south-eastern corner of the site is the main source of silt and other materials that could enter the local sewerage network as run-off from this area sheds flows onto the public highway. Silt trapping measures such as sedimentation basins will be required to mitigate this risk. Additionally, to control the quantity of silt washed into the local sewerage network from the public highway, a regime of road sweeping in conjunction with wheel washing for all construction vehicles will be implemented at all site accesses.
- 10.6.57 The implementation of these mitigation measures mean that the post-mitigation impact significance on the local surface water sewerage system from the Proposed Development during construction is reduced from moderate adverse to **Negligible**.

Post-Development

- 10.6.58 The surface water discharge rate into the existing surface water sewerage within Sandpits Lane will be limited to the existing annual average greenfield run-off rate less 20%, a flow rate of 24.1l/s. As this flow is being discharged into a sewer, this rate applies for all rainfall events up to and including the 1 in 30-year event; therefore, there are downstream benefits as the flow rates entering the system from more extreme events will still be limited to a lower flow rate than currently occurs within the system. This represents an improvement on the current situation.
- 10.6.59 On this basis, the mitigation measures allow the post-development impact significance on the local surface water sewerage system from the Proposed Development to be reduced from substantial adverse to **Minor Beneficial**.

Foul Water Sewerage

Construction

- 10.6.60 During construction, the options for mitigating the impact of additional foul water flows entering the local foul water sewerage system are limited; however, the flow rates will be low. It may be possible to programme the off-site capacity improvements to be undertaken early during the construction phase hence the impact will be of limited duration. Once the works are completed, capacity for the whole development will be available hence the foul contribution from the construction phase will have no adverse impact.
- 10.6.61 On the basis of the above, until the upgrade works are completed, the post-mitigation impact significance of the Proposed Development on the foul water sewerage system during construction remains unchanged as **Minor Adverse**. On completion of the upgrade works, the impact significance reduces from minor adverse to **Negligible**.

Post-Development

- 10.6.62 Severn Trent Water is currently undertaking a Sewer Capacity Assessment to determine where off-site improvement works are required to provide sufficient capacity to enable the Proposed Development to connect into the local system. These works will be undertaken during the early phases of the Proposed Development to ensure that capacity is available for all the dwellings within each phase. The off-site works will ensure that the Proposed Development will not adversely affect the local foul water sewerage system; therefore, the post-development impact significance of the Proposed Development on the local foul water sewerage system reduces from substantial adverse to **Negligible**.

Water Quality – Watercourses

Construction

- 10.6.63 During construction, measures will be put in place to limit the amount of silt and other pollutants that are able to reach the Hall Brook. Silt can be controlled through the use of traps and sedimentation basins. Filters formed of straw bales with a geotextile wrap can be placed within the Hall Brook to limit the degree to which silt can be carried downstream in the event that it enters the channel.
- 10.6.64 The risk of fuel and other oils entering the watercourse can be controlled by limiting where refuelling activities can take place, placing static plant such as pumps on spill trays, ensuring that all plant is well maintained in order to prevent leaks and having spill kits available to clear up any spills. Oil booms will be deployed within the Hall Brook together with the silt filters to intercept contaminants that enter the

channel. The impacts associated with other contaminants can be controlled by limiting where materials are stored and ensuring that appropriate containment measures are put in place to limit their movement over the surface of the site.

- 10.6.65 These mitigation measures are generally reliant on regular maintenance to ensure that they remain effective and site operatives complying with procedures that are put in place. There is also the risk of an accident spill or other release of pollutants that exceeds the capacity of the mitigation measures. On this basis, the mitigation measures allow the impact significance of construction on watercourse water quality to be reduced from substantial adverse to **Minor Adverse**.

Post-Development

- 10.6.66 The development proposals include a surface water drainage system that incorporates SuDS techniques. These will intercept and treat pollutants that are generated by run-off from highway and other hardstanding areas. The system is designed to provide one level of water treatment for roof run-off and at least two levels for run-off from other surfaces.
- 10.6.67 Surface water from paved areas will be passed through trapped gullies and potentially over filter strips and into filter drains. These will remove suspended solids and also separate out a proportion of any oils that are present. All flows also pass through ponds that will incorporate reed beds areas which will provide a degree of biological treatment. For non-residential areas that are identified as posing a significant pollution risk, interceptors will be installed to clean run-off before it is discharged further downstream.
- 10.6.68 The risk remains, albeit small, of a pollution event that could overwhelm the trapping, filtration and treatment capacity of the measures incorporated into the drainage system – fuel spillage from a removal van/refuse vehicle. Under such circumstances it is possible that water quality in the Hall Brook could be adversely affected. The proposed drainage system will provide an opportunity to contain any pollutants from a serious event within the site. On this basis, the mitigation measures enable the post-development impact significance of the Proposed Development on watercourse water quality to be reduced from substantial adverse to **Negligible**.

Water Quality – Groundwater

Construction

- 10.6.69 During construction, controls must be put in place to reduce the risk of pollutants such as oil, diesel and other construction related chemicals being spilled on the ground surface and then infiltrating. The risk of fuel and other oils being spilled can be controlled by limiting where refuelling activities can take place, placing static plant such as pumps on spill trays, ensuring that all plant is well maintained in order to prevent leaks and having spill kits available to clear up any spills.
- 10.6.70 The impacts associated with other contaminants can be controlled by limiting where materials are stored and ensuring that appropriate containment measures are put in place to limit the degree of infiltration that can occur. This may involve the use of impermeable membranes over the surface of the ground, spill trays and other containment measures.
- 10.6.71 These mitigation measures are generally reliant on regular maintenance to ensure that they remain effective and site operatives complying with procedures that are put in place. There is also the risk of an accident spill or other release of pollutants that overwhelm the mitigation measures. On this basis, the mitigation measures enable the impact significance of construction on watercourse water quality to be reduced from moderate adverse to **Minor Adverse**.

Post-Development

- 10.6.72 The impermeable surfaces introduced by the proposed development will reduce the areas where infiltration can occur. In addition, the likely sources of any spilled substances, generally vehicles, will tend to be located on these impermeable areas rather than open ground. This provides an opportunity for the pollutants to be contained and removed before they can reach an area where infiltration is possible.
- 10.6.73 The development proposals include a surface water drainage system incorporating SuDS techniques. These will intercept and treat pollutants that are mobilised by run-off from highway and other hardstanding areas. The systems provide an opportunity for filtration and biological treatment before

the run-off reaches an area where infiltration could occur hence the quality of any water entering the ground will be improved.

- 10.6.74 The risk remains of a pollution event that could overwhelm the trapping, filtration and treatment capacity of the measures incorporated into the drainage system. Under such circumstances it is possible that contaminated run-off could infiltrate into the ground and pollute groundwater. The proposed drainage system will provide an opportunity to contain any pollutants from a serious event within the site; however, this is dependent on the timely operation of penstocks and other isolation measures. Taking into consideration the mitigation measures and residual risks, the post-development impact significance of the Proposed Development on groundwater quality is reduced from moderate adverse to **Negligible**.

Water Supply

Construction

- 10.6.75 The mitigation measures required during construction are subject to discussions with Severn Trent Water to establish whether sufficient capacity is available for the anticipated demand during construction without undertaking any changes to the distribution network. If necessary, the capacity improvements, understood to involve the removal of a pressure reducing valve, will be undertaken early during the construction process to ensure sufficient water supply for the site.
- 10.6.76 Undertaking the capacity improvements, if necessary, on the local supply network will ensure that there is sufficient capacity available for the Application Site during construction; therefore, there are no residual impacts. On this basis, the impact significance on the water supply system during construction reduces from minor adverse to **Negligible**.

Post-Development

- 10.6.77 It is known that local distribution network capacity improvements, including the removal of a pressure reducing valve, are required to ensure sufficient water supply capacity for the Proposed Development. Severn Trent Water will be consulted regarding the scope of the capacity improvements required and the timescale for their implementation to ensure that sufficient capacity is available for each phase of the development.
- 10.6.78 The mitigation measures will ensure that the Proposed Development will have no impact on water supply hence the post-development impact significance on the water supply system reduces from moderate adverse to **Negligible**.

10.7 Summary

Introduction

- 10.7.1 This chapter within the Environmental Statement has identified the likely significant environmental effects of the Proposed Development in respect of the water resources, flood risk and the wider water environment. Relevant content is drawn from the Flood Risk Assessment (reference: 5116695-R.001) which forms an appendix of this document.
- 10.7.2 The baseline conditions present on the Application Site have been identified and the likely significant effects both to and from the Proposed Development have been discussed. Where necessary and appropriate, suitable mitigation measures have been identified.
- 10.7.3 The following highlights the key findings of this chapter, and identifies the issues that must be considered in the detailed design of the Proposed Development.

Baseline Conditions

- 10.7.4 The Hall Brook, running along the northern boundary of the site, is a potential source of fluvial flooding to the Application Site. Modelling has shown that the site, with the exception of a narrow strip along the northern boundary is located within Flood Zone 1 (low risk). Beyond the site boundary, local residents on Watery Lane, Bennetts Road South and Penny Park Lane have reported flooding partly originating from the culverted section of the Hall Brook downstream of the site.
- 10.7.5 The Application Site is not subject to significant surface water flooding by virtue of its topography, a number of field drains and other ditches, and a lack of large paved areas at an elevation above that

of the site. Coventry City Council and local residents have both reported that Bennetts Road South and Watery Lane beyond the site boundary are subject to surface water flooding.

- 10.7.6 According to the Coventry City Council Preliminary Flood Risk Assessment, the Application Site has the lowest risk, 25%, of groundwater flooding. The soils are primarily described as freely draining with those adjacent to the Hall Brook having impeded drainage. Anecdotal reports and site observations have shown that some parts of the Application Site become very wet; however, these are isolated areas. While the likelihood of such an occurrence is low, any emerging groundwater, as with surface water, would flow over the surface and be intercepted by the Hall Brook or one of the existing field drains; accumulation is deemed unlikely due to site topography.
- 10.7.7 The Application Site is not considered to be at risk from flooding associated with the local surface or foul water sewerage networks. There are areas, believed to be north of the Application Site, where a number of existing properties are included on the Severn Trent Water DG5 register.
- 10.7.8 A potential risk of flooding has been identified from artificially impounded fish ponds located to the north-west of the Application Site. There are no previous records of flooding from these features. Modelling has shown that the anticipated flood extents in the event of an impoundment failure will be very similar to the 1 in 100-year +20% flood event on the Hall Brook. The effects of a failure would spread beyond the Application Site downstream to Watery Lane and the Hall Brook culvert.
- 10.7.9 There are a number of foul water/combined sewers in the vicinity of the Application Site along both Bennetts Road South and Sandpits Lane. These are all small diameter (150mm). Severn Trent Water has stated that the local foul water sewerage system is working at or close to its effective capacity.
- 10.7.10 The local surface water sewerage system is limited to a short length of Sandpits Lane and the junction between Bennetts Road South and Sandpits Lane. These sewers all drain towards a watercourse, a tributary of the Hall Brook, immediately adjacent to the junction. No issues have been identified associated with surface water sewerage in this area; however, there are anecdotal reports of surface water flooding on Bennetts Road South that could be linked to the surface water sewerage system.
- 10.7.11 The Hall Brook will be the receptor, either directly or indirectly, of all the surface water run-off from the Proposed Development. The current Water Framework Directive assessment for the Hall Brook is *poor* and *good* for ecological and chemical indicators respectively. According to the Environment Agency website, this status is expected to remain into the future.
- 10.7.12 According to Environment Agency information, the Application Site is located within Source Protection Zone 3, and the quantitative and chemical quality of the groundwater is classified as poor. There is no change in quality expected in the future.
- 10.7.13 Severn Trent Water has advised that there are currently sufficient water resources to provide the Proposed Development with a water supply. Issues have been identified associated with the local water distribution network that currently limit the capacity available to serve any new development. The cause of this has been identified as a pressure reducing valve, the removal of which would resolve the matter.

Likely Significant Effects

- 10.7.14 Flooding from surface water and groundwater has been identified as the most significant impacts on the Application Site during construction. Once the site has been completed, these are added to by sewer flooding and the impact of the local surface and foul water sewerage systems.
- 10.7.15 During construction, the impacts are primarily associated with disruption of construction activities. Once the development has been completed, the flood risks with the most potential impact are those that are generated internally and could result in the new properties flooding. Local sewerage infrastructure has an impact on the Proposed Development because the capacity issues that have been identified could affect whether the new dwellings can be occupied.
- 10.7.16 The impacts generated by the Proposed Development both during construction and on completion fall into one of three categories:
- Worsening of off-site flood risk – either as a result of additional flows or diversion of existing flows.

- Overloading of existing infrastructure – surface and foul water sewerage systems and the water distribution network.
- Degradation of existing water quality – caused by construction activities and the placement of more polluting land uses closer to receptors.

Mitigation and Enhancement

10.7.17 The following mitigation measures are proposed for use during construction and for inclusion within the Proposed Development in order to address the impacts that have been identified:

- Careful storage of construction materials and plant to ensure that they are not damaged in the event of a flood. The materials will also be appropriately contained to ensure that they do not cause a pollution incident if immersed in the floodwater.
- Planning of construction activities (as part of the Construction Environment Management Plan, CEMP) to avoid creating areas where floodwater could accumulate, ensuring that existing flood flow paths are not blockage and that new flow paths are not created.
- Ensure that groundwater control measures, such as pumps, are available throughout construction.
- Maintain a regime of inspecting existing sewers within and adjacent to the Application Site throughout construction to check for damage and accumulation of debris. If any defects are identified, these must be rectified.
- Sediment control measures, wheel washing and regular road sweeping will be put in place at all site access points to limit the amount of soil and other material that could be washed into the local sewerage system.
- Watercourse water quality will be maintained through the use of silt traps and filter, sedimentation basins, controls on vehicle refuelling, use of spill trays, regular plant maintenance to control leaks, floating oil booms and having spill kits available to contain any pollutants. Similar measures will be used to ensure groundwater is not polluted.
- The maximum post-development discharge rate into the Hall Brook will be limited to 137.3l/s (existing average annual run-off rate less 20%) for all rainfall events up to and including the 1 in 100-year +30% event. Flow controls must be put in place as soon as possible within the construction sequence to ensure that downstream protection is provided.
- The maximum post-development discharge rate into the existing surface water sewerage system will be limited to 24.1l/s (existing average annual run-off rate less 20%) for all rainfall events up to and including the 1 in 30-year event. Flow controls must be put in place as soon as possible within the construction sequence to ensure that downstream protection is provided.
- The surface water drainage system will incorporate SuDS techniques to intercept, store and treat surface water run-off from the Proposed Development before it is discharged from the site.
- All parts of the new drainage systems serving the Proposed Development must be designed in accordance with the legislation, standards, guidance and best practice applicable at the time.
- The proposed surface water drainage system serving the Proposed Development will be designed to manage adverse off-site conditions in terms of surcharged outfalls that restrict the flow rate that can be discharged below the original design rate.
- Design all dwellings to have a finished floor level at least 0.15m above adjacent external ground levels.
- If possible, design proposed ground levels to fall away from any buildings, both new and existing.
- Incorporate surface water overland flow corridors into the development proposals.
- Either implement directly or liaise with Severn Trent Water to ensure the implementation of the recommendations of the Sewer Capacity Assessment to address the capacity limitations within the local foul water sewerage system.
- Undertake works or liaise with Severn Trent Water for the necessary works to be undertaken to remove the pressure reducing valve that is currently restricting water supply capacity to the Application Site.

Conclusions

10.7.18 The Proposed Development is both impacted by and impacts upon the surrounding water environment. The mitigation measures proposed allow the various impacts to be addressed as far as is practicable. In some cases, a residual risk remains; however, the mitigation measures attempt to ensure that likelihood of such an event occurring is low and that the consequences will be adequately managed to limit any impact.

10.7.19 The mitigation measures associated with the control of flow rates entering the Hall Brook and the existing sewerage system, and management of surface water flooding, represent an improvement on the existing situation with benefits in terms of lowered flood risk downstream. In this way, the Proposed Development is able to provide an improvement of the wider area and assist in addressing a recognised problem in the local area.