

GEOGRAPHIC IMPORTANCE	VALUE	CRITERIA
National	High	Rare, of national importance or recognition, limited potential for substitution, highly vulnerable to change. For example, national park, national heritage, protected in national legislation.
Regional / District	Moderate	Somewhat rare or vulnerable, county/district/local importance, difficult to substitute: For example: County Wildlife Sites etc.
District / Local	Low	Locally important, difficult to substitute at a local level, rare or unusual at the local level but well represented elsewhere. For example, Local Nature Reserves, local planning designations etc.
Local	Very low	Of limited importance or value, not vulnerable to change, can be readily substituted.

Table 8.2: Resource Sensitivity

KEY RECEPTORS	DESCRIPTION	SENSITIVITY
Human beings	Population which may be potentially affected by changes to water bodies and flood risk	High
Land and Property	General land and property which may be potentially affected by changes to water bodies and flood risk	Moderate
Heritage features	Scheduled Monuments near the Site could potentially be affected by changes to water bodies and flood risk	High
Future property forming part of the Proposed Development	Future property which may be potentially affected by changes to water bodies and flood risk	Low
River Cam	Fluvial and surface water flood risk	Moderate
Coldham's Brook and Tributary	Fluvial and surface water flood risk	Moderate
River Cam	Surface water quality	Moderate
Coldham's Brook and Tributary	Surface water quality	Moderate
Public Foul Sewer Network	Operational capacity and hydraulic performance	Low
Wastewater Treatment Facilities	Treatment capacity and ability to operate within discharge consent	Moderate
Water Resources (Local Aquifer)	Local groundwater supply capacity	Moderate
Water Resources (Mains Network)	Potable (mains) water supply capacity	Low
Water Resources (Local Abstraction)	Groundwater resources (boreholes) providing local potable water supply via a private abstraction licence	

KEY RECEPTORS	DESCRIPTION	SENSITIVITY
Water Resources (Strategic Abstraction)	Groundwater resources (boreholes) providing strategic potable water supply with the potential to directly or indirectly lead to harm to groundwater dependent receptors at unspecified locations	Moderate

Table 8.3: Significance Criteria

MAGNITUDE	SIGNIFICANCE	CHARACTERISTICS OF CHANGE
Major beneficial	Significant	The Proposed Development would remove features that adversely affect the existing environment, prevent further degradation, and enhance and protect the environment in the long-term.
Moderate beneficial	Significant	The Proposed Development would notably reduce rate of current degradation and/ or enhance existing character.
Minor beneficial	Significant	The Proposed Development would reduce rate of current degradation.
Neutral	Not significant	The Proposed Development would not result in any meaningful change to the receptor / resource.
Minor adverse	Significant	The Proposed Development would increase the rate of current degradation or introduce some minor detractors into the environment.
Moderate adverse	Significant	The Proposed Development would result in the partial loss of a resource or notably degrade a receptor environment.
Major adverse	Significant	The Proposed Development would result in the complete loss of a resource or compromise the integrity of a receptor such that its long term survival is highly unlikely.

Evaluation of Predicted Impacts During Construction Works

Fluvial Flood Risk

- 8.58 The Site is at low risk of fluvial flooding. No built development or land raising is proposed within the fluvial flood extents, therefore, no fluvial flood storage is displaced by the Proposed Development.
- 8.59 No increase in fluvial flooding elsewhere is generated by the construction of the Proposed Development, therefore, the likely effect upon fluvial flood risk would be a **temporary (short term), district / local, neutral effect of negligible significance**.
- 8.60 In the absence of mitigation, uncontrolled discharges of surface water runoff from the Site could lead to an increased risk of fluvial flood risk downstream. Due to the extensive impermeable coverage of the baseline Site, from which surface water is positively drained with a degree of attenuation and flow control, the likely effect of uncontrolled release of runoff during construction would be a **temporary (short term), district / local, adverse effect of minor significance**.

Surface Water (Pluvial) Flood Risk

- 8.61 No built development or land raising is proposed within significant overland surface water flow pathways, therefore, no surface water flood conveyance is displaced or affected by the Proposed Development.
- 8.62 The proposed construction works, including earthworks, removal of soft landscaping and trees, storage of construction materials and waste stockpiles, private sewer diversions and temporary construction drainage for the Site, would have the potential to alter the existing surface water runoff regimes during periods of heavy rainfall.
- 8.63 Overland surface water runoff could potentially be diverted away from existing private sewers and drainage channels during construction leading to the generation of localised overland surface water flood pathways.
- 8.64 In the absence of mitigation, uncontrolled discharges of surface water runoff from the Site could lead to an increased risk of surface water flood risk either downstream or across the Site. Due to the extensive impermeable coverage of the baseline Site, from which surface water is positively drained with a degree of attenuation and flow control, the likely effect of uncontrolled release of runoff during construction would be **temporary (short term), local, adverse effect of minor significance**.

Groundwater Flood Risk

- 8.65 The Proposed Development comprises low to mid-rise structures supported by piled foundations. Piling methods will be informed by detailed Ground Investigation (inherently secured via standard planning conditions attached to any future planning consent) and specified to minimise interaction with groundwater and the potential environmental effects, which are not anticipated to give rise to significant impacts on groundwater flood risk.
- 8.66 Basements are proposed at selected locations across the Proposed Development, broadly spread across the Site with significant lateral distances maintained between basement excavations. Groundwater flow beneath the Site is anticipated to be minor based upon the hydrological profile established in Chapter 9 : Ground Conditions and Contamination, therefore, no hindrance to groundwater movement leading to elevated groundwater flood risk would be anticipated.
- 8.67 Groundwater monitoring, carried out as part of the preliminary Ground Investigation (as described within **Appendix 9.1**), indicated the presence of perched groundwater within some boreholes and trial pits at shallow depth, therefore, basement excavations are expected to encounter groundwater during construction.
- 8.68 Limited reprofiling of the baseline landform is proposed to form the development platform of the Proposed Development. Therefore, there are no anticipated impacts on groundwater flood risk due to depths of cut and fill remaining shallow.
- 8.69 Based on the above information, it is considered that basement excavation works could lead to an increase in flood risk from groundwater on-site or off-site, and the likely effect during construction would be **temporary (short term), local, adverse effect of minor significance**.

Artificial Sources Flood Risk

- 8.70 The Site is not at risk of flooding in the event of a failure or overtopping of a reservoir or other artificial waterbody in the area, and the risk of flooding from public sewers is low. The proposed

construction works do not include any works that would impact the existing artificial waterbodies in the vicinity. Therefore, the likely effect of flood risk from artificial sources during construction would be a **temporary (short term), local, neutral effect of negligible significance**.

Surface Water Quality

- 8.71 Proposed construction works would temporarily alter the Site surface conditions, and could potentially give rise to adverse effects on surface water from release of sediments and contaminants into local water bodies. Therefore, the likely effect on surface water quality from release of sediments and contaminants during construction would be a **temporary (short term), district / local, adverse effect of minor significance**.
- 8.72 Spillage or leakage of fuels or chemicals into the private drainage networks could potentially give rise to adverse effects on surface water from release of contaminants into local water bodies. Therefore, the likely effect on surface water quality from spillage or leakage during construction would be a **temporary (short term), district / local, adverse effect of minor significance**.

Foul Water Infrastructure Capacity

- 8.73 Wastewater generation from the construction works would include effluent from sanitary facilities, as well as sediment-laden water from excavations, dust suppression, washing down and wheel wash facilities. During the works, it is expected that foul water would be drained via existing private sewer connections to the existing Anglian Water sewer network.
- 8.74 Whilst foul flows generated by the baseline Site are relatively low, foul flows generated during construction are unlikely to exceed the available capacity freed up within the public sewer network following termination of the existing retail usage across the baseline Site.
- 8.75 In the event that temporary or permanent connections to the public foul drainage system cannot be effectively made at an early stage, provisions would be made for temporary portable facilities for construction workers and visitors.
- 8.76 Without upgrades to the existing local foul drainage system, the likely effect on foul water infrastructure capacity during construction would be a **temporary (short term), local, adverse effect of minor significance**.

Water Resources

- 8.77 Potable water supply (mains) infrastructure serving the baseline Site would be utilised during construction, where practicable. Cambridge Water has confirmed that capacity is available within the potable water supply (mains) networks to serve the construction phase of the Proposed Development. No off-site network reinforcements are anticipated to be required to provide a potable water supply.
- 8.78 Potable water demand during construction is unlikely to exceed the available capacity freed up within the potable water supply network following termination of retail usage across the baseline Site. Taking into account some overlap of construction with operational phases anticipated across the Proposed Development demand is likely to marginally exceed the available capacity freed up within the potable water supply network.
- 8.79 However, in light of Cambridge Water pre-development application feedback, in the absence of third party upgrades to the local supply network system, the likely effect upon potable (mains)

water network capacity during construction would be a **temporary (short term), local, neutral effect of negligible significance**.

- 8.80 Provisions would also be made for re-use of harvested rainwater and basement dewatering volumes for washdown, dust suppression, etc during the demolition and construction works to reduce potable water demand.
- 8.81 Potable water demand for the construction phase, with some overlap of operational phases anticipated across the Proposed Development would only be partially offset by capacity freed up following termination of existing retail usage across the baseline Site. Whilst the local networks may have available capacity there is a potential requirement for strategic borehole abstraction to be marginally increased by Cambridge Water to serve the construction phase of the Proposed Development.
- 8.82 For local abstraction of groundwater to supplement water demand off mains' requiring a new private abstraction licence, the likely effect upon local groundwater resources during construction would be a **temporary (short term), district / local, adverse effect of minor significance**.
- 8.83 Based upon potable water demand being supplied via mains supply during construction, with some overlap of operational phases anticipated across the Proposed Development, provided that increased abstraction is not required from strategic supply boreholes, the likely effect of the Proposed Development on strategic groundwater resources would be a **temporary (short term), regional / district, neutral effect of negligible significance**.
- 8.84 Based upon potable water demand being supplied via mains supply during construction, with some overlap of operational phases anticipated across the Proposed Development, the likely effect upon regional groundwater resources and associated harm to environmental receptors only in the event that increased abstraction is required from strategic supply boreholes, would be a **temporary (short term), regional / district, adverse effect of minor significance**.

Evaluation of Predicted Impacts at Operational Development

Fluvial Flood Risk

- 8.85 The Site is at low risk of fluvial flooding. No built development or land raising is proposed within the fluvial flood extents, therefore, no fluvial flood storage is displaced by the Proposed Development.
- 8.86 No increase in fluvial flooding elsewhere is generated by the Proposed Development throughout its anticipated operational lifetime taking into account climate change, therefore, the likely effect of the development would be a **permanent (long term), district / local, neutral effect of negligible significance**.
- 8.87 In the absence of mitigation, uncontrolled discharges of surface water runoff from the Site could lead to an increased risk of fluvial flood risk downstream. Due to the extensive impermeable coverage of the baseline Site, from which surface water is positively drained with a degree of attenuation and flow control, the likely effects of uncontrolled release of runoff would be **permanent (long term), district / local, adverse effect of minor significance**.

Surface Water (Pluvial) Flood Risk

- 8.88 No built development or land raising is proposed within significant overland surface water

flow pathways, therefore, no surface water flood conveyance is displaced or affected by the Proposed Development.

- 8.89 The Proposed Development would have the potential to alter the existing surface water runoff regimes during periods of heavy rainfall by significantly modifying the extents and functionality of drainage sub-catchments across the baseline Site.
- 8.90 In the absence of mitigation, uncontrolled discharges of surface water runoff from the Site could lead to an increased risk of surface water flood risk either downstream or across the Site. Due to the extensive impermeable coverage of the baseline Site, from which surface water is positively drained with a degree of attenuation and flow control, and the proposed net reduction in impermeable area coverage attributed to the Proposed Development, the uncontrolled release of runoff could potentially give rise to a **permanent (long term), local, adverse effect of minor significance**.

Groundwater Flood Risk

- 8.91 Best practice basement design, informed by detailed Ground Investigation, (inherently secured via standard planning conditions attached to any future planning consent), including specification of tanking and waterproofing will be sufficient to resist ingress of groundwater.
- 8.92 Basement structures and foundations are non-continuous beneath the Site and would not be expected to lead to an increase in flood risk from groundwater on-site or off-site.
- 8.93 Owing to the presence of relatively shallow perched groundwater the likely effect of the Proposed Development on groundwater flood risk is therefore a **permanent (long term), local, adverse effect of minor significance**.

Artificial Sources Flood Risk

- 8.94 The Site is not at risk of flooding in the event of a failure or overtopping of a reservoir or other artificial waterbody in the area, and the risk of flooding from public sewers is low. The Proposed Development would pose no impact upon the existing artificial waterbodies in the vicinity, therefore, the likely effect of flood risk from artificial sources would be **permanent (long term), local, neutral effect of negligible significance**.

Surface Water Quality

- 8.95 Vehicular movements and external usage across the Proposed Development could potentially give rise to adverse effects on surface water from release of sediments and contaminants into local water bodies. The likely effect on surface water quality would be a **permanent (long term), district / local, adverse effect of minor significance**.
- 8.96 Due to the extensive impermeable coverage of the baseline Site, from which surface water is positively drained with proprietary pollution control in the form of hydrocarbon bypass interceptors, the likely effects on surface water quality, without mitigation, would be a **permanent (long term), district / local, adverse effect of minor significance**.

Foul Water Infrastructure Capacity

- 8.97 Proposed land usage associated with the Proposed Development would result in an increase in foul water discharge from the Site from that generated by the baseline Site.
- 8.98 A pre-development enquiry has been made to Anglian Water to determine whether the existing public sewerage infrastructure has the capacity to accommodate the Proposed Development,

however, at the time of preparing this chapter, a response has not yet been received. Based on the anticipated peak foul discharge rate, without local and/or strategic reinforcement works by Anglian Water to ensure that sufficient capacity is provided, it is likely that the Proposed Development would have a **permanent (long term), local, adverse effect of minor significance**.

Water Resources

- 8.99 Proposed land usage associated with the Proposed Development would result in an increase in potable water demand from that required by the baseline Site. Total water demand has been estimated to be 188,130 litres/day.
- 8.100 A pre-development enquiry has been made to Cambridge Water to determine whether the existing public water supply (mains) network has the capacity to accommodate the Proposed Development.
- 8.101 Water has confirmed that capacity is available within the potable water supply (mains) networks to serve the Proposed Development. No off-site network reinforcements are anticipated to be required to provide a potable water supply.
- 8.102 Upon the grant of a planning consent, Cambridge Water would also have an obligation, under the terms of the regulator Ofwat, to provide sufficient resilience within the water supply network to accommodate the Development without detriment to the water environment or water resources. Therefore, the likely effect of the Proposed Development on potable (mains) water supply network capacity would be a **permanent (long term), local, adverse neutral effect of minor negligible significance**.
- 8.103 No local abstraction of groundwater to supplement water demand 'off mains' requiring a new private abstraction licence is proposed as part of the Proposed Development. As a result, the likely effect of the Proposed Development upon local groundwater resources would be a **permanent (long term), district / local, neutral effect of negligible significance**.
- 8.104 Potable water demand post-occupation of early phases of the Proposed Development would only be partially offset by capacity freed up following termination of retail usage across the baseline Site. Whilst the local mains supply networks may have available capacity there is a potential requirement for strategic borehole abstraction to be marginally increased by Cambridge Water to serve the early phases of the Proposed Development, which has the potential to directly or indirectly lead to significant effects and harm to associated sensitive environmental receptors.
- 8.105 Based upon potable water demand being supplied via mains supply, and provided that increased abstraction is not required from strategic supply boreholes, without strategic mitigation, the likely effect of the Proposed Development on local strategic groundwater resources during early development phases would be a **permanent (short / medium term), regional / district / local, adverse neutral effect of minor negligible significance**.
- 8.106 Based upon potable water demand being supplied via mains supply, and only in the event that increased abstraction was required from strategic supply boreholes, and prior to the third party implementation of strategic mitigation and reinforcements without strategic mitigation, the likely effect on strategic groundwater resources over the operational lifetime of the Proposed Development would be a **permanent (long term), regional / district, adverse effect of minor significance**.

Mitigation

Flood Risk and Drainage

- 8.107 As set out within **Appendix 8.1: Flood Risk Assessment and Surface Water Drainage Strategy** the Proposed Development provides a net reduction in impermeable coverage together with the integration of a suite of SuDS measures both at building roof level and integrated within the external hard and soft landscape are proposed to manage surface water runoff in a sustainable manner, to reduce flood risk elsewhere, and to tackle climate change.
- 8.108 Integration of treatment trains and pollution control measures in tandem with bioretention tree pits and rain gardens within the SWDS will safeguard and improve water quality post-development.

Water Resources (Site)

- 8.109 The Applicant is committed to the delivery of an exemplar scheme embracing sustainability that includes driving down potable water demand for all areas of the Proposed Development within the Applicant's control.
- 8.110 The sustainability strategy for the Proposed Development is targeting the maximum 5 credits for BREEAM Wat 01 together with 1 additional 'exemplar' credit for rainwater harvesting and reuse. With the implementation of these measures the net potable water demand for the Proposed Development has been estimated to be 153,630 litres/day.
- 8.111 Specification of low flow outlets and efficient fittings within all buildings, and commitment to the integration of rainwater harvesting and reuse will reduce reliance upon mains water. Reuse is proposed for WC flushing at selected locations, facility for irrigation of external soft landscaping, and 'top up' of the proposed wetland (where appropriate to do so).

Water Resources (Strategic)

- 8.112 Responsibility for reinforcement and safeguarding future water supply falls to the statutory undertaker, in this instance, Cambridge Water. Responsibility for strategic reinforcement and improvements falls to Cambridge Water, not to individual developers.
- 8.113 At a strategic regional level, WRMP 24 sets out a proposed strategy and programme for Supply Options to be implemented by Cambridge Water, which includes:
- 15 MI/d of time limited transfers
 - 1.4MI/d of water re-use/recycling in development
 - 7MI/d of new resource – effluent re-use
 - 2MI/d of licence optimisation
 - 43.5MI/d of new regional reservoir and transfers (Fens)
- 8.114 In the WRMP 24, alongside options for abstraction and treatment from the River Cam and final treated effluent reuse at Milton Water Recovery Centre (WRC), the Fens Reservoir features as a regional option that is selected in the WRMP to meet the licence reductions resulting from and the environmental need to achieve good ecological status and enhance designated sites and chalk rivers.
- 8.115 Feasible options include transfer(s) from Fens Reservoir to the CAM Water Resource Zone

(WRZ). Fens Reservoir is a strategic resource option that is being developed in partnership with Anglian Water.

- 8.116 Fens Reservoir is an embanked winter storage reservoir, with 55 Mm³ of storage providing a useable volume of 50 Mm³ with a proposed yield of 87 Ml/d, shared equally between Cambridge Water and Anglian Water.
- 8.117 With an anticipated start date on site of 2029 Fens Reservoir could be in supply between 2035 and 2037.

Secondary Mitigation

Best Practice Working Techniques

- 8.118 A number of secondary mitigation measures, taking the form of best practice working techniques, will provide inherent mitigation of temporary, local adverse effects on the local water environment during demolition and construction.
- 8.119 Adoption of best working practices and measures to protect the water environment, including those set out in the EA's Guidance for Pollution Prevention (GPPs), most notably:
- GPP1 (Understanding your environmental responsibilities - good environmental practices);
 - Bunding of all above ground fuel and chemical storage, safe storage and disposal of materials in line with GPP2, GPP8 and GPP26;
 - GPP4 (Treatment and disposal of wastewater where there is no connection to the public foul sewer) to ensure effective management and disposal of effluent;
 - GPP6 (Working at construction and demolition sites);
 - Pollution incident response planning, and an emergency spill response kit would be maintained on-site during construction, to limit the consequence of a pollution event in line with GPP21 and GPP22.

Pollution Prevention

- Any facilities, above ground, for the storage of oils, fuels or chemicals shall be sited on impervious bases and surrounded by impervious bund walls.
- The volume of the bunded compound should be at least equivalent to the capacity of the tank plus 10%.
- All filling points, vents, gauges and sight glasses must be located within the bund.
- The drainage system of the bund shall be sealed with no discharge to any watercourse, land or underground strata.
- Associated pipework should be located above ground and protected from accidental damage.
- All filling points and tank overflow pipe outlets should be detailed to discharge into the bund.
- Prior to being discharged into any watercourse, surface water sewer or soakaway system, all surface water drainage from lorry parks and/or parking areas for fifty car park spaces or more and hardstandings should be passed through an oil interceptor designed compatible with the site being drained. Roof water shall not pass through the interceptor.

- Prior to being discharged into any watercourse, surface water sewer or soakaway system, all surface water drainage from parking areas and hard standings susceptible to oil contamination shall be passed through an oil separator designed and constructed to have a capacity and details compatible with the site being drained. Roof water shall not pass through the interceptor.
- Foul and surface water manhole covers should be marked to enable easy recognition, convention is red for foul and blue for surface water. This is to enable water pollution incidents to be more readily traced.

Sustainable Drainage Design Standards

- 8.120 Infiltration SuDS will require a minimum of 1.2m clearance between the base of infiltration SuDS and peak seasonal groundwater levels to maintain an unsaturated zone beneath to capture pollutants. All will be designed to meet the criteria in GPP1 – GPP13 and would not be constructed in ground affected by contamination.

Construction Environmental Management Plan

- 8.121 A Construction Environmental Management Plan (CEMP) has been prepared for the Proposed Development. This reviews all anticipated activities necessary to construct the Proposed Development, and provides detail on appropriate fuels, oils and chemical storage, demolition procedures, soil handling and storage techniques to prevent dust emissions or surface run-off causing impacts to off-site residents and users. This includes measures such as:
- Stockpiling of soils on plastic sheeting with bunds, and the use of hoarding around the perimeter of the Site to contain dust or surface run-off from exposed soils and stockpiles;
 - Using dust screens and covers and the appropriate location of dusty materials storage;
 - Effective silt management and suppression of dust and air-borne particulates;
 - Damping down of surfaces during dry weather;
 - Vehicle management systems, signage and road markings would be put in place wherever possible during construction and operation to reduce the potential conflicts between vehicles and thereby reduce the risk of collision;
 - Speed limit enforcement on Site to reduce the likelihood and significance of any collisions;
 - Using wheel washing facilities on the Site;
 - Avoidance of stockpiling contaminated materials where possible;
 - Appropriate storage and handling practices for any potentially contaminative fuels, oils or chemicals brought on-Site to facilitate the works.
- 8.122 Water resource measures and safeguards will be embedded within the CEMP, which could involve reuse of harvested rainfall and volumes of water generated by dewatering of excavations, for vehicle washdown, dust suppression, and for establishment of soft landscaping and newly planted trees. These procedures will minimise the potential for impacts to all identified receptors at or surrounding the Site. The CEMP can be secured by planning condition.
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Strategic Water Resources

- 8.123 At a strategic regional level, Cambridge Water are committed to making sure that the volume of water they take from the environment is sustainable. They will work with the EA to determine if

there is a potential impact, and if there is, to identify any measures that they need to take to put a workable solution in place.

- 8.124 WRMP19 strategy is based on new and innovative approaches, to reduce demand in the Cambridge region, including:
- 15% reduction in leakage by 2024/25 (equating to 2Ml/day reduction);
 - continuing to increase the number of customers who choose to have a water meter over the next 15 years; and
 - reducing the volume of water every person in the Cambridge region uses each day ('per capita consumption') to an average of 132litres per person per day (l/p/d) in 2024/25. This is anticipated to be driven lower (to 129 l/p/d) by 2044/45.
- 8.125 Within their supply aspects of WRMP19, Cambridge Water have already included some reductions in the volume of groundwater they historically used for our baseline supply forecast. They will make a further reduction in the volume of water they are entitled to take from the environment by about 6Ml/d where necessary to manage the risk of causing deterioration to that environment.
- 8.126 Cambridge Water also propose investment in new treatment processes at three of their groundwater sources (total volume almost 4Ml/d) to enable all three to be brought back into supply.
- 8.127 WRMP 24 sets out a proposed strategy and programme for Summary Demand Management which includes:
- 50% reduction in leakage (from 2017/18 levels) by 2050;
 - 10 l/h/d per capita consumption for households by 2050;
 - 9% reduction in non-household consumption by 2037.
- 8.128 Key enablers for this delivery are:
- Delivery of the Government's water labelling scheme for white goods by 2025;
 - Universal smart metering installed across the region by 2035.

Evaluation of Predicted Residual Impacts During Construction Works

Fluvial Flooding

- 8.129 Measures included within the CEMP will mitigate the potential impacts of the Proposed Development on fluvial flood risk elsewhere during construction.
- 8.130 Surface water runoff from the Site will be controlled by the retention and utilisation of attenuation storage and flow control arrangements serving the baseline Site until such time that SuDS and surface water management features serving the Proposed Development are constructed, or a suitable temporary drainage solution is implemented. Surface water attenuation and flow control arrangements serving phases of the Proposed Development will be constructed and operational prior to connection of impermeable areas from said phases to mitigate the risk of detrimentally affecting fluvial flood risk downstream. The resulting residual effect on fluvial flood risk would be a **temporary (short term), district / local, neutral effect of negligible significance**.

Surface Water (Pluvial) Flood Risk

- 8.131 Embedded mitigation measures within the CEMP will inherently mitigate the potential impacts of the Proposed Development on surface water flood risk elsewhere and within the Site during construction. Temporary drainage and storage arrangements and localised temporary private sewer diversions will be implemented where appropriate to control surface water runoff from the Site.
- 8.132 Surface water runoff from the Site will be controlled by the retention and utilisation of attenuation storage and flow control arrangements serving the baseline Site until such time that SuDS and surface water management features serving the Proposed Development are constructed, or a suitable temporary drainage solution is implemented. Surface water attenuation and flow control arrangements serving phases of the Proposed Development will be constructed and operational prior to connection of impermeable areas from said phases to on-site drainage networks. The resulting residual effect on surface water flood risk elsewhere would be a **temporary (short term), local, neutral effect of negligible significance**.

Groundwater Flood Risk

- 8.133 Measures within the CEMP will mitigate the potential impacts of the Proposed Development on groundwater flood risk elsewhere and within the Site during construction.
- 8.134 Construction methods will be informed by detailed Ground Investigation (inherently secured via standard planning conditions attached to any future planning consent) and dewatering of excavations will be undertaken where required to resist ingress of groundwater during construction.
- 8.135 Basement design will be informed by detailed Ground Investigation and tanking and waterproofing will be specified to resist ingress of groundwater, therefore, the likely effect of groundwater flood risk would be a **temporary (short term), local, neutral effect of negligible significance**.

Artificial Sources Flood Risk

- 8.136 No additional mitigation measures are required, therefore, the residual risk would remain a **temporary (short term), local, neutral effect of negligible significance**.

Surface Water Quality

- 8.137 Measures within the CEMP will mitigate the potential impacts of the Proposed Development on surface water quality during construction.
- 8.138 Appropriate sediment management, pollution control, and implementation of treatment trains within the temporary surface water drainage measures and basement excavation dewatering processes will manage surface water quality during construction, therefore, the resulting residual effect on surface water quality would be a **temporary (short term), district / local, neutral effect of negligible significance**.
- 8.139 Best practice and regulatory controls will seek to ensure that fuels and chemicals are appropriately stored, banded and managed during the construction phase, and spill kits will be available should any pollution incident occur. Therefore, the resulting residual effect on surface water quality would be a **temporary (short term), district / local neutral effect of minor / negligible significance**.

Foul Water Infrastructure Capacity

- 8.140 Measures within the CEMP will mitigate the potential impacts of the Proposed Development on foul water receptors during construction.
- 8.141 Sewer connection application(s), informed by impact studies where appropriate, will be submitted to and approved by Anglian Water prior to construction.
- 8.142 As described above, the anticipated residual effect would likely be a **temporary (short term), local, neutral effect of negligible significance**.

Water Resources

- 8.143 Cambridge Water has confirmed that capacity is available within the potable water supply (mains) networks to serve the construction phase of the Proposed Development. No off-site network reinforcements are anticipated to be required to provide a potable water supply.
- 8.144 Potable water supply connection application(s), informed by impact studies where appropriate, will be submitted to and approved by Cambridge Water prior to construction.
- 8.145 Upon the grant of a planning consent, the appointed water company would have an obligation, under the terms of the regulator OfWAT, to provide sufficient resilience within the water supply network to accommodate the Proposed Development without detriment to the water environment or water resources. Therefore, the likely effect of the Proposed Development on potable (mains) water supply network capacity would be a temporary (short term), local, neutral effect of negligible significance.
- 8.146 No local groundwater abstraction is proposed for construction of the Proposed Development, and this will be made clear within Employer's Requirements when tendering the construction contract. Therefore, the likely effect of the Proposed Development on local groundwater resources during construction would be a **temporary (short term), district / local, neutral effect of negligible significance**.
- 8.147 Provisions would also be made for re-use of harvested rainwater and basement dewatering volumes for washdown, dust suppression, etc during the demolition and construction works to reduce potable water demand.
- 8.148 Potable water demand for the construction phase, with some overlap of operational phases anticipated across the Proposed Development would only be partially offset by capacity freed up following termination of retail usage across the baseline Site. Whilst the local networks may have available capacity there is a potential requirement for strategic borehole abstraction to be marginally increased by Cambridge Water to serve the construction phase of the Proposed Development.
- 8.149 Whilst it is anticipated that third party provision would be made for reinforcement and upgrades to the strategic borehole abstraction and strategic water supply there is potential for these works to lag behind the construction programme.
- 8.150 Based upon potable water demand being supplied via mains supply during construction, with some overlap of operational phases anticipated across the Proposed Development, the anticipated residual effect upon regional groundwater resources and associated harm to

environmental receptors only in the event that increased abstraction was required from strategic supply boreholes, has the potential to remain as a **temporary (short term), district / local, adverse effect of minor significance**.

Evaluation of Predicted Residual Impacts at Operational Development

Fluvial Flood Risk

- 8.151 All areas of the Proposed Development are expected to remain at low risk of fluvial flood risk throughout its anticipated operational lifetime taking into account climate change effects.
- 8.152 Surface water attenuation and flow control arrangements, rainwater harvesting and reuse, together with a suite of SuDS and source control features integrated within the proposed landscape, will manage surface water runoff in a sustainable and effective manner throughout the operational lifetime of the Proposed Development.
- 8.153 Surface water management measures proposed to be incorporated within the Proposed Development, as set out within **Appendix 8.1** will provide a minimum 30% reduction in runoff rates post-development when compared to baseline Site conditions, taking into account allowances for climate change.
- 8.154 Target performance of the surface water management strategy will be secured via BREEAM Pol3 credits, and via conditions attached to planning consent.
- 8.155 The likely residual effect would be a **permanent (long term), district / local beneficial effect of minor / negligible significance**.

Surface Water (Pluvial) Flood Risk

- 8.156 Surface water attenuation and flow control arrangements, rainwater harvesting and reuse, together with a suite of SuDS and source control features integrated within the proposed landscape, will manage surface water runoff in a sustainable and effective manner throughout the operational lifetime of the Proposed Development.
- 8.157 Surface water management measures proposed to be incorporated within the Proposed Development, as set out within **Appendix 8.1** will provide a minimum 30% reduction in runoff rates post-development when compared to baseline Site conditions, taking into account allowances for climate change.
- 8.158 Target performance of the surface water management strategy will be secured via BREEAM Pol3 credits, and via conditions attached to planning consent.
- 8.159 Localised overland flood flow pathways and exceedance routes will be carefully integrated within the proposed landscape, including rain gardens, and managed without detrimental effect upon local surface water flood risk. The likely residual effect would be a **permanent (long term), local beneficial effect of minor significance**.

Groundwater Flood Risk

- 8.160 Best practice basement design, informed by detailed Ground Investigation, including specification of tanking and waterproofing will be sufficient to resist ingress of groundwater.
- 8.161 No additional mitigation measures are required to manage groundwater flood risk, therefore, the residual effect from and to groundwater flood risk would be a **permanent (long term), local neutral effect of negligible significance**.

Artificial Sources Flood Risk

- 8.162 No additional mitigation measures are required, therefore, the residual risk would remain a **permanent (long term), local neutral effect of negligible significance**.

Surface Water Quality

- 8.163 Proprietary pollution control measures, together with treatment trains provided as part of a suite of SuDS and source control features integrated within the proposed landscape, will manage surface water quality in an effective manner throughout the operational lifetime of the Proposed Development.
- 8.164 Full retention hydrocarbon interceptors, silt traps and trapped gullies to be integrated with the proposed drainage scheme provide treatment for runoff from trafficked surfaces in line with EA guidance and best practice to mitigate against the potential impacts on surface water quality.
- 8.165 Surface water management measures proposed to be incorporated within the Proposed Development, as set out within **Appendix 8.1** provide multiple treatment trains in the form of lined and under-drained permeable paving, bioretention tree pits, rain gardens and a wetland feature.
- 8.166 The likely residual effect on surface water quality from release of sediments and pollutants would be a **permanent (long term), district / local beneficial effect of minor / negligible significance**.
- 8.167 Best practice and regulatory controls will be sufficient to ensure that fuels and chemicals are appropriately stored, banded and managed during the operational phase of the Proposed Development. Therefore, the resulting residual effect on surface water quality from spillage or leakage of would be a **permanent (long term), district / local neutral effect of negligible significance**.

Foul Water Infrastructure Capacity

- 8.168 A pre-development enquiry has been made to Anglian Water to determine whether the existing public sewerage infrastructure has the capacity to accommodate the Proposed Development, however, at the time of preparing this chapter, a response has not yet been received. Based on the anticipated peak foul discharge rate, local reinforcement works may be required by Anglian Water to ensure that sufficient capacity is provided to accommodate foul flows from the Proposed Development.
- 8.169 Upon the grant of a planning consent, Anglian Water would also have an obligation, under the terms of the regulator Ofwat, to provide sufficient resilience within the sewerage network to accommodate the Proposed Development without detriment to the water environment, in particular the water quality of the receiving water body downstream of the relevant wastewater treatment facility, namely Milton WRC.
- 8.170 Sewer connection application(s), informed by impact studies where appropriate, will be submitted to and approved by Anglian Water prior to construction. Local and strategic reinforcements and upgrades to the public foul sewer network would ensure that hydraulic capacity and flood resilience are maintained within the system.
- 8.171 Following implementation of these measures, the anticipated residual effect on foul water

infrastructure capacity over the anticipated operational lifetime of the Proposed Development would likely be a **permanent (long term), local neutral effect of negligible significance**.

Water Resources

- 8.172 Cambridge Water has confirmed that capacity is available within the local potable water supply (mains) networks to serve the operational phase of the Proposed Development. No off-site network reinforcements are anticipated to be required to provide a potable water supply.
- 8.173 Potable water supply connection application(s), informed by impact studies where appropriate, will be submitted to and approved by Cambridge Water prior to construction.
- 8.174 Upon the grant of a planning consent, the appointed water company would have an obligation, under the terms of the regulator OfWAT, to provide sufficient resilience within the water supply network to accommodate the Proposed Development without detriment to the water environment or water resources. Therefore, the likely effect of the Proposed Development on potable (mains) water supply network capacity would be a **permanent (long term), local neutral effect of negligible significance**.
- 8.175 No local groundwater abstraction is proposed as part of the Proposed Development, therefore, the likely effect on local groundwater resources over the operational lifetime of the Proposed Development would remain a **permanent (long term), district / local neutral effect of negligible significance**.
- 8.176 Surface water management measures proposed to be incorporated within the Proposed Development, as set out within **Appendix 8.1** incorporate and align with rainwater harvesting and reuse techniques to reduce potable water demand.
- 8.177 Specification of low flow outlets and efficient fittings within all buildings, and commitment to the integration of rainwater harvesting and reuse will reduce reliance upon mains water. Reuse is proposed for WC flushing at selected locations, facility for irrigation of external soft landscaping, and 'top up' of the proposed wetland (where appropriate to do so).
- 8.178 Based upon potable water demand being supplied via mains supply, and provided that increased abstraction is not required from strategic supply boreholes, the likely effect of the Proposed Development on strategic groundwater resources would remain a **permanent (long term), district / local, neutral effect of negligible significance**.
- 8.179 Whilst the local mains supply networks may have available capacity there is a potential requirement for strategic borehole abstraction to be marginally increased by Cambridge Water to serve the Proposed Development, which has the potential to directly or indirectly lead to significant effects and harm to associated sensitive environmental receptors.
- 8.180 Whilst it is anticipated that third party provision would be made for reinforcement and upgrades to the strategic borehole abstraction and strategic water supply there is potential for these works to lag behind the programme for the early operational phases of the Proposed Development.
- 8.181 Based upon potable water demand being supplied via mains supply, and only in the event that increased abstraction was required from strategic supply boreholes, and prior to the third party implementation of strategic mitigation and reinforcements, the likely effect on strategic groundwater resources over the operational lifetime of the Proposed Development would remain a **permanent (medium term), regional / district, adverse effect of minor significance**.

- 8.182 By implementing the proposed programme of works outlined in the WRMP19 Cambridge Water are able to balance supply and demand in the Cambridge region up to and beyond 2045 and their preferred strategy shows a surplus over target headroom for the 25-year period with the options proposed.
- 8.183 Cambridge Water review their progress against expected outputs and forecasts each year through the established WRMP annual review process. If this showed a deficit, then they would identify which, if any, other options are required.
- 8.184 Should the impact on the supply/demand balance or changes be of sufficient materiality, this would constitute a material change and require that Cambridge Water fully revise the WRMP. Cambridge Water consider this extremely unlikely, but have committed to follow this route if required.
- 8.185 WRMP24 also sets out and reinforces preferred options which remove the initial deficits and maintain a surplus throughout the planning period.
- 8.186 Local and strategic reinforcements and upgrades to the strategic supply would ensure that sufficient capacity and water pressure is provided, without reducing hydraulic performance of the public water supply network and without detriment to the water environment or water resources.
- 8.187 Following implementation of third party strategic upgrades to the strategic supply by Cambridge Water, the anticipated residual effect of the Proposed Development upon regional groundwater resources is likely to be **a permanent (long term), district / local neutral effect of negligible significance.**

Monitoring

- 8.188 No specific bespoke requirements for monitoring are deemed to be required to ensure that proposed mitigation measures remain effective over the operational lifetime of the Proposed Development.

Summary of Impacts

- 8.189 A summary of impacts has been tabulated and presented in **Table 8.4.**
- 8.190 Potential flood risk and drainage impacts are considered to be adequately mitigated and managed with residual impacts considered to be **negligible.**
- 8.191 Potential impacts upon local water resources and water supply networks impacts are mitigated by promoting water efficiency and rainwater reuse to drive down potable water demand with residual impacts considered to be **negligible.**
- 8.192 Potential impacts upon strategic water resources and associated ecological and environmental receptors are partially mitigated by promoting water efficiency and rainwater reuse to drive down potable water demand, with residual impacts considered to be **minor adverse** in the short term.
- 8.193 Following implementation of strategic reinforcement schemes and leakage reduction by Cambridge Water in the short to medium term, residual impacts upon strategic water resources and associated ecological and environmental receptors reduce to **negligible** and would be anticipated to remain **negligible** over the operational lifetime of the Proposed Development.

Table 8.4: Summary of Impacts: Flood Risk, Drainage and Water Resources

DESCRIPTION OF IMPACT	GEOGRAPHICAL IMPORTANCE	RECEPTOR SENSITIVITY	MAGNITUDE	IMPACT BEFORE MITIGATION				MITIGATION	IMPACT AFTER MITIGATION (RESIDUAL)				
				ADVERSE/BENEFICIAL	REVERSIBLE/IRREVERSIBLE	SHORT-TERM/LONG TERM	SIGNIFICANCE		ADVERSE/BENEFICIAL	REVERSIBLE/IRREVERSIBLE	SHORT-TERM/LONG TERM	SIGNIFICANCE	
Construction													
Increased risk of fluvial flooding due to uncontrolled release of surface water runoff during construction.	Dist / Loc	Mod	Min	Adv	Rev	ST	Min	Embedded controls and mitigation within the CEMP to manage surface water runoff. Surface water attenuation and flow control measures to be in place prior to connection of impermeable areas to drainage networks.	Neu	Rev	ST	Neg	
Increased risk of surface water flooding due to uncontrolled release of surface water runoff, or changes to overland flow pathways during construction.	Loc	Mod	Min	Adv	Rev	ST	Min	Embedded controls and mitigation within the CEMP to manage surface water runoff. Surface water attenuation and flow control measures to be in place prior to connection of impermeable areas to drainage networks.	Neu	Rev	ST	Neg	
Increased risk of groundwater flooding, or hindrance to groundwater flow regime, during basement construction.	Loc	Low	Min	Adv	Rev	ST	Min	Embedded controls and mitigation within the CEMP to manage groundwater within excavations. Basement construction methods to be informed by Ground Investigation and results of groundwater monitoring.	Neu	Rev	ST	Neg	
Water quality impacts from surface-borne pollutants and sediments entering surface water receptors during construction.	Dist / Loc	Mod	Min	Adv	Rev	ST	Min	Embedded controls and mitigation within the CEMP to manage surface water quality. Proprietary pollution control measures to be in place prior to connection of impermeable areas to drainage networks.	Neu	Rev	ST	Neg	

DESCRIPTION OF IMPACT	GEOGRAPHICAL IMPORTANCE	RECEPTOR SENSITIVITY	MAGNITUDE	IMPACT BEFORE MITIGATION				MITIGATION				IMPACT AFTER MITIGATION (RESIDUAL)			
				ADVERSE/BENEFICIAL	REVERSIBLE/IRREVERSIBLE	SHORT-TERM/LONG TERM	SIGNIFICANCE					ADVERSE/BENEFICIAL	REVERSIBLE/IRREVERSIBLE	SHORT-TERM/LONG TERM	SIGNIFICANCE
Water quality impacts from spillage or leakage of fuels or chemicals entering surface water receptors during construction.	Dist / Loc	Mod	Min	Adv	Rev	ST	Min	Embedded controls and mitigation within the CEMP for storage of fuels and chemicals to minimise the risk of pollution to controlled waters.	Neu	Rev	ST	Neu	Rev	ST	Neg
Impact upon foul water network capacity and treatment capacity during construction.	Loc	Low to Mod	Min	Adv	Rev	ST	Min	Sewer connection application(s), informed by impact studies where appropriate, to be submitted to and approved by Anglian Water prior to construction.	Neu	Rev	ST	Neu	Rev	ST	Neg
Impact upon potable (mains) water network capacity during construction.	Loc	Low	Min	Neu	Rev	ST	Neg	Potable water supply connection application(s), informed by impact studies where appropriate, to be submitted to and approved by Cambridge Water prior to construction. Potable water demand during construction partially offset by disconnection of baseline water demand.	Neu	Rev	ST	Neu	Rev	ST	Neg
Impact upon local groundwater resources during construction.	Dist / Loc	Mod	Min	Adv	Irrev	ST	Min	No local groundwater abstraction proposed during construction or as part of the Proposed Development.	Neu	Irrev	ST	Neu	Irrev	ST	Neg
Impact upon regional groundwater resources during construction provided that increased abstraction is not required from strategic supply boreholes.	reg/dist	mod	min	neut	irrev	ST	Neg	Potable water supply connection application(s), informed by impact studies where appropriate, to be submitted to and approved by Cambridge Water prior to construction. Potable water demand during construction partially offset by disconnection of baseline water demand.	Neut	Irrev	ST	Neut	Irrev	ST	Neg

DESCRIPTION OF IMPACT	GEOGRAPHICAL IMPORTANCE	RECEPTOR SENSITIVITY	MAGNITUDE	IMPACT BEFORE MITIGATION				MITIGATION	IMPACT AFTER MITIGATION (RESIDUAL)			
				ADVERSE/BENEFICIAL	REVERSIBLE/IRREVERSIBLE	SHORT-TERM/LONG TERM	SIGNIFICANCE		ADVERSE/BENEFICIAL	REVERSIBLE/IRREVERSIBLE	SHORT-TERM/LONG TERM	SIGNIFICANCE
Impact upon regional groundwater resources during construction in the event that increased abstraction is required from strategic supply boreholes	Reg / Dist	Mod	Min	Adv	Irrev	ST	Min	Potable water supply connection application(s), informed by impact studies where appropriate, to be submitted to and approved by Cambridge Water prior to construction. Potable water demand during construction partially offset by disconnection of baseline water demand. Potential requirement for strategic borehole abstraction to be marginally increased by Cambridge Water to serve Proposed Development.	Adv	Irrev	ST	Min
Completed and Operational Development												
Increased risk of fluvial flooding due to uncontrolled release of surface water runoff.	Dist / Loc	Mod	Min	Adv	Rev	LT	Min	Landscape proposals provide a net reduction in impermeable area coverage post-development. Surface water attenuation and flow control measures, rainwater harvesting, and a suite of SuDS measures are designed to reduce runoff rates post-development and manage climate change impacts.	Ben	Rev	LT	Min/ Neg
Increased risk of surface water flooding due to uncontrolled release of surface water runoff, or changes to overland flow pathways.	Loc	Mod	Min	Adv	Rev	LT	Min	Landscape proposals provide a net reduction in impermeable area coverage post- development. Surface water attenuation and flow control measures, rainwater harvesting, and a suite of SuDS measures are designed to reduce runoff rates post-development and manage climate change impacts.	Ben	Rev	LT	Min

DESCRIPTION OF IMPACT	GEOGRAPHICAL IMPORTANCE	RECEPTOR SENSITIVITY	MAGNITUDE	IMPACT BEFORE MITIGATION				MITIGATION				IMPACT AFTER MITIGATION (RESIDUAL)			
				ADVERSE/BENEFICIAL	REVERSIBLE/IRREVERSIBLE	SHORT-TERM/LONG TERM	SIGNIFICANCE					ADVERSE/BENEFICIAL	REVERSIBLE/IRREVERSIBLE	SHORT-TERM/LONG TERM	SIGNIFICANCE
Increased risk of groundwater flooding, or hindrance to groundwater flow regime, due to basement structures.	Loc	Low	Min	Adv	Rev	LT	Min	No mitigation necessary beyond best practice basement construction methods.				Neu	Rev	LT	Neg
Water quality impacts from surface-borne pollutants and sediments entering surface water receptors.	Dist / Loc	Mod	Min	Adv	Rev	LT	Min	Proprietary pollution control, and a suite of SuDS measures, are designed to reduce improve water quality post-development.				Ben	Rev	LT	Min / Neg
Water quality impacts from spillage or leakage of fuels or chemicals entering surface water receptors.	Dist / Loc	Mod	Min	Adv	Rev	LT	Min	No mitigation necessary beyond that set out by existing legislative requirements for storage of fuels and chemicals.				Neu	Rev	LT	Neg
Impact upon foul water network capacity and treatment capacity.	Loc	Low to Mod	Min	Adv	Rev	LT	Min	Sewer connection application(s), informed by impact studies where appropriate, to be submitted to and approved by Anglian Water prior to construction. Treatment capacity at the local Water Recovery Centre to be incrementally increased by Anglian Water to serve projected growth in Cambridge.				Neu	Rev	LT	Neg

DESCRIPTION OF IMPACT	GEOGRAPHICAL IMPORTANCE	RECEPTOR SENSITIVITY	MAGNITUDE	IMPACT BEFORE MITIGATION				IMPACT AFTER MITIGATION (RESIDUAL)			
				ADVERSE/BENEFICIAL	REVERSIBLE/IRREVERSIBLE	SHORT-TERM/LONG TERM	SIGNIFICANCE	ADVERSE/BENEFICIAL	REVERSIBLE/IRREVERSIBLE	SHORT-TERM/LONG TERM	SIGNIFICANCE
Impact upon potable (mains) water network capacity.	Loc	Low	Min	Neu	Rev	LT	Neg	Neu	Rev	LT	Neg
								Potable water supply connection application(s), informed by impact studies where appropriate, to be submitted to and approved by Cambridge Water prior to construction.			
								Potable water demand partially offset by disconnection of baseline water demand, rainwater harvesting and reuse.			
								Specification of high efficiency water and sanitary fittings to achieve full WAT01 credits.			
Impact upon local groundwater resources.	Dist / Loc	Mod	Min	Neut	Irrev	LT	Neg	Neut	Irrev	LT	Neg
Impact upon regional groundwater resources provided that increased abstraction is not required from strategic supply boreholes.	Dist / Loc	Mod	Min	Neu	Irrev	MT	Neg	Neu	Irrev	MT	Neg
								Water supply provided by Cambridge Water without increasing groundwater abstraction and associated potential impacts upon ecological status of WFD water bodies.			

DESCRIPTION OF IMPACT	GEOGRAPHICAL IMPORTANCE	RECEPTOR SENSITIVITY	MAGNITUDE	IMPACT BEFORE MITIGATION				MITIGATION	IMPACT AFTER MITIGATION (RESIDUAL)			
				ADVERSE/BENEFICIAL	REVERSIBLE/IRREVERSIBLE	SHORT-TERM/LONG TERM	SIGNIFICANCE		ADVERSE/BENEFICIAL	REVERSIBLE/IRREVERSIBLE	SHORT-TERM/LONG TERM	SIGNIFICANCE
Impact upon regional groundwater resources in the event that increased abstraction is required from strategic supply boreholes prior to the implementation of third party strategic supply measures.	Reg / Dist	Mod	Min	Adv	Irrev	St - MT	Min	Potable water supply connection application(s), informed by impact studies where appropriate, to be submitted to and approved by Cambridge Water prior to construction. Potable water demand partially offset by disconnection of baseline water demand, rainwater harvesting and reuse. Specification of high efficiency water and sanitary fittings to achieve full WAT01 credits. Prior to the implementation of a strategic water transfer scheme by Cambridge Water to enhance potable water supply capacity to Cambridge resulting in an increase in groundwater abstraction and associated potential impacts upon ecological status of WFD water bodies.	Adv	Irrev	ST - MT	Min

DESCRIPTION OF IMPACT	GEOGRAPHICAL IMPORTANCE	RECEPTOR SENSITIVITY	MAGNITUDE	IMPACT BEFORE MITIGATION				MITIGATION				IMPACT AFTER MITIGATION (RESIDUAL)			
				ADVERSE/BENEFICIAL	REVERSIBLE/IRREVERSIBLE	SHORT-TERM/LONG TERM	SIGNIFICANCE					ADVERSE/BENEFICIAL	REVERSIBLE/IRREVERSIBLE	SHORT-TERM/LONG TERM	SIGNIFICANCE
Impact upon regional groundwater resources in the event that increased abstraction is not required from strategic supply boreholes and strategic water supply can be delivered via the implementation of third party strategic supply measures.	Reg / Dist	Mod	Min	Adv	Irrev	LT	Min	Potable water supply connection application(s), informed by impact studies where appropriate, to be submitted to and approved by Cambridge Water prior to construction. Potable water demand partially offset by disconnection of baseline water demand, rainwater harvesting and reuse. Specification of high efficiency water and sanitary fittings to achieve full WAT01 credits. Implementation of a strategic water transfer scheme by Cambridge Water to enhance potable water supply capacity to Cambridge without increasing groundwater abstraction and associated potential impacts upon ecological status of WFD water bodies will mitigate potential effects of the Proposed Development.				Neu	Irrev	LT	Neg

Key:

Dist: District Loc: Local Min: Minor Adv: Adverse Neg: Negligible LT: Long-Term Neu: Neutral
 Reg: Regional Mod: Moderate Ben: Beneficial Irrev: Irreversible Rev: Reversible ST: Short Term

Ground Conditions and Contamination



9.0 Ground Conditions and Contamination

Introduction

- 9.1 This chapter addresses the ground conditions and contaminated land impacts of the Proposed Development, both during demolition and construction works and through completed operation. It has been prepared by Waterman Infrastructure and Environment Ltd (“Waterman”) to assess the impacts of the Proposed Development in relation to the effects it would have on future and surrounding site users, ground and groundwater conditions, and where ground conditions and contamination could cause effects to the development and/or the surrounding area.
- 9.2 Where significant adverse impacts are identified, appropriate mitigation measures to avoid, reduce or offset these impacts are detailed in this chapter. The likely residual effects of the Proposed Development accounting for these mitigation measures are also provided.
- 9.3 This chapter is supported by the following technical appendices:
- **Appendix 9.1** Preliminary Risk Assessment, report reference WIE17469-100-R-5-1-2-PRA; February 2022;
 - **Appendix 9.2** Preliminary Generic Quantitative Environmental Risk Assessment, report reference WIE17469-100-R-12-1-2-GQRA; February 2023; and
 - **Appendix 9.3** Ground Investigation Report, report reference WIE17469-109-R-14-1-4.GIR; February 2023.

Potential Impacts

- 9.4 Contaminant linkages with the potential to cause significant impacts to the Proposed Development are set out below.

Construction Impacts

- 9.5 Works to redevelop the Site will involve demolition of existing structures, removal of hardstanding and exposure of soils beneath the Site. During construction works, new potential sources of contamination will be introduced to the Site, including diesel fuel to supply plant and chemicals necessary for construction works. Identified contaminant linkages during construction works include:
- Potential for contaminated dust emissions from exposed or stockpiled soils, inhaled by off-site users and on-site users of completed phases of development;
 - Potential for surface run-off from stockpiled soils, and direct contact with off-site users and on-site users of completed phases of development;
 - Direct contact, ingestion and inhalation of potentially contaminated exposed shallow soils and groundwater by construction workers and site visitors during the works;
 - Inhalation of vapours emitted from contaminated soils by ground workers and construction workers during redevelopment works; and
 - Potential for leaks or spills of fuels or chemicals brought on-site to reach underlying soils and groundwater.

Operational Impacts

- 9.6 The completed development end-use will be commercial, with the majority of the Site covered by new building structures and hardstanding. Small areas of soft landscaping will also be present. The development is likely to be supported by piled foundations, which may penetrate into the West Melbury Formation. Contaminant linkages potentially present at the completed development stage include:
- Direct contact with contaminants in the Made Ground in soft landscaped areas by future Site users;
 - Vapour ingress into the Proposed Development from potentially contaminated soils and groundwater, with risk of explosion or asphyxiation of Site users and visitors;
 - Mobilisation of contamination to aquifers in the bedrock deposits, notably where piled foundations may penetrate into the principal aquifer in the West Melbury Formation.

Methodology

- 9.7 The potential ground condition impacts have been assessed in consideration of the following legislative and technical guidance:
- Environmental Protection Act, Part IIA (EPA) 1990;
 - National Planning Policy Framework (NPPF) 2021, Paragraphs 174, 180, 183 to 185, 188; and;
 - National Planning Practice Guidance (PPG) 2012 (updated 2021), Land Affected by Contamination.
- 9.8 This chapter also considers the following additional ground contamination standards and guidelines:
- Land Contamination Risk Management (LCRM) 2019 (updated 2021); and,
 - BS10175:2011 + A2:2017, Investigation of Potentially Contaminated Sites Code of Practice.

Preliminary Risk Assessment

- 9.9 A desk-based qualitative Preliminary Risk Assessment (PRA) was undertaken by Waterman. This chapter establishes the potential for significant ground contamination to exist at the Site and the likely risk posed to a range of sensitive receptors, including human health, property, ecological systems and controlled waters. The PRA was undertaken in general accordance with LCRM guidance and has been informed by:
- A Groundsure Insight Report (reference WTM1-6857309; July 2020) which contains historical Ordnance Survey (OS) extracts, environmental data sheets and sensitivity plans;
 - A review of available and relevant historical, geological and hydrogeological information sources publicly available;
 - Completion of a Site walkover;
 - British Geological Survey (BGS) borehole records for the Site and surrounding area; and
 - A review of early Ordnance Survey (OS) maps and pre-Ordnance Survey maps;
- 9.10 The PRA includes a conceptual model which identifies likely significant potential pollutant linkages at the Site, and likely to arise during and after redevelopment. Consideration is given

in the conceptual model to the potential sources of contamination, migration pathways and sensitive receptors. Likely significant effects of ground contamination upon human health, property, ecological systems, and controlled waters are assessed as part of the PRA using this source-pathway-receptor approach.

- 9.11 The findings of the PRA have been used to inform the qualitative assessment presented in this chapter of likely significant effects to, and from, any potential ground contamination likely to exist at the Site. Using information obtained from the above sources, an appraisal of how sources might affect receptors (the linkage) has been carried out.

Preliminary Generic Quantitative Environmental Risk Assessment

- 9.12 Waterman completed a preliminary Generic Quantitative Environmental Risk Assessment (GQRA) at both the Beehive Retail Centre and wider surrounding area comprising the Cambridge Retail Park and 230 Newmarket Road. The GQRA was informed by the findings of the earlier PRA, results of soil, groundwater, ground gas and vapour monitoring and sampling, and a factual report prepared by the ground works contractor.
- 9.13 Intrusive investigation works at the Beehive Retail Centre involved 6No. boreholes completed to a maximum 40m bgl, with collection of soil samples for subsequent laboratory analysis. 2No. follow-up visits to the Site were completed for ground gas and vapour concentrations at all monitoring wells. Groundwater and vapour samples were also collected during each monitoring round.
- 9.14 Soils results collected from the Made Ground, Landfill material, West Melbury Formation and Gault Clay Formation were compared against Generic Assessment Criteria (GAC) for commercial land use. Concentrations of some Poly-cyclic Aromatic Hydrocarbons (PAH) were recorded slightly above the assessment criteria, however the majority of soils did not exhibit any elevated contamination concentrations. No visual evidence for fragments of asbestos or Asbestos Containing Materials (ACM) were identified.
- 9.15 Groundwater sampling recorded elevated metal and hydrocarbon contaminant concentrations. The elevated metal concentrations were localised with an off-site migration risk absent. Petroleum hydrocarbon contaminant concentrations were primarily elevated in WBH111 in the south east corner and WBH113 located centrally on-site (please see Appendix A3 and A4 of the GQRA report contained in **Appendix 9.2**). Given the north eastern groundwater flow and absence of likely sources on-site in the south east corner the petroleum hydrocarbon concentrations present in WBH111 was assessed as likely being associated with a historical transport depot located off-site. The petroleum hydrocarbon contaminant concentrations recorded in WBH113 was assessed as being likely associated with a former petrol station on-site. Petroleum hydrocarbon concentrations in the borehole (WBH114) down hydraulic gradient from WBH113 were below or close to the laboratory detection limit indicating significant attenuation of contaminant concentrations over a short distance on-site was present. To clarify the source and further assess the off-site migration risk, further ground investigation and assessment was identified as being required.
- 9.16 Assessment of the Site's vapour risk identified a significant vapour regime as likely being absent, however further ground investigation and assessment around the former petrol hydrocarbon hotspot in the south east corner of the Site recorded elevated hydrocarbons in soil and groundwater. This may indicate the potential for vapour emissions in this area of the Site. Ground gas monitoring did not identify the potential for a risk to future developments.

Predicted Impacts

- 9.17 There are no published criteria for assessing the significant potential impacts from ground conditions and contamination. Significance criteria have therefore been developed using contaminated land guidance and professional expert judgement.
- 9.18 With respect to ground contamination, the potential for adverse likely significant effects relies on the presence of a linkage between the contaminant source and any receptors. The significance of the effect depends on the value of the resource, the sensitivity of the receptor and the ways in which the Development can provide a pathway to the receptor. The significance of an effect is also informed by the timescales involved and extent of the affected area.
- 9.19 The assessment of the relative significance and likely significant residual effects has been based on the receptor sensitivity and resource sensitivity matrices detailed in **Tables 9.1**, and **9.2**, and the significance criteria set out in **Table 9.3**.

Table 9.1: Receptor Sensitivity

GEOGRAPHIC IMPORTANCE	VALUE	CRITERIA
International / National	Very high	Extremely rare (endangered), potentially extremely vulnerable to change, of international importance or recognition, very limited potential for substitution. For example, World Heritage Site, Ramsar Wetland etc.
National	High	Rare, of national importance or recognition, limited potential for substitution, highly vulnerable to change. For example, national park, national heritage, protected in national legislation.
Regional / District	Moderate	Somewhat rare or vulnerable, county/district/local importance, difficult to substitute: For example: County Wildlife Sites etc.
District / Local	Low	Locally important, difficult to substitute at a local level, rare or unusual at the local level but well represented elsewhere. For example, Local Nature Reserves, local planning designations etc.
Local	Very low	Of limited importance or value, not vulnerable to change, can be readily substituted.

Table 9.2: Resource Sensitivity

RELEVANT TYPES OF RECEPTOR	SIGNIFICANT HARM	SIGNIFICANT POSSIBILITY OF SIGNIFICANT HARM
Human beings	The following health effects should always be considered to constitute significant harm to human health: death; life threatening diseases (e.g. cancers); other diseases likely to have serious impacts on health; serious injury; birth defects; and impairment of reproductive functions.	The risk posed by one or more relevant contaminant linkage(s) relating to the land comprises: (a) The estimated likelihood that significant harm might occur to an identified receptor, taking account of the current use of the land in question.

RELEVANT TYPES OF RECEPTOR	SIGNIFICANT HARM	SIGNIFICANT POSSIBILITY OF SIGNIFICANT HARM
	Other health effects may be considered by the local authority to constitute significant harm. For example, a wide range of conditions may or may not constitute significant harm (alone or in combination) including: physical injury; gastrointestinal disturbances; respiratory tract effects; cardio-vascular effects; central nervous system effects; skin ailments; effects on organs such as the liver or kidneys; or a wide range of other health impacts. In deciding whether or not a particular form of harm is significant harm, the local authority should consider the seriousness of the harm in question: including the impact on the health, and quality of life, of any person suffering the harm; and the scale of the harm. The authority should only conclude that harm is significant if it considers that treating the land as contaminated land would be in accordance with the broad objectives of the regime as described in Section 1 of the Contaminated Land Statutory Guidance.	(b) The estimated impact if the significant harm did occur – i.e. the nature of the harm, the seriousness of the harm to any person who might suffer it, and (where relevant) the extent of the harm in terms of how many people might suffer it. In estimating the likelihood that a specific form of significant harm might occur the local authority should, among other things, consider: (a) The estimated probability that the significant harm might occur: (i) if the land continues to be used as it is currently being used; and (ii) where relevant, if the land were to be used in a different way (or ways) in the future having regard to the guidance on “current use” in Section 3 of the Contaminated Land Statutory Guidance. (b) The strength of evidence underlying the risk estimate. It should also consider the key assumptions on which the estimate of likelihood is based, and the level of uncertainty underlying the estimate.
Ecological systems	The following types of harm should be considered to be significant harm: harm which results in an irreversible adverse change, or in some other substantial adverse change, in the functioning of the ecological system within any substantial part of that location; or harm which significantly affects any species of special interest within that location and which endangers the long-term maintenance of the population of that species at that location.	Conditions would exist for considering that a significant possibility of significant harm exists to a relevant ecological receptor where the local authority considers that: significant harm of that description is more likely than not to result from the contaminant linkage in question; or there is a reasonable possibility of significant harm of that description being caused, and if that harm were to occur, it would result in such a degree of damage to features of special interest at the location in question that they would be beyond any practicable possibility of restoration.
Ecological systems	In the case of European sites, harm should also be considered to be significant harm if it endangers the favourable conservation status of natural habitats at such locations or species typically found there. In deciding what constitutes such harm, the local authority should have regard to the advice of Natural England and to the requirements of the Conservation of Habitats and Species Regulations 2010 (as amended).	Any assessment made for these purposes should take into account relevant information for that type of contaminant linkage, particularly in relation to ecotoxicological effects of the contaminant.

RELEVANT TYPES OF RECEPTOR	SIGNIFICANT HARM	SIGNIFICANT POSSIBILITY OF SIGNIFICANT HARM
Structures and services	Structural failure, substantial damage or substantial interference with any right of occupation. The local authority should regard substantial damage or substantial interference as occurring when any part of the building ceases to be capable of being used for the purpose for which it is or was intended. In the case of a scheduled Ancient Monument, substantial damage should be regarded as occurring when the damage significantly impairs the historic, architectural, traditional, artistic or archaeological interest by reason of which the monument was scheduled. The Guidance states that this description of significant harm is referred to as a 'building effect'.	Conditions would exist for considering that a significant possibility of significant harm exists to the relevant types of receptor where the local authority considers that significant harm is more likely than not to result from the contaminant linkage in question during the expected economic life of the building (or in the case of a scheduled Ancient Monument the foreseeable future), taking into account relevant information for that type of contaminant linkage.
Controlled waters	In deciding whether significant pollution of controlled waters is being caused, the local authority should consider that this test is only met where it is satisfied that the substances in question are continuing to enter controlled waters; or that they have already entered the waters and are likely to do so again in such a manner that past and likely future entry in effect constitutes ongoing pollution. For these purposes, the local authority should:	In deciding whether or not a significant possibility of significant pollution of controlled waters exists, the local authority should first understand the possibility of significant pollution of controlled waters posed by the land, and the levels of certainty/uncertainty attached to that understanding, before it goes on to decide whether or not that possibility is significant.
Controlled waters	(a) Regard substances as having entered controlled waters where they are dissolved or suspended in those waters, or (if they are immiscible with water) they have direct contact with those waters on or beneath the surface of the water. (b) Take the term "continuing to enter" to mean any measurable entry of the substance(s) into controlled waters additional to any which has already occurred. (c) Take the term "likely to do so again" to mean more likely than not to occur again. Land should not be determined as contaminated land on grounds that significant pollution of controlled waters is being caused where: (a) the relevant substance(s) are already present in controlled waters; (b) entry into controlled waters of the substance(s) from land has ceased; and (c) it is not likely that further entry will take place.	The term "possibility of significant pollution of controlled waters" means the estimated likelihood that significant pollution of controlled waters might occur. In assessing the possibility of significant pollution of controlled waters from land, the local authority should act in accordance with risk assessment guidance.

Table 9.3: Significance Criteria

MAGNITUDE	SIGNIFICANCE	CHARACTERISTICS OF CHANGE
Major beneficial	Significant	The Proposed Development would remove features that adversely affect the existing environment, prevent further degradation, and enhance and protect the environment in the long-term.
Moderate beneficial	Significant	The Proposed Development would notably reduce rate of current degradation and/ or enhance existing character.
Minor beneficial	Significant	The Proposed Development would reduce rate of current degradation.
Neutral	Not significant	The Proposed Development would not result in any meaningful change to the receptor / resource.
Minor adverse	Significant	The Proposed Development would increase the rate of current degradation or introduce some minor detractors into the environment.
Moderate adverse	Significant	The Proposed Development would result in the partial loss of a resource or notably degrade a receptor environment.
Major adverse	Significant	The Proposed Development would result in the complete loss of a resource or compromise the integrity of a receptor such that its long term survival is highly unlikely.

9.20 The timescale relating to the length of time that the impacts prevail needs to be defined as follows:

- Temporary (e.g. construction phase);
- Short Term (e.g. less than 5 years);
- Medium Term (e.g. 5-10 years);
- Long Term (e.g. for the duration of the operational phase of the development); and
- Existing Baseline Conditions.

Existing Baseline Conditions

Baseline Ground Conditions

9.21 The Site is centered at National Grid Reference 546677 258593.

9.22 Historical mapping records the Site as undeveloped or in use as allotments up until the 1960's, whereby various warehouses, a dairy, builders' yards, and a bakery were developed. The northern half of the Site was redeveloped in the 1980's into the existing Beehive Retail Centre layout, with the remainder of the Site also developed by 1994. A petrol filling station was constructed on the western boundary as part of the initial Beehive Retail Centre before being decommissioned in 2003.

9.23 Geological and hydrogeological conditions at the Site as informed by the ground investigation works are detailed in **Table 9.1**.

Table 9.1: Geology & Hydrogeology

STRATA	TYPICAL THICKNESS (M)	GEOLOGICAL DESCRIPTION	HYDROGEOLOGICAL CLASSIFICATION
Concrete/Tarmac	0.1 - 0.3	Tarmac or Concrete	Unproductive Stratum
Made Ground	0.1 - 2.5	Light brown/brown silty sandy gravelly clay/ sandy gravelly clay. Gravel of subangular to angular fine to coarse chalk, and flint. Fragments of brick and concrete present	Unproductive Stratum
River Terrace Gravels	4.65 (south-west of site only)	Light brown gravelly medium to coarse sand (1.75m thick) underlain by a light brown light grey gravelly very sandy clay (2.9m thick)	Secondary A Aquifer
West Melbury Formation	0.4 – 6.65	Structureless chalk comprised of cream/ cream mottled brown gravelly silty clay with low to moderate cobble content.	Principal Aquifer
Gault Clay Formation	>35.8	Dark grey laminated clay	Unproductive Stratum

- 9.24 Surface water abstractions are not recorded on-Site or in the surrounding area. The Site is not located within a source protection zone.

Previously Identified Ground Contamination

- 9.25 The PRA for the Site identified the former petrol filling station at the western boundary as a potential hydrocarbon contamination source to shallow ground and groundwater. Ground investigation works recorded elevated hydrocarbon concentrations in soil and groundwater proximal to this location, along with vapour emissions. Further ground investigation was required to delineate the extent of this contamination and confirm that no risks of off-site migration exist.

Evolution of the Baseline Conditions without Development

- 9.26 The existing Beehive Retail Centre occupies the entire Site. The majority of the Site area is covered by buildings and hardstanding. These features act as a barrier between contamination in the ground and potential receptors such as future site users. Managed drainage across the Site also prevents rainfall infiltration to ground, in turn reducing the potential for mobilisation of soils or groundwater contamination within the Site boundary or off-site.
- 9.27 In consideration of these factors, should the development not be undertaken the current uses would continue to operate as they currently do at present, therefore this would not present a significant change in baseline conditions from current situations.

Predicted and Evaluation of Impacts

During Construction

Risks to off-site Residents and Users

- 9.28 Redevelopment works will involve demolition of all existing structures, stripping back of surface hardstanding and excavation of the underlying ground for foundation works. To facilitate this, potentially contaminated arisings may be stockpiled on the Site while awaiting transport or re-use.
- 9.29 Potentially contaminated dust could be generated from these stockpiles during dry and windy conditions, or run-off during rainy conditions, potentially exposing residents and users adjacent to the Site to contamination via inhalation or dermal contact.
- 9.30 As these receptors would not be wearing protective equipment the worst-case likely impacts are considered to be **short-term, local and of minor adverse significance**.
- 9.31 During rainy conditions, potentially contaminated run-off could be generated from soils stockpiled on-site. This could expose residents and users adjacent to the Site to contamination via dermal contact. In these situations, as these receptors would not be wearing PPE the worst-case likely significant effects are considered to be **short-term, local, and of minor adverse significance**.

Risks to on-Site Users of completed phases of the development

- 9.32 Redevelopment works will involve demolition of all existing structures, stripping back of surface hardstanding and excavation of the underlying ground for foundation works. To facilitate this, potentially contaminated arisings may be stockpiled on the Site while awaiting transport or re-use.
- 9.33 Potentially contaminated dust could be generated from these stockpiles during dry and windy conditions, or run-off during rainy conditions, potentially exposing on-Site users of completed phases of the development to contamination via inhalation or dermal contact.
- 9.34 As these receptors would not be wearing protective equipment the worst-case likely impacts are considered to be **short-term, local and of minor adverse significance**.
- 9.35 During rainy conditions, potentially contaminated run-off could be generated from soils stockpiled on-site. This could expose on-Site users of completed phases of the Site to contamination via dermal contact. In these situations, as these receptors would not be wearing PPE the worst-case likely significant effects are considered to be **short-term, local, and of minor adverse significance**.

Risks to Construction Workers

- 9.36 Initial redevelopment works will involve demolition of all existing buildings, stripping back all hardstanding and some Made Ground for levelling of the Site. During the Works the potential exists for exposure of workers to contamination within the ground, and hazardous materials such as asbestos in the ground and within existing structures. Asbestos fibers and hydrocarbon contamination have been detected in shallow Made Ground by previous investigation works.
- 9.37 However, workers on the Site would be subject to mandatory health and safety requirements

of the Control of Substances Hazardous to Health (COSHH) Regulations 2002 1 and Control of Asbestos Regulations (CAR) 2012 2. This would require mitigation measures to identify and remove potential asbestos in structures ahead of demolition, and the provision of appropriate personal protective equipment (PPE) to all construction workers and Site visitors. This would minimise the risk of exposure to potential contamination from contact with soils, groundwater, dust emissions and other potential contamination sources.

- 9.38 Adherence to the legislative requirements described above would reduce the potential risks to workers and Site visitors from ground contamination. As such, the likely impact is considered **neutral**.
- 9.39 Environmental investigation at the Site identified hydrocarbon contamination in soils, groundwater and through post-works monitoring of groundwater and soil atmosphere. Whilst measured concentrations were low, the potential exists for vapour accumulation in trenches and below-ground excavations during the works.
- 9.40 Further ground investigation is required to fully quantify the potential for a vapour regime at the Site. The findings of this will determine the necessary mitigation measures to break linkages to construction workers.
- 9.41 In absence of mitigation, the impacts to construction workers would be **temporary, local and of major adverse significance**.

Risks to Controlled Waters Receptors

- 9.42 Ground investigation has identified hydrocarbon contamination in shallow soils and groundwater. Ground works have the potential to cause temporary disturbance and mobilise any contamination present vertically and laterally. During the works, areas of existing hardstanding would be broken out to accommodate new foundations and below ground infrastructure. This would temporarily increase the permeable cover of the Site, allowing increased rainwater and surface water run-off infiltration to the ground and shallow groundwater.
- 9.43 In the absence of mitigation, the effects to shallow soils and groundwater would be **temporary, local, and of minor adverse significance**.
- 9.44 During the works it is likely new sources of contamination would be introduced and stored on the Site such as diesel fuel, oils, chemicals and other construction materials. As a result, there would be a risk of leakages or spillages directly or indirectly into the ground and the Secondary A Aquifer within the River Terrace Gravels and underlying principal aquifer in the West Melbury Formation.
- 9.45 In such circumstances, and in consideration of existing contaminants in the shallow groundwater, the likely effects in the absence of mitigation would be **short-term, local, and of minor adverse significance**.

Evaluation of Predicted Impacts at Operational Development

Risks to Site Staff and Visitors

- 9.46 The new development buildings and hardstanding will break contaminant linkages between future Site users and ground contamination. However in areas of soft landscaping, the potential exists for direct contact with contaminants in the Made Ground in soft landscaped areas, where

shallow soils will be exposed at surface level.

- 9.47 In absence of mitigation, the risks to these users would be **long-term, local, and of minor adverse significance**.

Risks to Structures

- 9.48 Ground investigation has identified the potential for vapour emissions at the Site. The floor slab and substructure of new buildings would offer some level of protection against vapour ingress, however protection measures may still be required. Further ground investigation is required to fully quantify the potential for vapour emissions from soils or groundwater to affect new buildings.

- 9.49 In the absence of mitigation, the likely effect to users could be classified as **long-term, local, and of major adverse** significance.

Risks to Controlled Waters

- 9.50 The West Melbury Chalk Formation is in current hydraulic continuity with the overlying Made Ground or River Terrace Gravel Deposits. The progression of piles through or into the West Melbury Chalk Formation would not create preferential pathways. Without mitigation the likely impact on the Principal Aquifer in the West Melbury Chalk Formation through completion of piles would be **neutral**.
- 9.51 The Principal Aquifer in the Lower Greensands Formation is overlain by the Gault Clay Formation which is forming an aquiclude preventing the migration of contaminants and groundwater migrating vertically. The Gault Clay Formation is >35m thick and is unlikely to be penetrated by piles proposed by the development given the proposed massing and loads. The completion of piles found in the Gault Clay Formation would not create preferential pathways to the Principal Aquifer in the Lower Green Sands Formation and without mitigation the impact would be neutral.

Mitigation

Additional Ground Investigation

- 9.52 Hydrocarbon contamination has been identified in soils and groundwater by previous ground investigation activities. This has informed the requirement for further ground investigation work, to fully quantify the vapour risk and contamination migration risks associated with this contamination. This would further assess the risks identified in the PRA and preliminary GQRA and identify the requirement for remediation. It is anticipated the requirement for this additional ground investigation would be secured by an appropriately worded planning condition, and would be undertaken once planning permission has been granted for the redevelopment.
- 9.53 The full scope for this investigation work will be determined by the final Proposed Development designs, however, it is anticipated to involve the following:
- Groundwater level monitoring, sampling and chemical testing at previously installed wells;
 - Vapour concentration monitoring;
 - Reassessment of the conceptual model developed for the Site as part of the preliminary GQRA; and
 - Assessment of requirement for further works or mitigation measures to break this linkage to future receptors at the completed development.

- 9.54 Following completion of the investigation, the results will be reported in a Quantitative Environmental Risk Assessment. Mitigation measures recommended in this report will break all contaminant linkages to future Site users and visitors, structures and controlled waters receptors.
- 9.55 A Remediation Strategy would be prepared and agreed in consultation with the Environment Agency and Cambridge City Council. This would detail all remediation or mitigation works necessary to break contaminant linkages to future receptors.
- 9.56 The scope of works necessary will be informed by findings of the ground investigation but could include, without limitation, installation of vapour barriers in structures, excavation and removal of contaminated soils, or infilling with suitable cover material to an appropriate depth. Implementation of any remediation strategy would be followed by a process of validation, with findings set out in a Validation Report.

Construction Environmental Management Plan

- 9.57 A Construction Environmental Management Plan (CEMP) has been prepared for the Site. This reviews all anticipated activities necessary to construct the development, and details appropriate fuels, oils and chemical storage, demolition procedures, soil handling and storage techniques to prevent dust emissions or surface run-off causing impacts to off-site residents and users. This is achieved through measures such as:
- Stockpiling of soils on plastic sheeting with bunds, and the use of hoarding around the perimeter of the Site to contain dust or surface run-off from exposed soils and stockpiles;
 - Using dust screens and covers and the appropriate location of dusty materials storage;
 - Damping down of surfaces during dry weather;
 - Using wheel washing facilities on the Site;
 - Avoidance of stockpiling contaminated materials where possible; and
 - Appropriate storage and handling practices for any potentially contaminative fuels, oils or chemicals brought on-Site to facilitate the works.
- 9.58 These procedures will minimise the potential for impacts to all identified receptors at or surrounding the Site.

Evaluation of Predicted Residual Impacts

During Construction Works

Risks to off-site Residents and Users

- 9.59 Redevelopment works will expose potentially contaminated soils beneath existing hardstanding and structures. Arisings may be stockpiled on the Site while awaiting transport or re-use.
- 9.60 The CEMP prepared for the Site will detail appropriate measures to prevent impacts to off-site residents and users throughout the works.
- 9.61 Adherence to the measures set out in the CEMP will reduce the likely significant impacts to **neutral**.

Risks to on-Site Users of Completed Phases of the Development

- 9.62 Redevelopment works will expose potentially contaminated soils beneath existing hardstanding and structures. Arisings may be stockpiled on the Site while awaiting transport or re-use.

9.63 The CEMP prepared for the Site will detail appropriate measures to prevent impacts to on-Site Users of completed phases of development throughout the works.

9.64 Adherence to the measures set out in the CEMP will reduce the likely significant impacts to neutral.

Risks to Construction Workers

9.65 Environmental investigation at the Site identified hydrocarbon contamination with the potential for vapour accumulation in trenches and below-ground excavations during the works.

9.66 The further ground investigation will fully quantify the potential vapour regime at the Site. This will inform if measures such as respiratory protective equipment or active ventilation are necessary to protect construction workers against vapour accumulation.

9.67 With appropriate mitigation in place, the impacts to construction workers would be of **neutral significance**.

Risks to Controlled Waters Receptors

9.68 Ground works have the potential to cause temporary disturbance to hydrocarbon contamination in shallow soils and groundwater beneath the Site. In turn, this could mobilise contamination laterally to the surrounding shallow secondary A aquifer in the River Thames Gravels, and vertically to the underlying principal aquifer in the West Melbury Formation.

9.69 The findings of further ground investigation recommended at the Site will quantify the potential for hydrocarbon contamination to be mobilised off-site, and inform appropriate remediation or mitigation measures if necessary.

9.70 Adherence to the measures as assessed by the further investigation will reduce the significance of potential impacts to **neutral**.

9.71 During the works there will be a risk of leakages or spillages directly or indirectly into the ground from new contamination sources stored on the Site to facilitate the works.

9.72 The CEMP prepared for the Site includes measures to minimise the potential impacts to controlled waters from these activities. Implementation of these measures will reduce the likely significance of potential impacts to **neutral**.

Evaluation of Predicted Residual Impacts at Operational Development

Risks to Site Staff and Visitors

9.73 New areas of soft landscaping included as part of the development will expose shallow, potentially contaminated soils at surface level. To mitigate this, the GQRA recommended new soft landscaping should be installed in an appropriate thickness of imported, certified clean topsoil to break contaminant linkage between residual potentially contaminated soils and future Site users in these areas. Installation of this topsoil will be validated as part of the remediation works at the Site.

9.74 With this mitigation in place, the likely impacts to future site users would be reduced to **neutral**.

Risks to Structures

9.75 The findings of the further ground investigation at the Site will fully quantify the potential for vapour emissions from soils or groundwater to affect new buildings. This in turn will inform the

mitigation measures necessary to break this contaminant linkage.

9.76 Implementation of the measures recommended by the further ground investigation will be validated as part of the remediation strategy, and detailed in a Validation Report at project completion.

9.77 With these measures in place, the risks of vapour accumulation in structures would be reduced to **neutral**.

Risks to Controlled Waters

9.78 Evaluation of the ground conditions present identifies piled foundations as unlikely creating preferential pathways for the migration of contaminants within either the Principal Aquifer in the West Melbury Chalk Formation or the Principal Aquifer in the Lower Greensands Formation. Without mitigation measures a neutral risk has been determined.

Monitoring

9.79 A further scheme of ground investigation will be completed across the Site to quantify the risk presented by hydrocarbon contamination in soils and groundwater. The full scope for this investigation work will be determined by the final Proposed Development design, however it is anticipated to involve additional groundwater level monitoring, sampling and testing, and vapour concentration monitoring at previously installed wells across the Beehive Retail Centre.

9.80 The findings of this research will be assessed quantitatively to inform reassessment of the conceptual model developed for the Site as part of the preliminary GQRA. This in turn will determine if additional further investigation works are necessary, or allow for design of mitigation measures to break all potential contaminant linkages to future receptors at the completed development.

Summary of Impacts

9.81 The following potential impacts to receptors at or surrounding the Site were identified:

During Construction Works

- Potential for impacts to off-site users due to inhalation of contaminated dust emissions or direct contact with surface run-off from exposed or stockpiled soils during construction works;
- Potential for impacts to on-Site users of completed phases of the development due to inhalation of contaminated dust emissions or direct contact with surface run-off from exposed or stockpiled soils during construction works;
- Potential impacts to ground workers and construction workers during demolition and construction from direct contact, ingestion and inhalation of potentially contaminated exposed shallow soils and groundwater, and from inhalation of vapours emitted from contaminated soils;
- Potential for impacts to these surrounding groundwater receptors from lateral or vertical migration of existing contamination in shallow groundwater due to increased rainfall infiltration while hardstanding cover is not present across the Site; and
- Potential for impacts to shallow soils, the secondary A aquifer in the River Terrace Gravels and principal aquifer in the West Melbury Formation from leaks or spills of fuels or chemicals brought on-site to construct the development.

Completed and Operational Development

- Potential for impacts to future Site users via direct contact with contaminated Made Ground in soft landscaped areas;
- Potential impacts to future structures from vapour ingress into the Proposed Development, arising from potentially contaminated soils and groundwater; and
- Potential impacts to the off-site shallow secondary A aquifer in the River Terrace Gravels, and principal aquifer in the West Melbury Formation from shallow groundwater contamination.

- 9.82 The assessment of ground conditions and contamination found that following mitigation which included the use of a CEMP and a further ground investigation, residual effects would be **neutral and not significant**.
- 9.83 A summary of impacts can be found in **Table 9.5**.

Table 9.5: Summary of Impacts: Ground Contamination

DESCRIPTION OF IMPACT	GEOGRAPHICAL IMPORTANCE	MAGNITUDE	IMPACT BEFORE MITIGATION				MITIGATION	IMPACT AFTER MITIGATION (RESIDUAL)			
			ADVERSE/BENEFICIAL	REVERSIBLE/IRREVERSIBLE	SHORT-TERM/LONG TERM	SIGNIFICANCE		ADVERSE/BENEFICIAL	REVERSIBLE/IRREVERSIBLE	SHORT-TERM/LONG TERM	SIGNIFICANCE
Potential for impacts to off-site users due to inhalation of contaminated dust emissions during construction works.	Loc	Min	Adv	Irrev	ST	Min	CEMP prepared for the site including measures to prevent dust emissions from exposed or stockpiled soils during the works.	-	Irrev	ST	Neu
Potential for impacts to off-site users due to direct contact with surface run-off from exposed or stockpiled soils during construction works.	Loc	Min	Adv	Irrev	ST	Min	CEMP prepared for the site including measures to prevent run-off from exposed or stockpiled soils during the works.	-	Irrev	ST	Neu
Potential impacts to ground workers and construction workers during demolition and construction from direct contact, ingestion and inhalation of potentially contaminated exposed shallow soils and groundwater.		-	-	-	-	Neu	No mitigation necessary beyond that set out by existing legislative requirements.	-	-	-	Neu
Potential impacts to ground workers and construction workers during demolition and construction from inhalation of vapours emitted from contaminated soils.	Loc	Maj	Adv	Irrev	ST	Maj	Further ground investigation will fully quantify the potential vapour regime at the Site and measures necessary to protect construction workers against vapour accumulation.	-	Irrev	ST	Neu

DESCRIPTION OF IMPACT	GEOGRAPHICAL IMPORTANCE	MAGNITUDE	IMPACT BEFORE MITIGATION				MITIGATION	IMPACT AFTER MITIGATION (RESIDUAL)			
			ADVERSE/BENEFICIAL	REVERSIBLE/IRREVERSIBLE	SHORT-TERM/LONG TERM	SIGNIFICANCE		ADVERSE/BENEFICIAL	REVERSIBLE/IRREVERSIBLE	SHORT-TERM/LONG TERM	SIGNIFICANCE
Potential for impacts to these surrounding groundwater receptors from lateral or vertical migration of existing contamination in shallow groundwater due to increased rainfall infiltration while hardstanding cover is not present across the Site.	Loc	Min	Adv	Irrev	ST	Min	Further ground investigation will quantify the potential for hydrocarbon contamination to be mobilised off-site, and inform appropriate remediation or mitigation measures if necessary.	-	Irrev	ST	Neu
Potential for impacts to shallow soils, the secondary A aquifer in the River Terrace Gravels and principal aquifers in the West Melbury Formation and Lower Greensands Formation from leaks or spills of fuels or chemicals brought on-site to construct the development.	Loc	Min	Adv	Irrev	ST	Min	CEMP prepared for the Site will include measures to minimise the potential impacts to controlled waters from storage of fuels or chemicals during redevelopment.	-	Irrev	ST	Neu
Potential for impacts to future Site users via direct contact with contaminated Made Ground in soft landscaped areas.	Loc	Min	Adv	Irrev	LT	Min	New soft landscaping installed in an appropriate thickness of imported, certified clean topsoil.	-	Irrev	LT	Neu
Potential impacts to future structures from vapour ingress into the proposed development, arising from potentially contaminated soils and groundwater.	Loc	Maj	Adv	Irrev	LT	Maj	Further ground investigation will fully quantify the potential for vapour emissions from soils or groundwater to affect new buildings, which will inform the mitigation measures necessary to break this contaminant linkage.	-	Irrev	LT	Neu

DESCRIPTION OF IMPACT	GEOGRAPHICAL IMPORTANCE	MAGNITUDE	IMPACT BEFORE MITIGATION				MITIGATION				IMPACT AFTER MITIGATION (RESIDUAL)			
			ADVERSE/BENEFICIAL	REVERSIBLE/IRREVERSIBLE	SHORT-TERM/LONG TERM	SIGNIFICANCE					ADVERSE/BENEFICIAL	REVERSIBLE/IRREVERSIBLE	SHORT-TERM/LONG TERM	SIGNIFICANCE
Potential impacts to the off-site shallow secondary A aquifer in the River Terrace Gravels, and principal aquifer in the West Melbury Formation from shallow groundwater contamination.	-	-	-	-	-	Neu	No mitigation necessary.				-	-	-	Neu

Key:

Loc: Local Neu: Neutral Rev: Reversible Adv: Adverse ST: Short Term
Min: Minor Maj: Major Irrev: Irreversible LT: Long-Term

Townscape and Visual

10

10.0 Townscape and Visual

Introduction

10.1 This chapter addresses the likely significant townscape and visual impacts of the Proposed Development. It has been prepared by Martina Sechi BSc. BE MALA CMLI to assess the impacts of the Proposed Development in relation to the effects it would have on the townscape resources and visual receptors identified within the study area.

10.2 Technical appendices that support this chapter are:

- Appendix 10.1 – Methodology
- Appendix 10.2 – Mapping
- Appendix 10.3 – Viewpoint Assessment
- Appendix 10.4 – Technical Visualisations
- Appendix 10.5 – Correspondence

Potential Impacts

10.3 As identified in the Townscape and Visual Impact Assessment Baseline submitted at scoping stage, the preliminary analysis of the Proposed Development against the baseline conditions concluded that the following townscape and visual effects are to be expected:

- The building volumes and height would alter the views from strategic green spaces, namely Coldham's Common and Ditton Meadows;
- Views from within the Mill Road Conservation Area could be visually impacted by development on Site;
- Building heights on Site in excess of those around are likely to have an impact on nearby and long-distance views identified in the relevant Local Plan's policies; and
- The change in land use that would come with the proposed diversification of offering on the Site would change the experiential quality of the Site and so the setting of the adjacent residential areas.

Methodology

10.4 The townscape and visual impact assessment (TVIA) accords with the current best practice guidance, namely:

- 'Guidelines for Landscape and Visual Impact Assessment', (GLVIA3) produced by the Landscape Institute with the Institute of Environmental Management and Assessment (Third Edition, 2013);
- 'Visual Representation of Development Proposals'. Technical Guidance Note 06/19, by the Landscape Institute (17 September 2019);
- 'Townscape Character Assessment', Technical Information Note 05/2017, by the Landscape Institute (5 December 2017);
- 'Tall Buildings', Historic England Advice Note 4, by Historic England (December 2015 and 2nd edition March 2022); and
- Policy 60 and Appendix F, Cambridge Local Plan (2018).

- 10.5 Given the proximity of residential properties, the following guidance has also been considered:
- 'Residential Visual Amenity Assessment' (RVAA), Technical Guidance Note 2/19, by the Landscape Institute (15 March 2019).
- 10.6 In response to the particular urban nature of the Site context this assessment refers to townscape impacts, rather than purely landscape impact. The GLVIA3 defines townscape as *'the landscape within the built-up area, including the buildings and the relationship between them, the different type of urban spaces, including green spaces, and the relationship between buildings and open spaces'*. It also stresses the importance to consider the historic evolution of landscape and townscape to reveal how villages, towns and cities change over time to reach their current character.
- 10.7 It should, therefore, be noted that for the purposes of this assessment the term 'townscape' is used to encompass all the urban and landscape characteristics of the Site and its context. It incorporates the meaning and role of the general concept of 'landscape' used within the GLVIA3.
- 10.8 In accordance with the GLVIA3 approach to assessment there are differences between townscape and visual impact of the development which will result in certain effects:
- Townscape Effects relate to changes in the fabric, character and quality of the urban landscape. These include direct impacts such as loss of vegetation and additional built form, or indirect impacts such as changes to tranquilly. Townscape effects do not need to be visible.
- Visual Effects relate to specific changes in views and the effects on visual receptors (e.g. users of public rights of way or recreational facilities). Changes to the visual setting of protected cultural heritage features are also considered (e.g. Scheduled Monuments, Listed Buildings and Conservation Areas).
- 10.9 A detailed methodology of how the appraisal of the above elements is applied can be found in **Appendix 10.1**. Generally, townscape or visual effects are considered significant if:
- They result in a major loss of or irreversible negative effect over an extensive area, and/or a valuable feature, and/or a sensitive receptor; and
 - The quality of change is of such scale and nature to cause a major and unacceptable mutation of the distinctive characteristics and value of the receptor (i.e. a non-characteristic, discordant or intrusive element).
- 10.10 Due to the outline nature of the application, a Year 15 scenario is considered only to the extent that the parameter plan allows it, as they do not include sufficient details to adequately inform the assessment of the impact of mature planting on the identified effects. However, the allocation of strategic open space or landscape areas will be considered where relevant and appropriate.
- 10.11 On the consideration of impact at night, in liaison with the Local Planning Authority (see **Appendix 10.5**) it was agreed that night-time views were not feasible due to the outline nature of the planning application. However, commentary on the potential impact at night will be included where possible and relevant. A detailed assessment of the night-time view shall be conducted during the reserved matters stage of the application, as the detail of the proposal will allow the production of suitable technical visualisations.

Study Area

- 10.12 Initial baseline investigations noted that the Site is located within the dense urban fabric of Cambridge suburbs, which surrounds the existing retail centre. The proposed land use is similar in nature to the existing commercial use and introduces a coherent townscape character to the baseline condition. It is therefore considered that 1km radius would be appropriate to the assessment of the relevant townscape effects (see Map 1b in **Appendix 10.1**). The study area would also include local townscape designations that are of particular relevance to the TVIA, such as Mill Road Conservation Area, including Registered Parks and Gardens, and the public open space and Green Belt area at Coldham's Common.
- 10.13 In terms of visual effects, it is noted that the Site is relatively enclosed by built form with residential development around the entirety of the southern and western Site boundaries. To the north, the large scale retail premises and the location of the vehicular bridge crossing the rail line restrict views into the Site from the Newmarket Road area. Nevertheless, it is envisaged that the visibility of the proposed buildings, due to their heights, might encompass an envelope beyond the 1km to include critical views listed in the Local Plan documents. Although any significant visual impact is likely to be concentrated within the 1km radius, views beyond such area will be considered to inform the extent of the study area for the visual effects.

Desk-Based Study

- 10.14 A desk-study is undertaken to identify planning policy and designations relevant to the assessment of landscape and visual effects, this will include:
- Ordnance Survey 1:10,000 scale Application Site-centred digital raster map;
 - National Planning Policy Framework (July 2021);
 - Cambridge Local Plan (October 2018);
 - Adopted Cambridge Policies Map (October 2018);
 - Mill Road Area, Conservation Area Appraisal (June 2011);
 - Natural England, National Landscape Character profiles;
 - Cambridge Landscape Character Assessment (April 2003);
 - Townscape Character Areas abstract from the Cambridge Inner Green Belt Boundary Study, (2015);
 - Greater Cambridge Landscape Character Assessment (Chris Blandford Associates, February 2021);
 - Multi-Agency Geographic Information for the Countryside (MAGIC): Web-based interactive GIS mapping site (www.magic.gov.uk);
 - Nightblight.cpre.org.uk/maps/ (The Countryside Charity); and
 - Aerial photography: Google Maps (<http://maps.google.co.uk>).

Field Study

- 10.15 A field survey was undertaken on the 24th and 25th of November 2020, 24th March and 24th of August 2022 to:
- Be familiarised with the surrounding landscape/townscape characteristics of the Site and its context; and
 - Define the location of visual receptors and representative viewpoints.

- 10.16 The surveys were generally undertaken from roads, bridleways, tracks, footpaths and publicly accessible viewpoints within 2 km of the Site.

Consultation

- 10.17 Pre-application consultation was conducted with the Local Planning Authority, including workshops focused on townscape/visual input into the design evolution. VuCity was used, occasionally live during the meeting, to explore the design at the identified viewpoints.
- 10.18 During the pre-application meetings with the Local Planning Authority, the TVIA approach was discussed and agreed with the landscape officer, including the list of viewpoints and the approach to the technical visualisations. Communication on the omission of night-time views is included in **Appendix 10.5**.

Limitation and Assumptions

- 10.19 The scope of the TVIA was agreed with the Local Planning Authority (LPA) through the EIA scoping and pre-application process, therefore, desk-based and on-site analysis are limited to the agreed documents and viewpoints.
- 10.20 The outline nature of the proposal, albeit accompanied by a Design Code (DC), results in some limitations to the level of details of the design, which affects the outcome of the LVIA. In particular, the following create uncertainty on the final visual outcome:
- The lack of a detailed landscape scheme (i.e. site level plan, planting schedule, planting specification and maintenance plan) reduces the ability to assess the impact at year 15 knowing the amount, growth and ability to thrive of the proposed planting.
- 10.21 The LVIA does not include a review of the methodologies and conclusion of the considered documents listed in the References. The Proposed Development is analysed against the content of the available landscape/townscape evidence and policies.
- 10.22 To inform the assessment of visual effects, technical visualisations have been produced. The baseline and visualisation photography has largely been carried out during the winter months, therefore allowing the understanding of the worst-case scenario. However, visual assessment is also aided by on-site experience and reasonable assumptions are made to consider seasonal effects.
- 10.23 To inform the assessment of construction effects assumptions are made on the likely work and machinery required.
- 10.24 Assessment of the visual impact of the proposal during the night could not be carried out due to the outline nature of the planning application. The External Lighting Strategy by Hoare Lea does not include a detailed design but general guidance on areas that will need illumination; therefore, there are not enough details on the proposed lighting scheme to produce suitable night-time views that would inform the assessment.

Mitigation – Primary Measures

- 10.25 During the iterative design process, the masterplan has evolved in response to townscape and visual analysis findings as well as other stakeholder comments. The design evolution is illustrated in Section 7 of the Design and Access Statement (DAS). In particular, the following mitigation measures have been incorporated to reduce likely significant effects:
- Creation of an articulated skyline to avoid a flattening of the horizon above the tree canopies;