15. Ground Conditions

Background

15.1 This Chapter assesses the effects of the Proposed Development on ground conditions and considers the implications of the prevailing conditions of the Application Site on the Proposed Development. In particular, it considers the potential risk of contamination to human health and the environment and the effect of existing ground conditions on new structures, water resources and soils.

15.2 This Chapter has been written by Pam Brown Associates Ltd (PBA). It summarises a Phase I Desk Study and Phase II Environmental Site Investigation entitled *'Sainsbury's New Build, Macclesfield Road, Leek, Phase I Desk Study and Site Audit and Phase II Environmental Site Investigation for Sainsbury's Supermarkets Ltd*'. *946-08/CT/PB (November 2009)*, presented as **Appendix 15.1**.

15.3 The report includes an assessment of the data obtained from geo-environmental and historic searches for the Site and the findings of an initial PBA Site investigation completed in April 2009.

15.4 This chapter characterises the Site in terms of its geological, hydrogeological, hydrological and environmental setting, and describes the baseline ground conditions. The direct and indirect effects of the Proposed Development arising from the existing ground conditions, hazardous materials, and potential future sources of contamination are then assessed in accordance with the described methodology in terms of the demolition and construction phase and the operational phase of the completed development.

15.5 Some effects of the Proposed Development may be assessed as beneficial, however, where adverse effects are identified mitigation measures are described in order to prevent, reduce or offset these effects. The residual effects after instigation of the mitigation measures are then assessed in terms of the operational development.

15.6 The assessment briefly considers site hydrology and archaeological remains, but reference should also be made to Chapter 14: Hydrology and Drainage and Chapter 11: Archaeology.

Legislation and Planning Policy Context

Legislation

Environmental Protection Act, 1990 - Part IIA

15.7 Part IIA of the Environmental Protection Act (EPA) 1990 (Ref. 15.1) provides a regulatory regime for the identification and remediation of historically contaminated land. The legislation introduced the principle of 'suitable for use' which requires a risk based approach to dealing with contaminated land. The legislation recognises that the risk will vary according to the use of the land and other environmental factors including geology. The approach is applied to remediation of contaminated land in order to drive sustainable development.

15.8 Section 78A(ii) of Part IIA of the EPA 1990 defines 'contaminated land' as any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land that:

i) significant harm is being caused or there is a significant possibility of such harm being caused; or

ii) pollution of controlled waters is being, or is likely to be caused.

15.9 If the site is categorised the authority shall act in accordance to guidelines to determine the contamination, the harm caused, the degree of significance of contamination and thus determine the remediation.

15.10 'Significant harm' is determined based on the demonstration of a significant pollution linkage being present. A pollution linkage consists of three parts:

iii) a contaminant e.g. a substance which is in, on or under the land which has the potential to cause harm or to cause pollution of controlled waters;

iv) a receptor, e.g. human beings, ecological systems, property in the form of buildings, property in the form of livestock/crops; and

v) a pathway e.g. one or more routes or means capable of exposing a receptor to the contaminant.

15.11 The three elements must be present to form a pollutant linkage, and a risk assessment must be undertaken to determine the likelihood of significant harm being caused to one of the specified receptors.

15.12 The principle regulators of Part IIA are the local authorities and the EA, the latter has a complementary regulatory role, in particular to provide advice in relation to pollution of controlled waters.

Environment Act 1995

15.13 Section 57 of the Environment Act 1995 (Ref. 15.2) inserted Part IIA into the Environmental Protection Act.

Contaminated Land (England) Regulations 2000

15.14 The Contaminated Land (CLA) (England) 2000 Regulations (Ref. 15.3) implemented Part IIA of the Environmental Protection Act (EPA) 1990. This placed a duty on all local authorities to identify contaminated land in their area and bring about its remediation. The CLA (England) Regulations 2000 set out further requirements in respect of: categories of land which are to be designated as special sites, form and content of remediation notices, appeals, compensation for access and public remediation registers.

15.15 CLA 2000 also provides detailed rules for assigning liabilities based on the 'polluter pays' principle.

Contaminated Land (England) Regulations 2006

15.16 The Contaminated Land (England) Regulations 2000 were repealed and replaced by the Contaminated Land (England) Regulations 2006 (Ref. 15.4) which modified Part IIA of the Environmental Protection Act 1990 by including provisions for radioactive contaminated land and setting out provisions relating to the identification and remediation of contaminated land.

Water Resources Act 1991

15.17 The Water Resources Act (1991) (Ref. 15.5) established the regime, now controlled by the EA, to conserve, manage and control pollution of water resources, abstraction and impoundment, and offences for contravening and organising flood defences. Under Section 161 of the Act, the EA can serve an anti-pollution works order on a person or persons who cause or knowingly permit pollution of controlled waters (including both surface water and groundwater).

Water Framework Directive 2000/60/EC 2000

15.18 The purpose of the Water Framework Directive (WFD) (Ref. 15.6) is to establish a framework for the protection of inland surface waters (rivers and lakes), transitional waters (estuaries), coastal waters and groundwater. It ensures that all aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands meet 'good status' by 2015. The WFD introduces the key concept of integrated river basin planning and management based on integrated River Basin Management Plans (RBMP), which include environmental objectives for each body of surface or groundwater.

15.19 Interaction between WFD and spatial planning is encouraged in order that the planning process is used to achieve WFD 'good status' objectives, through the application of planning conditions and obligations to planning permission for new developments. The WFD is implemented by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 (Ref. 15.7)

The Landfill Regulations (England and Wales) (as amended) 2005

15.20 The Regulations (Ref.15.8) completed the implementation of the Landfill Directive 1999/31/EC and Council Decision 2003/33/EC which aim to divert waste away from landfill, establishing criteria for the acceptance of waste at landfill, 'waste acceptance criteria'. The legislation defines three types of landfill; hazardous, non hazardous and inert according to the type of waste they receive. Classification of waste is based on the results of waste acceptance criteria testing which determines how waste is to be disposed and the requirement for pre-treatment prior to disposal in order to reduce its volume, hazardous nature, improve handling, or enhance its recovery.

Environmental Permitting Regulations 2007

15.21 The Environmental Permitting Regulations (Ref. 15.9) came into force in 2008 and combined pollution prevention and control (PPC) and waste management licensing (WML) so that all PPC permits or waste management licences became an environmental permit. The Regulations provide a single, streamlined, risk-based framework for permitting and compliance. Under the Regulations an exemption will be required in order to stock pile and replace arisings from excavations on site, as they will be classified as waste.

15.22 Both hazardous and non-hazardous waste requires pre-treatment either on- or off-site prior to being disposed of at a licensed landfill site with prior consent from the EA.

Environmental Protection (Duty of Care) Regulations 1991

15.23 The Duty of Care Regulations (Ref. 15.10) are part of the EPA 1990 (Part IIA) (Ref. 15.1), and relate to the handling of business waste in a responsible manner, preventing fly tipping and pollution.

15.24 The obligations of businesses under the Duty of Care Regulations are:

- To prevent the escape of waste from their containers;
- To ensure that there is a written description of the waste when it is transported to and arrives at the waste disposal Site.;
- To ensure that transport of waste is carried out by an authorised, licensed waste carrier; and
- To ensure, within reason, that waste is dealt with in an appropriate manner at a licensed landfill or waste management facility.

15.25 These Regulations apply to all industrial and commercial waste (with the exception of mining, quarrying, and radioactive wastes).

Site Waste Management Plans Regulations 2008

15.26 The Site Waste Management Plans (SWMPs) Regulations (Ref. 15.11) require any developer who intends to carry out a project on any one construction site with an estimated value greater than £300,000 excluding VAT to prepare a SWMP conforming to these Regulations before construction work begins. The SWMPs must include the name of the client, principal contractor and the author of the plan, location of the Site and estimated cost of the project. Descriptions should be provided of each waste type expected to be produced, along with associated waste management actions to include: reuse, recycling, recovery and disposal. It should also include a declaration that the client and principal contractor will take all reasonable steps to ensure that:

- All waste will be dealt with in accordance with section 34 of the EPA 1990 (Ref. 15.1) and the Environmental Protection (Duty of Care) Regulations 1991 (Ref. 15.9); and

- Materials will be handled efficiently and waste managed appropriately.

National Planning Guidance

Planning Policy Statement 23 Planning and Pollution Control, 2004 (PPS23)

15.27 PPS23 (Ref. 15.12) contains the Government's planning policy on contaminated land along with Annex 2 to the document entitled Development on Land Affected by Contamination. The aim of PPS23 is to identify potential contamination at an early stage in the planning process. Appropriate policies should be developed to enable risks to be identified, assessed and overcome so that land affected by contamination can be put to beneficial use and planning applications determined on the basis of adequate information.

15.28 The potential for adverse effects on human health, the environment (including controlled waters, buildings and neighbouring land), and amenity should thus be reduced to acceptable levels.

15.29 The standard of remediation to be achieved through the grant of planning permission for new development (including permission for land remediation activities) is the removal of unacceptable risk to ensure the site is suitable for its new use, including the removal of all existing pollutant linkages. All receptors relevant to the site should therefore be protected to an appropriate standard.

15.30 Paragraphs 23 – 25 state that the LPA should satisfy themselves that the potential for contamination and associated risks have been assessed via appropriate studies and remediation options appraised by appropriately qualified persons with planning conditions to ensure remediation is undertaken to secure the removal of unacceptable risks and make the site suitable for new use.

15.31 In conclusion, Paragraph 26 states that:

> *"Opportunities should be taken wherever possible to use the development process to assist and encourage the remediation of land already affected by contamination".*

Regional Planning Policy

West Midlands RSS (formerly known as RPG 11) revised 2008 (Ref. 15.13)

15.32 Policies QE2 and QE9 are of particular relevance to the Application Site and Proposed Development:

- Policy QE2 (Restoring degraded areas and managing and creating high quality new environments):

  B ii) *'promote the restoration and remediation of derelict and contaminated sites and reuse of buildings, having regard to the Region's biodiversity and historic assets;'*

- Policy QE9 (The Water Environment):

  A. Development plan policies and plans of the Environment Agency and other agencies should be co-ordinated, where necessary across local authority and Regional boundaries, to:

  i) protect and improve water quality, manage demand and conserve water supply and reduce the adverse effects of development on the water environment by consideration of suitable drainage systems;

  v) reduce any adverse effects of development on the water environment by encouraging consideration of sustainable drainage systems where appropriate at an early stage in the design process;

  vii) maintain and enhance river and inland waterway corridors as key strategic resources, particularly helping to secure the wider regional aims of regeneration, tourism and the conservation of the natural, built and historic environment'.

Staffordshire and Stoke on Trent Structure Plan 1996-2011 (Adopted May 2001)

15.33 The Plan (Ref. 15.14) provides a comprehensive, sustainable strategy relating to land use, transportation and the environment, extracts of key relevant policies are:

- Policy D1 Sustainable forms and patterns of new development will be sought which:

b) '*consider all possibilities for reuse of land and buildings, including the reclamation of contaminated land and derelict land in sustainable development locations before using greenfield land ….*'

- Policy D2 (Development) should generally conserve and, where possible, improve the quality of life and the environment and should:

  c) *'minimise pollution of land, water and air, waste generation, nuisance from noise and pollution by artificial sources of light*'.

- Policy D3 (Urban Regeneration):

  c) *'reclaim and reuse derelict, contaminated, degraded or underused land and buildings…'*

Local Planning Policy

Staffordshire Moorlands Local Plan 1998

15.34 The Local Plan (Ref.15.15), contains policies directing development proposals and promoting appropriate land-use.

15.35 Policy N28 (Contaminated/Derelict Land):

> *'The district council will encourage and where possible assist proposals which will result in the reclamation and appropriate redevelopment of contaminated land and/or derelict land.'*

Local Development Framework - Staffordshire Moorlands

15.36 Draft Policy SDI (Achieving Sustainable Development) of the Core Strategy Submission DPD requires all development to make sustainable use of resources, help to minimise any environmental and amenity impacts and adapt to climate change. This will be achieved inter alia by '*supporting or promoting proposals that remediate brownfield sites affected by land contamination, where this is consistent with other policies'.*

15.37 Appendix B 'Strategic Development Areas Plan' refers to Churnet Works site as a 'Major Regeneration Opportunity Area' and acknowledges that 'land remediation' is required.

Assessment Methodology and Significance Criteria

Assessment Methodology

15.38 The baseline conditions of the Application Site were established by conducting a detailed desk-based Phase I Desk Study and Phase II Environmental Site Investigation (the 'Report'), which is presented as **Appendix 15.1**.

15.39 The 'Report' was completed in accordance with current best practice guidance as contained within the DEFRA Contaminated Land Reports (CLR) series (Refs 15.16-22), specifically CLR11. As described in **Table 15.1**, CLR 11 describes the risk management process to be adopted when assessing potentially contaminated sites and introduces the concept of the Conceptual Site Model (CSM) which supports the identification and assessment of pollution linkages. The CSM identifies the sources of contamination, the potential receptors and potential migration/exposure pathways by which the receptors can be exposed to the contamination. The CSM is developed in the preliminary risk assessment and further refined as additional information becomes available e.g. site investigation data.

15.40 Possible contaminants which may have arisen in soil and aquatic media from historic and current on and off-site activities are identified and hazards assessed according to the magnitude of the potential consequences (severity) when reaching a receptor as described in CIRIA C552 report (2001). This is known as Environmental harm[1] and can be classified as minor, mild, medium or severe

15.41 The significance and likelihood of each pollution linkage being formed was then assessed on the basis of the Proposed Development based on guidance in CIRIA C552 2001(Ref 15.23).

15.42 The Phase I desk study and subsequent investigation were based upon the guidance documents in **Table15.1**.

[1] Rudland, D., Lancefield, R.M., Mayel, P.N. (2001) "Contaminated land Risk Assessment: A guide to good practice. CIRIA C552. UK. pp.80.

Table 15.1: National Methodology Guidance

Title	Abbreviation	Description with regard to Site Investigations
Contaminated Land Report (1994) - Sampling Strategies for Contaminated Land.	CLR 4	Guidance on planning site investigations on suspected contaminated land including; sampling densities, depth and spatial distribution.
Contaminated Land Report (2004) - Model Procedures for the Management of Land Contamination	CLR 11	'The Model Procedures for the Management of Land Contamination are intended to provide the technical framework for structured decision-making about land contamination. The basic process can be adapted to apply in a range of regulatory and management contexts. The Model Procedures are intended to assist all those involved in "managing" the land – in particular landowners, developers, industry, professional advisors, financial service providers, planners and regulators.'
Science Report SC050021/SR3: Updated technical background to the CLEA Model	SR3	This report replaces CLR 10 and provides the technical basis for the Contaminated Land Exposure Assessment Model, with further consideration of the generic land use scenarios and assumptions used in the CLEA model. The report is one of a series published by DEFRA and the EA that is relevant to assessment of risks to human health arising from long-term exposure to soil contamination. The model estimates child and adult exposures to soil contaminants for those potentially living, working and/or playing on contaminated sites over long time periods and has been used to produce the Soil Guideline Values (SGVs) for the UK, taking into account land-use, contaminant type and general site conditions.
British Standards (2001) - Investigation of Potentially Contaminated Sites-Code of Practice	BS 10175	The British Standard is applicable to the investigation of all potentially contaminated sites and also to land with naturally enhanced concentrations of potentially harmful substances. The management involves identifying risks due to the presence of contaminants, in order that appropriate action can be taken. The risk assessment of a potentially contaminated site requires information to characterise the contamination status. This information is gathered by a process of site investigation as set out in this Standard. This is through the preliminary investigation (desk study). The information required comprises; Details of historical setting and potential presence of contaminants Identification of who or what could be affected by the contaminants (receptors) Information on the pathways by which contaminants could migrate or come into contact with receptors (inc. details of any physical characteristics of the site that will affect contaminant movement) The results of the investigation should define all known aspects of the site that could impinge upon or affect the

Title	Abbreviation	Description with regard to Site Investigations
		contaminant-pathway-receptor scenario and is referred to as the conceptual model. The desk study is then used to focus subsequent investigation, where necessary, to meet the objectives of the overall investigation. The use of the conceptual model to assess the requirement for remedial action is part of the risk assessment process.

Significance Criteria

15.43 Published EIA guidance does not define significance criteria for assessing the significant effects relating to ground conditions. Significance criteria have therefore been developed based on the criteria described in **Table 2.1** in Chapter 2 and contaminated land guidance (CIRIA C552).

15.44 In order for an adverse effect (harm) to occur all three elements of the source-pathway-receptor scenario must be present. The significance of the effect depends on the value of the resource, the sensitivity of the receptor and the presence of viable pathways present due to the Proposed Development. The significance of an effect is also influenced by the timescales during which it can occur, i.e. short, medium or long term and the extent of the area affected.

15.45 The assessment of potential and residual effects in relation to ground conditions uses the seven level scale of significance, set out in **Table 15.2**.

Table 15.2: Significance Criteria

Magnitude of Effect	Definition
Substantial Adverse	Acute or chronic severe effect to human health and or ecosystem. Severe temporary or permanent reduction in the quality of groundwater or surface water of local, regional or national importance. Catastrophic damage to buildings or property e.g. explosion.
Moderate Adverse	Chronic effect to human health and or ecosystem due to presence or likely presence of a significant pollution linkage and concentrations of contaminants exceed generic assessment criteria. Moderate, reversible, reduction in quality of groundwater, surface water resource, of local, regional or national importance. Damage to property rendering it unsafe to occupy.
Minor Adverse	Detectable but minor harm to identified receptors, likely to be short term and reversible, e.g. non permanent health effects to human health, pollution of non sensitive water resource. Damage to buildings, structures or services, localised and easily repaired.

Magnitude of Effect	Definition
Negligible	No appreciable effect on identified receptors.
Minor Beneficial	Risks to human health and ecosystems reduced to acceptable levels. Local scale improvement to the quality of groundwater or surface water resources. Risks to property reduced.
Moderate Beneficial	Moderate reduction in risk to human health and ecosystems. Moderate local improvement to the quality of groundwater or surface water resources. Moderate reduction in risks to property.
Substantial Beneficial	Significant reduction in risks to human health and ecosystems. Significant local / moderate regional scale improvements to quality of potable groundwater or surface water resources. Significant reduction in risk to property.

Baseline Conditions

Site Review

15.46 All environmental site review information, as well as details regarding the type, status and use of the site infrastructure are based on site visits.

15.47 As discussed in Chapter 3 the site comprises three large brick built buildings on the main body of the Site which originally housed the Churnet Dye Works and more recently have been divided internally into smaller units and leased to tenants. A further unit is located to the front, adjacent Macclesfield Road and is an engineering works (Industrial & Agricultural Engineers, IAE).

15.48 Previous and current Site users include a range of commercial / industrial activities; signage manufacturers, dye works, body repair workshops, antique dealership, haulage services and engineering works.

15.49 A Site plan showing the approximate divisions of the buildings, annotations and photograph locations is included at Figure 4 in **Appendix 15.**1 (following the building numbers differ to those discussed in Chapter 9). Photographs of specific areas or details of interest are also included in **Appendix 15** (Section 3 and **Appendix 1**). The various site uses and areas of concern identified during the original site visit are now described.

Building 1

15.50 Building 1 is the largest building on the Application Site, located to the north of the main access road. The building had been divided into several units:

- Leek Signs and Spectrum Transport occupied a unit at the front of the building which covered 3 bays (Plate 1) they have since relinquished their tenancy;
- the remaining units at the front were disused, with vegetation growing through cracks in the concrete externals (Plate 2);
- Portland Dye works is located in Unit 3, at the rear, the largest unit within the building. The Dye Works effluent treatment plant is located at the northern rear elevation to the building;
- Scheme Printers are located in Unit 17.

15.51 To the rear of Building 1 several tanks were noted and beyond was an area used for the indiscriminate dumping of waste chemical drums, bowsers and waste metal materials (Plates 3, 4 and 5). The hardstanding surfaces around the building varied between asphalt and concrete of varying quality.

15.52 A partially canopied walkway connects Building 1 on the eastern part of the Application Site to Building 2 (Plate 6).

Building 2 and Environs

15.53 Building 2 was occupied by Portland Dye Works' offices, a car repair works to the rear and private storage units (Plate 7). To the north and rear of the building are 5 silos used by Portland Dyeing to hold water which has been abstracted from the River Churnet (Plates 8 and 9), filtered through a Haith Filtration Plant (Plate 10) and softened via ion exchange within Unit 18 (Plate 11) and then stored for use (Plate 12).

15.54 A small building south of Building 2 and adjacent the river was noted as James Close Bodywork, Unit 19 (Plate 13). An electricity sub station is located in the same area (Plate 14).

15.55 Unit 18 is located south of the River opposite Unit 19 on the southern part of the main Site. The building housed the groundwater abstraction borehole and the water softening treatment plant (Plate 11).

Building 3

15.56 Building 3 comprised a small garage works (Plate 15), pine furniture restorer and manufacturer, woodworking, and maggots breeding for the leisure fishing industry (Plate 16). The building backs onto the flood relief channel, west of the Site.

15.57 To the rear of Building 3 is an underground effluent treatment plant (Plate 17) with a flume and associated consent to discharge to the flood relief channel.

External Areas

15.58 The external surfaces varied significantly across the Site, from asphalt and concrete to open ground. During the initial site visits it was noted that to the rear of Buildings 2 and 3 there was evidence of significant tipping, rubble, asphalt and other demolition wastes and general rubbish (Plates 18 to 22). A small unit undertaking car repair works was disposing of oil into drums which were overflowing with spent oil (Plate 23).

15.59 A free-standing burner was noted (Plate 24) which appeared to be used to recover metal from wire, with approximately three mounds of burnt waste residue.

15.60 The original site review noted evidence of tipping to the rear of Building 2 primarily the blue drums from Portland Dying previously containing soaps, enzymes and hydrogen peroxides, and caustic soda. Plates 25 to 28 identify a few of the contaminants;

- Clariant Paper Chemicals – Leucophor; paper optical brighteners (Plate 25);
- Intracron Black V-CKN – textile dye (Plate 26);
- Sodium Silicate Solution – Liquid glass, for metal repair, food preservation, and cement uses, as it is a successful binder (Plate 27); and
- Sodium Dithionite - eliminates excess dye, residual oxide, and unintended pigments, thereby improving overall colour quality (Plate 28).

15.61 By June 2009, the majority of the chemical drums, oil drums and the free-standing burner had been cleared from the Site by the occupiers in accordance with their tenancy agreements.

Building 4

15.62 Building 4 is located to the south of the Site between Macclesfield Road and the River Churnet. Access to the Site was from Macclesfield Road and is used by IAE for the manufacture of steel galvanised agricultural, equestrian and fencing equipment.

Open Space

15.63 A former playing field and football pitch are located to the north, separated from the main Site by a steep embankment/flood defence bund (**Figure 4** continued tin **Appendix 15.1**). To the eastern boundary a row of terraced housing back onto the Site. The embankment forms part of the flood relief channel.

Topography

15.64 The topography of the Site is generally flat with elevations recorded at 154.5m to 155.5m AOD on the main Site and 153.5 to 154.5m AOD on the open space to the north. A bund separates the main industrial area from the open space and a second bund has been formed along the flood relief channel.

Geology and Ground Conditions

15.65 British Geological Survey (BGS) Map Sheet 111: Buxton, Scale 1:50,000 Solid and Drift Edition was consulted in order to establish information regarding the underlying geology and potential mining around the Site. The expected ground conditions at the Site are anticipated to comprise the following:

Strata	Age	Description
Alluvium	Quaternary	Clay with sands and gravels
Sherwood Sandstone	Triassic	Sandstone yellowish/grey and pebbly

15.66 Information from the Envirocheck Report presented within the 'Report' (**Appendix 15.1**) indicates that the Site presents:

- no risk from shallow mining hazards;
- no risk from collapsible ground stability hazards;
- no risk from compressible ground stability hazards;
- no risk from ground dissolution stability hazards;
- very low to moderate risk from landslide ground stability hazards;
- none to very low risk from running sand ground stability hazards; and
- none to very low risk from shrinking and swelling clay ground stability hazards.

15.67 The Site is located in an area that is not affected by coal mining.

15.68 The Site is within an area where the number of houses affected by radon is between 1-3%. No specific protection measures are required for new builds.

15.69 Based on the published geological information and the findings of the PBA site investigations the strata encountered in the exploratory holes are classified as Made Ground and Alluvium, and described as follows:

- *Made Ground* – encountered in all exploratory holes to depths between 0.35m to 4.90m bgl.
  - *Main Site* - the made ground was described as a granular sub-base underlain by a sandy, gravelly clay with gravel of brick, concrete, quartzite, ash, clinker, coal and plastic.
  - *Possible Former 'Landfill',* to the rear of Buildings 2 and 3 - the soils encountered were described as a clayey, slightly sandy gravel to clayey gravelly sand with gravel of brick, concrete, coal, plastic, ceramics, ash, textiles, metal, glass, clinker. A phenol odour and pink dye were identified in three of the exploratory holes. The findings indicate this was an area of uncontrolled deposition of waste rather than a designated landfill site.
  - *Open Space* – topsoil was encountered to depths between 0.35m to 1.60m bgl, consisting of a silty sandy slightly gravelly clay to clayey sand with gravel of quartzite, coal and sandstone with abundant roots and rootlets.
- *Alluvium* – encountered beneath the made ground to the base of the exploratory holes, generally comprised a very soft to firm grey green sandy clay becoming sand and gravel at depth. Gravel comprised granite, quartzite, sandstone, siltstone and occasional mudstone.

15.70 The investigation areas are identified on **Figures 5 and** 6 in **Appendix 15.1**.

Hydrogeology

15.71 According to the EA Groundwater Vulnerability Map 1:100,000 scale, Sheet 17: Derbyshire & North Staffordshire, the Site is underlain by a Major Aquifer. These are highly permeable formations usually with a known or probable presence of significant fracturing. They may be highly productive and able to support large abstractions for public water supply and other purposes.

15.72 Information provided by the EA identifies the Site as being located within a groundwater Source Protection Zone III – Total Catchment, to various sources. The nearest being the Abbey Green public water supply operated by Severn Trent, 407m northeast of the Site.

15.73 'Zone III' – or 'Total Catchment' is the total area needed to support removal of water from the borehole, and to support any discharge from the borehole.

15.74 Two discharge consents to groundwater have been recorded within 1km of the Site:

- Abbey View Tennis Club – 343m east for sewage effluent; and
- J P Littlejones – 549m north for sewage effluent.

15.75 There is one groundwater abstraction licence located on-site. Churnet Works Estate Ltd. held two permit versions, nos. 102 and 103, the latter start date was October 2007, for textiles & leather – non-evaporative cooling and process water. Norcart Enterprises Ltd. previously held this license under permit versions 100 and 101 between June 1998 to 2005 for textiles and leather – non-evaporative cooling and process water.

15.76 The permit end date for the abstraction consents are not detailed within the 'Envirocheck' report. Further investigation with the Portland Dyeing Company would indicate that the groundwater abstraction is no longer operational.

15.77 Within 500m of the Site boundary the following groundwater abstraction consents have been recorded:

- Mr R W Maydock - 226m north for general farming & domestic use.
- Avon Holdings (Wolverhampton) Ltd – 284m east for general farming and domestic use.
- Severn Trent Water – 403 and 407m north-east for public water supply.

15.78 There are a further eight consents recorded up to and beyond 1km of the Site detailed within the 'Envirocheck' report (**Appendix 15.1**).

15.79 Groundwater strikes were encountered within several window sample holes during drilling, and most window sample hole materials were recorded as 'wet' within the natural alluvial deposits. Perched waters were encountered during monitoring at levels between 2m and 4m below ground level (bgl). The main groundwater has been recorded within the deeper boreholes at 8m bgl.

Hydrology

15.80 The nearest surface water feature is the River Churnet which defines the eastern Site boundary and flows through the southern part of the Site, the flow of the Churnet is to the south west. A man-made flood relief channel for the River Churnet, controlled by a series of weirs, defines the northern and western boundaries of the Site confluencing with the Churnet at the south western edge of the Site.

15.81 According to the EA General Quality Assessment (GQA) Scheme, the river quality of the River Churnet was recorded at three points along its course during 2000, the results vary from GQA Grade B (Good) to GQA Grade A (Very Good).

15.82 The chemical and biological qualities of the River Churnet were also monitored by the EA from 1990 to 2006. The biological quality was recorded between GQA Grade C (Fairly Good) and GQA Grade B (Good). The chemical quality ranged from GQA Grade D (Fair) to GQA Grade A (Very Good).

15.83 Consent was granted in 1995 to the Churnet Works Estates Ltd for the discharge of process water to enter the River Churnet. No permit end date is detailed within the 'Envirocheck' report. Further enquiries have been made with The Portland Dye Works which elicited the following information:

- There are two effluent treatment plants on Site, both constructed by Courtaulds, one remains in use by the Portland Dye Works and the second, main treatment plant, has ceased use. The effluent discharge point is recorded on **Figure 4** contained within **Appendix 15.1**.

15.84 There are a further ten surface water discharge consents within 1km of the Site. STW hold nine of the consents, the closest of which was recorded 2m southeast of the Site for sewage discharges, the consent has been revoked.

15.85 Two surface water abstraction licences are located to the Site;

- Licence No. 03/28/30/0208 has been held by various companies under different permit versions:
  - Permit Version 101 held by Courtaulds Jersey Leisurewear in 1998;
  - Permit Versions 102 and 103 by Norcart Enterprises between 1999 to 2005; and
  - Permit Versions 104 to 106 by Churnet Estates between 2005 and 2008.

15.86 All consents were for textile and leather: process water and non evaporative cooling water and private water: general use

Licence no. 03/28/30/0117/1 held by Sir Thomas & Arthur Wardle for abstraction of waters for industrial cooling.

15.87 The permit end dates for the surface water abstractions on Site were not detailed within the 'Envirocheck' report. Further investigation indicates that Portland Dye Works hold a current licence to abstract surface water, at volumes ranging from 3000 - 8,000m^3 per month. The water is stored in silos on Site, the location of the current infrastructure is noted on **Figure 4** of **Appendix 15.1**.

15.88 Within 1km of the Site boundary six current surface water abstraction consents are noted, including Tessenderlo Fine Chemicals Ltd (TFC) located 24m south west of the Site who hold a licence for evaporative cooling and process water. The Brindley Mill Preservation Trust hold a consent for production of energy: mechanical, non-electrical – milling and water point, south of the Site, the permit start date is 1974.

15.89 The Site is within a flood risk area, Zone 3a where the probability of fluvial flooding is 1 in 75 years (1.3%).

15.90 The EA has reported that the whole Site flooded in 2000, which was verbally confirmed by current Site users. The flood waters overtopped at the upstream sluice of the flood relief channel, broke through the defence bund and flowed down between Buildings 2 and 3, to discharge into the River Churnet.

15.91 A detailed surface water drainage plan has not been provided but further details on site hydrology and drainage are described within Chapter 14: Hydrology and Drainage.

Environmental Database

15.92 The 'Envirocheck' database was reviewed as part of the Phase I Desk Study in order to obtain environmental information regarding the Site, its development, and the surrounding area within a 1km radius. The most relevant findings are now discussed. The report and site sensitivity maps are reproduced in **Appendix 15.1**.

Regulatory Controls

15.93 There are 22 Integrated Pollution Controls (IPPCs) located within 100m of the Site all held by TFC located 7m south west of the Site. These controls have been superseded by IPPC's for combustion and oxygen containing compounds.

15.94 Two Local Authority Pollution Prevention and Controls were found (now revoked) on Site for textile and coating finishing processes, and coating of metal and plastic.

Landfills

15.95 A summary of landfill sites is noted in **Table 15.3** below, all are beyond 800m of the Site.

Table 15.3: Summary of Registered Landfill Sites

Operator	Location	Accepted Waste	Prohibited Waste	Maximum Input	Status
3C Waste Ltd *	Fowlchurch Landfill, Fowlchurch Road, 806m E	Civic amenity, commercial and construction and demolition wastes	Drums, liquid and notifiable	>75,000 - <250,000 T p.y.	Operational
British Trimming (Leek) Ltd	Ball Haye Road, 841m E	Ash, flue sweepings, hardcore & rubble	Liquid, notifiable & sludge wastes	<10,000 T p.y.	Licence lapsed/ cancelled
C & C Diesels	Rear of Station Garage, Burton Street, 860m S	Inert - only waste produced on Site.	-	Undefined	Licence lapsed / cancelled
F Bock and Son Ltd	Rear of factory Premises adjacent Ball Haye Green	Excavated materials, hardcore & rubble - only waste produced	Liquid, notifiable, sludge waste	<10,000 T p.y.	License lapsed / cancelled.

Operator	Location	Accepted Waste	Prohibited Waste	Maximum Input	Status
	Recreation Ground, 991m E	on Site.			

* Previously Staffordshire County Council, also recorded as a licensed waste management facility.

Waste Management Sites

15.96 Three licensed Waste Transfer Sites have been identified beyond 700m of the Site:

Table 15.4: Summary of Registered Waste Transfer Sites

Operator	Location	Accepted Waste	Prohibited waste	Maximum Input	Status
Staffordshire Moorlands District Council	Fowlchurch Depot, 743m E	Clinical, Construction and demolition waste and excavation waste	Drums, notifiable and dredged waste	>10,000 - <25,000 T p.y.	Operational
3C Waste Ltd	Fowlchurch Household Waste Site, Fowlchurch Rd, 760m E	Household, Industrial, commercial waste and mineral oils	Clinical, difficult, liquid, sludge and special waste	>25,000 - <75, 0000 T p.y.	Operational
R.Beswick trading as Leek Waste Disposal	Plot 5 Town Yard Industrial Estate, 818m S	General skip waste, inert industrial / commercial	-	Undefined	Licence lapsed / cancelled

Hazardous Substances

15.97 A control of major accident hazards (COMAH) site is located 34m south west of the Site, granted to TFC.

15.98 One current planning hazardous substance consent is noted. This being located to Tessenderlo Group at 15m south west of the Site, the consent is active, although the hazardous substance is not identified.

Commercial Activities

15.99 Active trades on Site include dye works, agricultural engineers, printers and a garage/workshop.

15.100 Five fuel station entries are noted within 1km of the Application Site, two of which are active, the closest being Bridge End Garage, Macclesfield Road (28m to the south west).

Sensitive Land Use

15.101 The Site lies within a nitrate vulnerable zone for surface waters as interpretated by DEFRA and the EA (Ref. 15.24).

15.102 An area of adopted Green Belt is located 136m to the west.

15.103 The Borough Park Fields Nature Reserve and the South West Peak (Sensitive Area) are located at 194m east and 915m north, respectively. Further detail is provided in Chapter 10, Landscape and Visual.

Pollution Incidents

15.104 Between 1995 – 1998 there were a number of recorded pollution incidents on Site, associated with organic chemicals, all were classed as minor.

15.105 Following a spillage of dry cleaning solvents during a routine tanker fill, in 2001, long term quarterly monitoring of a groundwater plume was undertaken by Courtaulds (now Sara Lee/Courtaulds) in conjunction with the EA as part of an agreed monitored natural attenuation (MNA) scheme.

15.106 The EA (personal communication, M Ashgar) has concluded that no further monitoring is required within the confines of the Application Site, and that the groundwater quality has improved significantly. This incident remains the responsibility of Sara Lee/Courtaulds as the original polluter.

15.107 An enforcement notice was served 13m west of the Site for a breach of PPC conditions, no further details are recorded.

Site History/Historical Land Uses

15.108 Superseded historical maps have been obtained from Envirocheck and reviewed for the Site and surrounding area, as part of the Phase I Desk Study. The maps cover the period **1879** to **2009**, the extracts of which are presented in **Appendix 15.1** as part of the Phase I and Phase II document. The maps provide an indication of the course of development of the Site and whether potentially polluting activities have been located on, or in close proximity to it.

15.109 The earliest map dated **1879** shows the majority of the Site to be undeveloped. The River Churnet is identified and to the west the flood relief channel is indicated as a tributary of the Churnet which rises in the area of the former Abbey to the north east.

15.110 Abbey Green Road was noted parallel to the eastern Site boundary, a few houses had been constructed adjacent the road. A single unit was identified adjacent the southern Site boundary as a dye works. A silk mill, corn mill and two dye works were located near to the south eastern boundary of the Site, beyond this housing is noted. The Macclesfield Road was noted adjacent the southern boundary of the Site. To the west of the Site was another dye works.

15.111 The map dated **1887-1888** identified no changes on-site.

15.112 No changes were noted within the immediate surroundings. Beyond 500m of the Site, the town of Leek was noted to the south east. To the south west the Churnet Valley railway was located. No further changes were noted.

15.113 By **1899** a football ground was recorded on the north eastern part of the Site. To the east of the Site, adjacent Abbey Green Road the Hencroft Print Works had been constructed. A smithy had also been noted beyond the south eastern corner of the Site, no further changes were noted.

15.114 No further changes were noted until the map dated **1925** when a dye works had been constructed on-site between the southern site boundary and the River Churnet, named the Churnet Dye Works. The football pitch was relocated into the central eastern part of the Site, with a pavilion. On the eastern part of the Site three small buildings had been constructed. The map also identified that the northern part of the Site had flooded during November 1923 to a depth of 511.59ft.

15.115 Within the immediate surrounds the dye works, an area west of the Site had expanded and was identified as Bridge End Dye Works. To the south east of the Site the smithy was no longer noted and Hope Silk Mill was identified within the area. To the east the dye works had expanded and connected with the previous Hencroft Dye Works.

15.116 By **1955** the football ground is no longer noted within the Site boundary. The central eastern part of the Site was occupied by a large unit and several smaller units are recorded on the central western part of the Site.

15.117 No changes were noted north of the Site. To the south east a silk mill had been constructed 250m from the Site, and Leek town centre had expanded with mixed residential and industrial development.

15.118 By **1966-1970** the buildings had been rebuilt or extended and tanks are noted. Three bridges had been constructed over the River Churnet for access to the units. A garage was located within one of the units to the south east of the Site, and other buildings were part of the Dye Works.

15.119 The Bridge End Dye Works, west of the Site was renamed the Churnet Works (works within the Site had expanded). The Hencroft Print Works and Dye works were then disused. The silk mill was still noted off the southeastern Site boundary. Further housing had been built to the south of Macclesfield Road.

15.120 No changes were noted until the map dated **1993** when the sports ground was noted within the northern part of the Site and the flood relief channel had been constructed.

15.121 To the east the former Hencroft units had been redeveloped into two large units, and to the south a Sunday School had been built. Adjacent the southern Site boundary a works unit with tanks had been built. To the west of the Site the Churnet Works had become a chemical works, with a bridge connecting the building adjacent the southern site boundary. A reservoir had been constructed 100m northwest of the Site. Beyond 500m of the Site, Leek had expanded to the south and southeast with residential and commercial developments.

15.122 The most recent map dated **2009** shows the current site layout.

15.123 Within the immediate surrounds the silk mill to the south east of the Site had been converted into a museum. No further changes were noted.

Environmental Sensitivity

15.124 A 'site sensitivity assessment' was undertaken in accordance with NHBC guidance (Ref. 15.25) as part of the PBA report (**Appendix 15.1**). The environmental sensitivity provides an indication of the vulnerability of aquatic, human and ecological environments in the vicinity of the Site.

15.125 The sensitivity with respect to controlled waters is classified as high. The site is underlain by a Major Aquifer and is within Zone III of a groundwater Source Protection Zone, to a potable supply approximately 400m from the Site. The River Churnet flows through the Site and a flood relief channel forms the western and northern Site boundary.

15.126 A Local Nature Reserve is located within 200m of the Site, but upstream and topographically higher than the Site, therefore the sensitivity is classified as moderately low with respect to designated sites and ecosystems. The Site lies predominately within a commercial/industrial area and therefore the sensitivity with regard to humans is classified as low.

15.127 The environmental aspects of the Site are also discussed at Chapter 10: Landscape and Visual.

Environmental Investigation

15.128 PBA excavated 35 window sample holes with 23 monitoring wells installed to measure ground gas and groundwater levels. A total of 66 soil samples were extracted and submitted for chemical analysis, the suite was determined based on historic and current land use. A representative set of samples were also subject to leachate analysis to determine the mobility of the contaminants. A set of groundwater samples were taken and scheduled for analysis based on the soil suite.

15.129 The site investigation divided the Site into three areas for investigation (**Figures 5 and 6** of **Appendix 15.1**) as well as targeting specific areas of potential contamination sources e.g. tanks, chemical storage areas:

- Main Site;
- Possible former ‘Landfilled’ Area; and
- Open Space.

Contamination

15.130 Based on the findings of the chemical analysis undertaken as part of the PBA Phase II Environmental Assessment the following contamination has been recorded. Full details are presented with the report at **Appendix 15.1**.

Soils

15.131 A Tier 1 Assessment was undertaken in accordance with the EA R&D publication 20 (Ref. 15.26) and the results of the soil and water analyses were compared with generic guidelines.

15.132 The values obtained from chemical analysis of the soil samples were compared against CLEA (2009) Soil Guideline Values (SGVs). Where no SGV is available the analytical results were compared against LQM CIEH Generic Assessment Criteria for soil (2009) (Ref. 15.27). The values applied corresponded to both commercial/industrial and residential end uses as both form part of the Proposed Development. Drawing No. 946-08/02 illustrates the findings (**Figure 3** of **Appendix 15.1**).

Commercial / Industrial

15.133 Lead was recorded as being elevated within the Main Site in several samples extracted from the made ground, to a maximum concentration of 1500mg/kg.

15.134 The Total Petroleum Hydrocarbon (TPH) values are not elevated above the guideline values for commercial industrial land use.

15.135 Polyaromatic hydrocarbon (PAH) species were generally not found to be elevated, one sample exhibited an elevated level of benzo(a)pyrene, which was taken at depth within the area of the 'former landfill'.

15.136 Volatile organic carbons (VOCs) were identified above detection levels within the area of the possible former ‘landfill'. However only cis-1,2-dichloroethene was recorded to exceed generic assessment criteria within one sample of natural materials.

Residential

15.137 Metal and metalloid contaminants are recorded to be within residential Tier 1 screening values within the made ground and natural materials across areas identified for residential development. Arsenic was identified in the natural

materials at levels above the residential Tier 1 guidance within the area designated as open space.

15.138 Heavy aromatic fractions of petroleum hydrocarbon contamination were identified in the made ground, but none exceeded their corresponding generic assessment criteria (GAC) for residential land use.

15.139 Total PAHs are identified within the made ground and to a lesser extent in the natural, within the proposed residential development area.

Leachates

15.140 A representative set of soil samples were subject to leachate analysis on elevated metal contaminants. The results were compared to Environmental Quality Standards (EQS) guideline values (Ref. 15.28), since the Churnet was identified as the most likely controlled water receptor. The metals analysis proved the materials to be non-leachable and it was concluded that they did not pose a risk to controlled waters.

Groundwater

15.141 Groundwater samples were abstracted from both the PBA window sample holes and boreholes, where sufficient water was present. The results were compared with EQS values derived based upon a water hardness concentration of 127mg $CaCO_3$ l-1 provided by STW (Ref. 15.29).

15.142 Generally the samples were found to be uncontaminated with a few exceptions:

- An elevated level of arsenic was identified within the open space.
- VOC contaminants in the form of 1,1-Dichloroethane and 1,1,1-Trichloroethane and chloroethene were identified as elevated in one hole in the northern area of the Main Site.
- A borehole, in the southern area of the Site was found to contain elevated levels of nickel and zinc, and on the final monitoring visit elevated tetrachloroethene was recorded.

Ground Gas

15.143 PBA undertook ground gas monitoring between the 10 June and 15 July 2009, which included two periods of low pressure in accordance with CIRIA C665 (Ref. 15.30).

15.144 The methane gas was recorded at a maximum concentration of 4.4% by volume and a maximum carbon dioxide level of 13.5% by volume.

15.145 In accordance with CIRIA C665 (Ref. 15.30) this produces a gas screening value (GSV) of 0.0028l/hr, which characterises the Site as Characteristic Situation (CS1). However, the maximum methane concentration is in excess of 1% and carbon dioxide concentration in excess of 5% and these require a CS2 to be considered. The elevated carbon dioxide and methane values were recorded within the area of the proposed retail car park, in natural floodplain materials, all other carbon dioxide values were below 3.0 (%vol).

Risk Assessment

15.146 The PBA report describes the development and refinement of the CSM for the Site based on the desk study information and the findings of the Site investigation works. A **moderate** risk from the identified contamination within both the proposed commercial/industrial and residential areas has been identified based on C552 (Ref. 15.23). Based upon significance criteria this represents a **moderate adverse** effect to human health and controlled waters.

Potential Effects

15.147 This section of the Chapter describes the potential effects of the Proposed Development on identified receptors and potential contamination migration pathways based on the findings of the Phase I Desk Study, Site Review and Phase II Environmental Site Investigation (**Appendix 15.1**).

15.148 During the decommissioning, demolition, remediation and construction phase, it is inevitable that the ground will be disturbed due to the lifting of hardstanding, excavation of existing foundations and infrastructure, excavation and screening of made ground materials and construction of new foundations. As a consequence, the potential for the mobilisation of contaminants and creation of new pathways exists which could effect identified sensitive receptors.

15.149

15.150 Receptors in and around the Application Site include:

- Human - future site users/general public/construction workers;
- Soils;
- Groundwater - Major Aquifer beneath the Site;
- Surface water - River Churnet/Flood Relief Channel;
- Sensitive ecosystem - Local Nature Reserve and wildlife on site, such as badgers and snakes;
- Proposed Structures.

15.151 The potential effects likely to occur during the demolition and construction phase include:

- generation of contaminated fugitive dusts during excavation of contaminated soils, which could effect construction workers and the general public;
- direct contact between contaminated soils and construction workers after lifting of hardstanding/removal of buildings;
- increased infiltration or precipitation into soils following removal of hardstanding which could generate contaminated leachates and vertical and lateral mobilisation into groundwaters and surface waters;
- accidental leakage of chemicals and fuels could cause further contamination of soils and controlled waters;
- surface run-off of contaminated waters from stockpiled contaminated soils/pumping of contaminated perched waters;
- creation of new pathways via vertical migration of mobile contaminants along piled foundations into the deep groundwater; and
- beneficial effect from removal of contaminated soils/groundwater.

15.152 The type of effects likely to occur after completion of the Proposed Development include:

- exposure of site users to any remaining contaminated soils within landscaping and garden areas;

- exposure of site users to elevated levels of ground gas within buildings;
- release of contaminants from site activities which could affect soils/groundwaters /surface waters; and
- damage to buried structures from the prevailing chemical environment within the soil / residual contamination.

Demolition and Construction Phases

15.153 The potential effects during the demolition and construction phase on the basis of the identified contaminants and pathways are now discussed for each of the receptors.

Effect on Site Workers and Public

15.154 The disturbance of contaminated soils during the demolition/construction phase increases the risk of exposure to contamination via the following pathways:

- dust/vapour inhalation;
- dermal contact; and
- ingestion of contaminated soil/ groundwater sources.

15.155 Without appropriate management of human exposure pathways the potential effect on construction workers and the general public would be classed as **minor adverse.**

Effect on Soils/Ground

15.156 During decommissioning and site clearance operations there will be a risk of pollution incidents such as spillages of fuel/chemicals occurring and indirect derogation of soil quality. The potential effect would be of **minor adverse** significance.

15.157 Hotspots of contaminated soils have been identified during the site investigation works, particularly in the area of the uncontrolled deposition of industrial waste identified as the former ‘landfilled area'. This material is currently anticipated to have a **minor adverse** effect.

Effect on Groundwater

15.158 The Application Site is underlain by a Major Aquifer and within Zone III of a groundwater Source Protection Zone to a public supply well. A groundwater abstraction consent is also recorded on Site. On this basis the groundwater resource underlying the Site is considered to be of high sensitivity.

15.159 Currently the Main Site (employment area) is covered with buildings and hardstanding of varying condition, which reduces the potential for infiltration, However, infiltration of rainwater and other surface waters into the ground may increase temporarily during the demolition and excavation phase by exposing previously covered soils to the elements, temporarily increasing the mobility of contaminants, particularly organic and volatile organic contamination. This could allow vertical migration to the aquifer, resulting in a localised **minor adverse** effect.

15.160 The likely foundation solution for the development has not been formalised. However based on the initial findings of the environmental site investigation which identified the presence of significant depths of made ground and soft alluvial clays at depth, this would limit the foundation options and a piled solution is considered the most feasible at this stage. The use of a piled foundation may cause disturbance of the perched waters and major aquifer beneath the Site, and could create a preferential pathway for the vertical movement of contaminants which may have a **moderate adverse** effect upon the underlying aquifer.

Effect on Surface Water

15.161 The surface water drainage on Site is assumed to outfall directly into the River Churnet/flood relief channel.

15.162 The perched groundwater underlying the Site is potentially contaminated and may be in hydraulic continuity with the River Churnet, therefore there is a risk of lateral migration of contaminants into the River which may affect the quality of the river water. These waters are potentially having a **minor adverse** effect on surface waters.

Effect on Sensitive Ecosystems

15.163 A designated Local Nature Reserve is located approximately 200m to the east of the Application Site. There are unlikely to be any major pathways which link this sensitive area to the Site as the Nature Reserve is in an elevated position and is

upstream. Fugitive dusts could potentially effect the Reserve, dependant upon the prevailing wind direction, however any effect is likely to be **negligible.**

Operational Development

Effect on Humans

15.164 The Proposed Development is described in Chapter 4: Description of Development, the scheme incorporates the demolition and removal of the existing structures followed by the construction of:

- A Sainsbury's supermarket with PFS;
- Industrial/commercial units;
- Retail units;
- Residential units;
- Car parking;
- Areas of soft landscaping, garden areas;
- Open space/recreational land; and
- Flood storage zones.

15.165 In order to facilitate the development two new vehicle and pedestrian access roads into the Site will be formed. The Proposed Development seeks to reopen the pedestrian bridge in the south east corner of the Application Site.

15.166 The site investigation has identified the presence of elevated levels of ground gases within certain areas of the Site based on CIRIA C665 (Ref. 15.30). which would have a potentially **minor adverse** effect upon future commercial or residential site users.

Effect on Soils/Ground

15.167 The Proposed Development includes commercial development with some potentially contaminative uses including the relocation of the Portland Dyeing Company and any other industrial/commercial activity which may occupy the new units and the Sainsbury's PFS. However in accordance with CLR 11 (Ref 15.20) it should be assumed that current legislation and regulatory devices will control the

contamination risk from these land uses. The operational development would therefore have a **negligible** effect on identified receptors.

15.168 After development the only pathways which will exist to human receptors from residual soil contamination would be via dermal contact, inhalation/ingestion in areas of soft landscaping/garden areas. If source-pathway-receptor linkages remain, there could be a **moderate adverse** effect on future residential occupiers.

Effect on Groundwater

15.169 The majority of the Application Site will be covered with buildings and hardstanding, the main areas of soft landscaping will be the large area of open space in the northern area of the Site, soft landscaping, and garden areas to the residential developments. Contaminated soils and groundwaters have been identified and whilst areas of hardstanding will reduce the infiltration of rainfall/ precipitation into the underlying soils, in areas of soft landscaping soil leaching may occur. There will therefore be a **minor adverse** effect on groundwater.

Effect on Surface Waters

15.170 The Application Site may be in hydraulic continuity with the River Churnet, and its flood relief channel. After development, the areas of the Site where potentially contaminative activities will be occurring will primarily be covered with buildings and hardstanding, thereby reducing the infiltration of waters into the underlying soils and hence the potential for contaminant mobilisation. Proposals for the disposal of surface drainage waters may potentially effect surface waters by the discharge of contaminated surface waters from car parks and hardstanding surfaces. Significant contaminant sources and pathways for residual leached in situ contaminants migrating to surface waters may have a **minor adverse** effect on surface waters post development.

Effect on Proposed Landscaped Areas and Sensitive Ecosystems

15.171 As there are no pathways post development, which would link contamination on site to the Nature Reserve, a **negligible** effect is envisaged to this receptor.

Effect on Proposed Structures

15.172 Further investigation will be undertaken in order to determine the risk to the proposed structures from potential aggressive ground conditions such as sulphate attack or organics, which could cause damage to concrete, cement and below-

ground structure, and water supply pipework. The available data suggests that without mitigation there may be a **minor adverse** effect on buried structures and pipework from chemical attack.

Mitigation Measures

Demolition and Construction Phases

Remediation

15.173 A preliminary reclamation strategy has been prepared (**Appendix 15.1**) based upon the proposed redevelopment works. The objectives of the reclamation strategy are to:

- Remove the risk of contamination to adjacent land;
- Minimise the future migration of contaminants off site to either adjacent land users or controlled waters;
- Removal of all near surface contaminants which present a risk to the Site user/occupier; and
- Minimise the off-site disposal of contaminated materials.

15.174 Works are anticipated to include:

- Remediation of contaminated soil hotspots identified during the site investigation works, particularly in the area of the uncontrolled deposition of industrial waste identified as the possible former 'landfilled' area. The resultant spoil is to be screened and either confirmed as suitable for reuse or removed from site to an appropriately licensed facility;
- Further areas of contamination may be excavated from back garden areas to the proposed residential development and either removed from site or replaced elsewhere on site;
- the reuse of materials to be dependant upon further soils analysis to confirm its acceptability;
- wastes identified for off-site disposal to be subject to waste acceptance criteria (WAC) analysis to confirm the most appropriate disposal route, in accordance with the Landfill Regulations 2005 (Ref. 15.7);

- controlled decommissioning of existing infrastructure to prevent release of contaminants;
- removal of all general waste, debris and drums to be collected and disposed off site by an appropriately licensed company in accordance with Duty of Care Regulations 1991;
- removal of unsuitable soils and/or placement of a depth of clean cover soils within garden/soft landscaped areas. All imported soils to meet the guidelines for inert soils or for topsoil, the requirements of BS 3882:2007. The depth of cover to be calculated using BRE Clean Cover System (Ref. 15.32);
- derivation of site specific assessment criteria for residential areas without gardens in order to confirm the requirement or otherwise for remedial works/placement of clean cover;
- further investigation of the ground gases within the former landfilled area after remediation works and design of ground gas protection measures, and development of a Design Sulphate Class based on BRE Special Digest 1 (Ref 15.31) to minimise the risk to structures;
- further investigation and delineation of VOC contamination within deep groundwater, to be agreed in consultation with SMBC and EA;
- preparation of an Implementation Plan and subsequent verification in accordance with CLR 11 (Ref. 15.20).

Site Workers and Public

15.175 Site works will be undertaken in accordance with current health and safety legislation and relevant guidance including:

- CIRIA Report 132 A guide to safe working practices on contaminated sites (1996) (Ref. 15.33);
- HSG 66 Protection of Workers and the General Public During Development of Contaminated Land (1991) (Ref. 15.34); and
- CDM Regulations 2007 (Ref 15.35).

15.176 Public access to the site will be restricted by construction of solid hoarding/fencing around the site perimeter, with controlled access onto site via a security gate. The main pathway therefore via which the public could be affected by on-site

contamination is the uncontrolled release of dust/vapours. Standard environmental controls will be put in place to control this pathway e.g. dust suppression measures and the use of monitoring devices at the site boundary. Further detail is contained within Chapter 13 Air Quality.

15.177 In order to manage environmental issues during construction the contractor will prepare a CEMP which will take into account guidance provided by the EA and CIRIA in order to achieve best practice. Implementation of the plan should control/minimise the risk of pollution incidents occurring and indirect derogation of soil quality reducing the risk of contamination incidents. Guidance will include:

- Preparation of Method Statements and Risk Assessments;
- Use of dust suppression measures to control fugitive dust emissions to reduce inhalation by workers and off-site dispersal to surrounding receptors;
- Provision of appropriate PPE, to include as standard, protective overalls, gloves, goggles, and dependant upon the risk RPE;
- Appropriate welfare facilities of washing and changing;
- Information related to contamination to be included in the pre-tender Health and Safety plan and disseminated through site induction and tool box talks, and inclusion in site rules; and
- Care Of Substances Hazardous to Health (COSHH) assessments will be completed for all potentially hazardous materials used during the construction process.

15.178 The Site will be secured to prevent access by the general public and measures will be put in place to prevent dispersal of soils off-site onto public roads e.g. use of wheel wash, and road sweepers.

Soils, Ground Conditions and Water Resources

15.179 The contractors will be required to use best practice construction methods and techniques and work in accordance with relevant environmental legislation and guidance to ensure that contamination of the ground and groundwater is avoided during the demolition and construction phase of the Proposed Development.

15.180 As detailed previously practical measures will be implemented in order to prevent/reduce the risk of accidental spillages of chemicals and fuels associated

with the construction process in accordance with the EA Pollution Prevention Guidelines which will be detailed within the CEMP. Examples include:

- control of onsite drainage, use of cut-off trenches and bunding to prevent discharge of contaminated sediments and silts into surface watercourse;
- storage of fuels on hardstanding away from the watercourse in bunded area and storage of emergency spill kits on site for use during incidents involving uncontrolled releases of fuels/hazardous substances;
- secure storage of chemicals/potential pollutants away from watercourse;
- refuelling/maintenance of vehicles in designated areas away from watercourses on hardstanding;
- provision of safe waste water disposal including disposal of groundwater from dewatering activities, surface water run-off in accordance with Water Resources Act 1991, and in consultation with the EA and STW;
- provision of wheelwash facilities to prevent transfer of soils/contaminants to surrounding roads and thereby entering surface water drainage system;
- management of site waste in accordance with the SWMP;
- use of appropriately licensed waste carriers for disposal of waste off-site in accordance with Duty of Care Regulations (Ref. 15.9);
- surface water monitoring throughout works if required by the EA;
- stockpiling of contaminated soils to be minimised, if required, storage on impermeable surfaces to be away from surface watercourses and sheeted. Use of sheeted lorries to remove waste from Site.

15.181 In order to prevent damage to water resources from groundwater contamination, if piling is the proposed foundation solution, a piling strategy will be agreed with the EA and a foundation risk assessment undertaken to confirm the piling methodology in accordance with the EA Guidance 'Piling in Layered Ground: risks to groundwater and archaeology. Science Report SC020074/SR. (Ref. 15.36) and Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination and Pollution (Ref 15.37).

Operational Development

Future Occupants

15.182 Remediation measures should be completed in accordance with the implementation and verification plans, and to the satisfaction of the regulating authorities to minimise the risk presented to future occupants from residual contamination. Development of hardstanding surfaces and clean cover thicknesses in gardens and soft landscaping to remove the risk from occupants or maintenance workers

15.183 After completion of additional gas monitoring the appropriate gas protection measures will be designed for inclusion in the new builds to remove the risk of ground gases.

Soils, Ground and Water Resources

15.184 All potentially contaminative activities operating on the completed development will be managed in accordance with current legislation and good practice to remove the risk to controlled waters and human receptors.

15.185 Surface water sewers will include oil interceptors and sediment traps to prevent contaminated run-off from car parks entering the River Churnet.

Proposed Structures

15.186 The specification for cement aggregate and concrete proposed for below-ground structures/foundations will be in accordance with BRE Special Digest 1 (2005) (Ref. 15.31), and based on the prevailing chemical environment of the soils. Potable water supply pipework to be designed in accordance with Water Authority requirements.

Residual Effects

Demolition and Construction

Humans

15.187 Implementation of health and safety guidelines, environmental controls and best practice will remove the pathways of exposure to contaminants for construction

workers and the general public, whereby there is a **minor beneficial** residual effect.

Soils/Ground

15.188 Implementation of the CEMP and pollution prevention guidance during construction phase will control storage and use of fuels and chemicals, thereby reducing the risk of pollution incidents. Any residual effects are therefore anticipated to be **minor beneficial**.

15.189 Remedial works to be undertaken to the approval of the regulatory authorities to remove the potential risk of to human health and controlled water receptors.

15.190 The completion of the proposed remedial works, including removal of hotspot contaminated soils and industrial wastes where deemed unsuitable, and possible groundwater remediation, provides **minor beneficial** effect.

Groundwater

15.191 Implementation of a CEMP would minimise the potential release of contaminants into the underlying groundwater during demolition and remediation and additional groundwater monitoring would confirm the requirement for remedial works. Management of the groundwater quality would therefore have a **moderate beneficial** effect.

15.192 If a piled foundation solution is required for the Site, this would be carried out with due regard to EA guidance to minimise potential mobilisation of contaminants and ensure there was a **negligible** effect.

Surface Waters

15.193 CEMP implementation would include measures to prevent uncontrolled release to surface or foul water systems, or River Churnet, in conjunction with temporary drainage/cut-off trenches whereby a **minor beneficial** effect can be anticipated.

Sensitive Ecosystem

15.194 The Local Nature Reserve has been identified as the only sensitive ecosystem in the vicinity of the Site, and only one pathway has been identified during demolition and construction phase, related to fugitive dust emissions. The pathway can be controlled, thereby reducing the potential residual effect to **negligible**.

Operational Development

Humans

15.195 After development the residual risk from the presence of ground gases will be removed by the design of gas protection measures within the buildings based on the requirements of CIRIA C665 (Ref 15.30) leaving a residual **moderate beneficial** effect.

Soils/Ground

15.196 Potentially contaminative uses will occupy areas of the Proposed Development including possibly Portland Dyeing and the Sainsbury's PFS, both of which will be controlled by regulatory devices, reducing the contamination risk. The completed development would therefore have a **moderate beneficial** effect on soils/ground.

15.197 After remediation the quality of underlying soils will meet regulatory requirements. All industrial wastes will have been removed and within gardens and open landscaping clean capping cover will have been placed and validated. The completed development will remove risk from human receptors and will therefore have a **moderate beneficial** effect.

Groundwater

15.198 Removal of contamination hotspots, placement of clean cover capping materials, and construction of buildings and hardstandings will reduce infiltration of rainfall. There will therefore be a **minor beneficial** effect on groundwater quality following remediation and redevelopment.

Surface Waters

15.199 The removal of both significant contaminant sources and pathways for leachable contaminants, combined with the design of interceptors and other traps to the discharge of contaminated storm waters from car parks etc. creates a **minor beneficial** effect to surface waters post development.

Sensitive Ecosystem

15.200 As there are no pathways post development to link contamination on Site to the Nature Reserve, a **negligible** effect is envisaged to this receptor.

Proposed Structures

15.201 Concrete classification, gas protection and water supply pipes will be designed to have **negligible** effect.

Table 15.5: Summary of the Potential and Residual Effects

Issue	Potential Effects	Mitigation Measure (s)	Residual Effect
Demolition and Construction			
Exposure of construction workers and general public to contaminated soils	**Minor Adverse**	Implementation of CEMP, stipulate use of PPE, welfare facilities, use of good practice and site security	**Minor Beneficial**
Risk of pollution incidents during decommissioning and site clearance	**Minor Adverse**	Implementation of CEMP	**Minor Beneficial**
Risk of hotspot areas of contaminated soils, particularly industrial waste	**Minor Adverse**	Remedial works, including removal of contaminated soils and industrial wastes where deemed unsuitable, and possible groundwater remediation.	**Minor Beneficial**
Risks to groundwater from exposed ground during demolition	**Minor Adverse**	Implementation of the CEMP, management of groundwater quality	**Moderate Beneficial**
Risks to groundwater from migration pathways created by foundation solutions	**Moderate Adverse**	Piling methodology will be chosen to reduce the risk of mobilising contamination in	**Negligible**

Issue	Potential Effects	Mitigation Measure (s)	Residual Effect
		accordance with EA guidance and consultation	
Risks to surface waters from lateral migration of contaminants	**Minor Adverse**	Implementation of CEMP, and guidance provided by EA and CIRIA	**Minor Beneficial**
Risk to Local Nature Reserve	**Negligible**	Use of dust suppression measures to limit potential dispersion of contaminated dusts.	**Negligible**
Operational Development			
Risks to future occupants from ground gases	**Minor Adverse**	Additional gas monitoring to be undertaken after completion of soils remediation works, and 2000g dpm with joints and penetrations sealed to be incorporated in residential buildings.	**Moderate Beneficial**
Risk to soils from future Site Uses	**Negligible**	Portland Dyeing Co. and Sainsbury's PFS are potentially contaminative activities however it is assumed they will be operated in accordance with current regulatory devices which will	**Moderate Beneficial**

Issue	Potential Effects	Mitigation Measure (s)	Residual Effect
		control risk of contamination.	
Risk of human receptors being effected by residual soil contamination	**Moderate Adverse**	Removal of surface contamination and or placement of clean capping layer, to depth to be agreed with SMDC. All imported soils to meet inert classification for soils.	**Moderate Beneficial**
Risks to groundwater from leachate generated from soils	**Minor Adverse**	Hotspots of contamination will have been remediated and new development incorporates hardstanding and buildings which will reduce infiltration of precipitation and hence potential for contaminated leachates to be generated.	**Minor Beneficial**
Risk to surface water from leaks and spills - car parking	**Minor Adverse**	All surface water drainage will pass through sediment traps and interceptors prior to being discharged	**Minor Beneficial**
Risk to Local Nature Reserve	**Negligible**, no pathways will link the Site to the	None	**Negligible**

Issue	Potential Effects	Mitigation Measure (s)	Residual Effect
	Nature Reserve		
Risks to proposed pipework and structures from ground contaminants	**Minor Adverse**	Concrete classification, gas protection and protected water supply pipework designed in accordance with current guidance	**Negligible**

Conclusions

15.202 The direct and indirect effects of the Proposed Development arising from the existing ground conditions have been assessed in accordance with the described methodology in terms of the demolition and construction phases and the operational phase of the completed development. The potential effects have been determined for the following receptors:

- Site workers and public;
- Future Site occupants;
- Surface Waters;
- Groundwaters;
- Soil/Ground;
- Sensitive Ecosystem; and
- Proposed Structures.

15.203 Mitigation/remediation measures are described and the residual effects after implementation of the mitigation determined.

15.204 During the demolition and construction phase, **minor adverse** effects are anticipated. However, once the site has been remediated and validated to statutory regulatory approval the completed the development will have a **minor to moderate beneficial** effect on the ground conditions of the Application Site.

References

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15.35 Construction (Design and Management) Regulations, 2007

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APPENDICES

15.1 PBA Phase I Desk Study and Phase II Environmental Investigation, 2009