

10. Ground Conditions

Introduction

- 10.1 This chapter identifies the existing soil and geological conditions and development constraints, evaluates the potential for contamination and assesses the potential effects on ground conditions during both the construction and operational phases.
- 10.2 The following ES Chapter has been written to support two outline planning applications for a residential-led mixed use development referred to as Application A and a residential development referred to as Application B. The area of Application A is indicated on the 5plus architects Application A Parameter Plan – Red Line ref: 05745_MP_00_1000-100 and the area of Application B is indicated on the 5plus architects Application B Parameter Plan – Red Line ref: 05745_MP_00_2000-101 (copies of which are included within **Figure 1.1** and **Figure 1.2** of Chapter 5: The Proposed Development). Plans of proposed land use for both Application A (5plus architects Application A Parameter Plan – Land Use ref: 05745_MP_00_1001-103) and Application B (5plus architects Application B Parameter Plan – Land Use ref: 05745_MP_00_2001-100) are available in **Figure 5.1** and **Figure 5.5** respectively.
- 10.3 It is assumed that the impacts of both application sites will be similar due to the current widespread land use as predominantly agricultural land, as well as overlap in impacts arising from redevelopment proposals.
- 10.4 The chapter describes the methods used to assess the impacts, the baseline conditions currently existing at the Site (As defined by the current application boundaries presented in the aforementioned parameter plans included within **Figure 1.1** and **Figure 1.2**) and surroundings, the potential direct and indirect impacts of the Proposed Development arising from the excavation of potentially contaminated material, exposure to ground gas ingress, the potential for surface water contamination and the mitigation measures required to prevent, reduce, or offset the impacts and the residual impacts. It has been written by RoC Consulting.
- 10.5 The following has been provided within the appendices to this report as part of the assessment:
- **Appendix 10.1:** RoC Consulting 2018 Pickering's Farm, Penwortham Phase 1 Desk Top Study (ref: MN/AS/p1 3861)
 - **Appendix 10.2:** TDS 2019 Utility Planning Report
 - **Appendix 10.3:** Brownfield Solutions Ltd 2020 The Lanes, Penwortham Geo-Environmental Assessment Report (ref: NS/C4259/9441 Rev A)

Planning Policy Context

National Planning Policy

National Planning Policy Framework

- 10.6 Chapter 15 of the NPPF (updated 2021) sets out the policy framework for conserving and enhancing the natural and local environment by protecting and enhancing valued landscapes, geological conservation interests and soils. It states that the planning system should guide towards preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability. The planning system further outlines the remediation and mitigation of despoiled, degraded, derelict, contaminated and unstable land. Where appropriate, each of the aforementioned measures should be considered at all stages of the planning process.
- 10.7 Chapter 15 of the NPPF outlines that in order to meet development needs, the aim should be to minimise pollution and other adverse effects on the local environment. The guidance further states that plans should allocate land with the least environmental or amenity value.
- 10.8 The guidance advises that local planning authorities should consider the economic and other benefits of the best and most versatile agricultural land. Where significant development of agricultural land is demonstrated to be necessary, local planning authorities should seek to use areas of poorer quality land in preference to that of a higher quality.

Local Planning Policy ^(3 & 4)

- 10.9 The Central Lancashire Core Strategy is the key document within the Development Plan for South Ribble, Chorley and Preston. The South Ribble Borough Council Local Plan forms part of the statutory Development Plan and focuses on The South Ribble Urban Area including Penwortham, Lostock Hall, Bamber Bridge, Walton-le-Dale and Higher Walton.
- 10.10 The Core Strategy sets out the strategic vision for Lancashire up to the year 2026. It identifies South Ribble as likely to attract investors and visitors, capitalising on its location with improved transport and sustainable neighbourhoods.

Development Policies

- 10.11 Policy G14 within the South Ribble Local Plan
- Applicants will be required to provide evidence of a satisfactory site investigation and provide evidence that any proposed remedial works are sufficient to deal with any identified hazards;
 - Developments should not have an adverse impact on the stability of surrounding areas; and

- Applicants should address the physical capability of the land and the effects on local amenities and conservation interests of the development and any remedial measures.

Site Specific Policies

- 10.12 The Central Lancashire Core Strategy Policy 1 concentrates on development in Preston and South Ribble urban area and includes a strategic location to the south of Penwortham and North of Farington, namely Pickering's Farm.
- 10.13 The strategic location has been identified due to the requirements for housing and employment land with the protection of existing Green Infrastructure.
- 10.14 The Council has identified around 79 ha of the Site to be allocated for redevelopment to comprise 1,350 dwellings and deliver infrastructure. The Proposed Development will bring forward 1,100 of the dwellings within the land under the Applicants' control. The strategic location to the south of the Site is safeguarded for future development.

Other Relevant Policy, Standards and Guidance

- 10.15 A review of publicly available guidance documents via the South Ribble Borough Council website has failed to reveal any relevant supplementary planning document or planning guidance.

Assessment Methodology and Significance Criteria

- 10.16 Prior to undertaking the Assessment for Ground Conditions, the baseline information for the Site is obtained. Baseline conditions pertaining to the Ground Conditions (including geology, soils, land use, contaminated land and hydro-geological issues) have been compiled from a review of readily available published information previously undertaken as part of the RoC Consulting Phase 1 Desktop Study ⁽¹⁾ and Brownfield Solutions Ltd Geo Environmental Assessment Report ⁽²⁾. The following sources were used in the production of the Desk Study report:
- Envirocheck at the Ordnance Survey;
 - British Geological Survey 1" to 1 mile/1:10'000, solid & drift plans;
 - Environment Agency Groundwater Vulnerability Map;
 - Observations from site walkover survey;
 - Radon Atlas of England; and
 - BGS Borehole Log sheets (via the Borehole Scans website)
 - Brownfield Solutions Ltd (2020) Geo-Environmental Assessment Report (ref: NS/C4259/9441 Rev A)
- 10.17 An overview to the findings of the above reports is provided as part of the Baseline Assessment (pg 10-9).

Geology and Soils

- 10.18 The geology of the Site has been determined with reference to British Geological Survey 1" to 1 mile/1:10'000, solid & drift as well as BGS Borehole Logsheets and Brownfield Solutions Ltd Borehole Logs from an intrusive site investigation undertaken in 2020.
- 10.19 The main geological impacts are likely to be the permanent loss of geological materials through any requirement for earthworks; as well as loss and damage to agricultural farm land. Magnitude of the impact of the scheme on geology and soils is based on the criteria shown in Table 10.1 (presented on pg 10-6).

Hydrogeology

- 10.20 Groundwater represents a potential receptor for any pollutants emanating from the Proposed Development, either during construction or operation. The baseline information and the assessment of the impact on groundwater used desk based and site investigation information.
- 10.21 Aquifers that are a source of public water supply, or that connect directly to surface water bodies are particularly sensitive to pollution incidents. The magnitude of potential impacts on the hydrogeological resources that may be affected by the Proposed Development is based on the criteria shown below in Table 10.1.

Contaminated Land

- 10.22 A contaminated land qualitative Phase I risk assessment has been undertaken by RoC Consulting in accordance with the guidance contained within CLR 11 (provided within **Appendix 10.1**). The assessment uses a risk-based approach following the source-pathway-receptor methodology promoted by the EA, which considers the nature of potentially contaminated areas in relation to the proximity of any sensitive receptors such as controlled waters or residential developments.
- 10.23 A Phase II Geo-Environmental Assessment Report was undertaken by Brownfield Solutions Ltd in 2020.
- 10.24 The current environmental assessment utilises the findings of both the Phase 1 Desk-based review and Phase 2 site investigation to establish the significance and severity of environmental impacts that may arise as a result of the Proposed Development in the context of ground conditions and quality. The potential impact is based on the criteria presented in Table 10.1

Characterisation of Effect

- 10.25 The Environmental Appraisal provides an initial assessment of the likely significant effects of the Proposed Development in relation to site preparation and construction activities, and operational activities.
- 10.26 The environmental effects have been predicted with reference to definitive standards and legislation where available. Where it has not been possible to quantify effects, qualitative assessment has been carried out based on available knowledge and professional judgement. Where uncertainty exists, this has been noted.

10.27 The potential significance of predicted impacts on ground conditions has been determined by reference to criteria for each topic. Broadly, the significance of the impact is determined with reference to the magnitude of the potential impact, the value of the receiving environment or receptor and the likelihood of the impact occurring and its duration. In order to provide a consistent approach to expressing the outcomes of each of the assessments, the following terminology has been used to assist in determining the degree of significance.

Magnitude

10.28 Magnitude refers to the 'size' or 'amount' of an impact. It is a function of other aspects such as the 'extent' of an impact being the area over which the impact occurs, the duration i.e. the time for which the impact is expected to last prior to recovery or replacement of the resource or feature, the likelihood (i.e. the chance that the impact will occur) and reversibility. An irreversible (permanent) impact is one from which recovery is not possible within a reasonable timescale or for which there is no reasonable chance of action being taken to reverse it. The level of 'Magnitude' is defined in Table 10.1.

Value

10.29 The value or sensitivity of a receptor is a function of a variety of factors e.g. biodiversity value, social/community value and economic value. The value or potential value of a resource or feature can be determined within a defined geographical context. The level of value is defined in Table 10.2.

Significance

10.30 Using the value of the environmental receptor, together with the determined magnitude of the impact and consideration of factors such as the sensitivity of the receptor to change, the significance of an impact can be determined.

10.31 The classification of significance aids in the identification of the main environmental effects of the Proposed Development and what weight should be given to these effects. There is no statutory definition of what constitutes a significant effect and guidance is intended to support the overall impact assessment process. However, it is widely recognised that 'significance' reflects the relationship between the magnitude of an impact and the value of the affected resource or receptor.

10.32 Statutory designations and any potential breaches of environmental law take precedence in determining significance, because the protection afforded to a particular receptor or resource has already been established as a matter of law. However, any assessment of specific impacts that may occur is based on professional judgement, utilising site specific information on ground conditions / quality.

10.33 To assist in the assessment process, an impact matrix (Table 10.3) has been used in determining the level of impact significance.

Table 10.1: Level of Impact Significance

Magnitude	General Impact	Geology & Soils	Contaminated Land	Groundwater
High	Significant, permanent loss / irreversible changes, to key characteristics, features or function of an environmental parameter. Impact may occur over a significant area (>50%). Significant Impact certain or likely to occur	An internationally or nationally designated site, such as an SSSI or a significant area of high quality or rare soil type that will be significantly damaged or destroyed by the Proposed Development.	An area where contaminated zones are present or likely. Impacts from contamination and disturbance will effect the surrounding built and natural environment during construction and operation. Extensive, long term mitigation measures required to avoid adverse impacts.	Pollution, damage or destruction of an aquifer within a Source Protection Zone (SPZ), public water supply or Principal Aquifer.
Medium	Damaging significant changes to key characteristics or features or function. over a moderate area (15%-50%). Likely to last for more than 2 years. Impact likely to occur.	A locally designated or proposed site of geological interest, such as a RIG, an area of high quality soil type Loss of good agricultural land (1, 2, 3A) that will be significantly damaged.	An area where contaminated zones are present or likely. Impacts that effect the surrounding natural environment will be prevalent during construction, but are unlikely to affect the operation of the scheme. Moderate / short term mitigation measures to be incorporated.	Pollution or damage to Secondary (Class A) Aquifer providing local resource / base flow to rivers.
Low	Noticeable but not significant changes (temporary / potentially reversible), over a partial area (<15%), to key characteristics or features of an environmental parameter. Impact will possibly occur.	Slight damage to a designated site of geological interest or damage to soils or good agricultural land (Grade 1,2,3a). Any other prominent but undesignated geological feature that will be damaged.	An area where contaminated zones are possible, but where it is considered very unlikely that contamination will affect the environment during construction or operation. No mitigation measures anticipated. Minor site investigation may be required.	Pollution or damage to a Secondary (Class B) aquifer or Secondary (Class A) Aquifer that is used for industrial or agricultural purposes.
Very Low	Noticeable temporary / reversible, changes for less than 6 months, or barely discernible changes for any	Slight damage to other sites of geological interest, soils or poor agricultural land (Grade 3b, 4, 5). that is in the	Potentially contaminated site in the study area that is sufficiently distant from the Proposed Development that it will not	Minor pollution of Secondary (Class B) aquifer and/or where there is no significant groundwater resource.



	length of time, over a small area, to key characteristics or features of an environmental parameter. Impact unlikely to occur	vicinity of the Site but will not be affected by the Proposed Development.	affect, or be affected by, its construction or operation.	
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Table 10.2: Assessment of Receptor Value

Value	Description	Examples
High	<p>Feature possessing key characteristics which contribute significantly to the distinctiveness, rarity and character of the Site</p> <p>Feature possessing very significant biodiversity, social/community value and/or economic value at the national level.</p> <p>Feature is extremely rare.</p>	<p>Significant residential/industrial development.</p> <p>Strategic sites e.g. hospital, park.</p> <p>Surface Water: Salmonid/Cyprinid fishery River Ecological Quality High.</p> <p>Designated sites protected under International or UK wildlife legislation (SAC, SPA, SSSI, Ramsar site).</p> <p>Groundwater: Principal aquifer providing a regionally important resource, Public water supply abstractions, SPZ or supporting site protected under wildlife legislation.</p>
Medium	<p>Feature possessing key characteristics which contribute significantly to the distinctiveness, and character of the Site.</p> <p>Feature possessing significant biodiversity, social/community value and / or economic value at the regional level.</p> <p>Feature is uncommon.</p>	<p>Sites of Special Scientific Interest (SSSIs). Regionally Important Geological Sites (RIGS).</p> <p>Significant transport links e.g. railway, airport.</p> <p>Significant utilities.</p> <p>Species protected under EU or UK wildlife legislation.</p> <p>Surface Water: River Ecological Quality Good.</p> <p>Groundwater: Secondary aquifer providing a locally important resource or supporting river ecosystem.</p> <p>High quality agricultural land.</p>
Low	<p>Feature possessing characteristics that are locally significant.</p> <p>Feature not designated or only designated at a regional / local level.</p> <p>Feature possesses moderate biodiversity, social/community value</p>	<p>Surface Water: River Ecological Quality Moderate.</p> <p>Groundwater: Secondary (Class A) Aquifer providing water for agricultural or industrial.</p>

Value	Description	Examples
	and / or economic value at the local level. Feature is relatively common.	
Very Low	Feature characteristics do not make a significant contribution to the character or distinctiveness locally. Feature not designated. Feature possesses low biodiversity, social/community value and / or economic value. Feature is common.	Minor residential / industrial development. Surface Water: River Ecological Quality Poor - Bad Secondary (Class B) Aquifer with limited connection to surface water. Low quality agricultural land.

Table 10.3: Impact Matrix

Magnitude	Value and Sensitivity of Receptor			
	Very Low	Low	Medium	High
Very Low	Negligible	Negligible	Minor	Minor
Low	Negligible	Minor	Minor	Moderate
Medium	Minor	Minor	Moderate	Major
High	Minor	Moderate	Major	Major

10.34 The ratings derived through the assessment process and as set out in Table 10.3 can also generally be described in a generic manner as shown in Table 10.4. The descriptors for the various significance ratings given in Table 10.4 can be used as a framework for confirmation (or not) of the ratings and also provide a greater understanding of the nature, scale and type of determined impact.

Table 10.4: Generic Significance Descriptors

Significance	Generic Significance Ratings
Major	Very large or large change in environmental or socio-economic conditions. Effects, both adverse and beneficial, which are important considerations at a national to regional level because they contribute to achieving national / regional objectives, or, likely to result in exceedance of statutory objectives and/or breaches of legislation.
Moderate	Intermediate change in environmental or socio-economic conditions. Effects that are likely to be important considerations at a district to local level because they contribute to achieving local objectives, or, may result in exceedance of local statutory objectives and/or breaches of legislation.
Minor	Small change in environmental or socio-economic conditions. These effects may be raised as local issues but are unlikely to be of importance in the decision-making process.
Negligible	No discernible change in environmental or socio-economic conditions. An effect that is likely to have a negligible or neutral influence, irrespective of other effects.

10.35 Although Tables 10.1 to 10.3 generally consider adverse effects that have a negative influence on receptors and resources potential impacts from the Proposed Development may also be beneficial and have a positive influence on receptors or provide opportunities for improvement. Consequently, final residual significance ratings may include:

- Major, Moderate, Minor and Negligible Beneficial impacts; and
- Major, Moderate, Minor and Negligible Adverse impacts.

10.36 The rating of the impact significance may provide a strong indication as to whether mitigation may be required and also determines whether, following the use of mitigation measures, identified impacts may be avoided, reduced or offset. Any impact that is moderate or above is considered a significant impact in EIA terms.

Assumptions/Limitations

10.37 A significant proportion of the information contained in this assessment is derived from a recent phase 2 intrusive site investigation alongside desk-based studies. The reliability of conclusions drawn from third party reports is based on the accuracy of information provided. While care has been taken in assessing the information some changes to site conditions are likely to have taken place during the intervening periods.

10.38 The assessment has been based on the Site redevelopment proposals as described within Chapter 5: The Proposed Development. Any deviation or revision of site layout and / or land use will result in the full or partial re-interpretation of results.

Baseline Conditions

- 10.39 This section describes the baseline conditions at the Site (and surrounding area as appropriate). Current site conditions, features and issues are identified and their potential to interact with the development process is assessed.
- 10.40 The Site has remained predominantly agricultural greenfield land since earliest mapping records. Numerous farming operations, stables and associated residential properties are noted across the Site along with several access roads. Circa 90% of the Site is comprised of grass fields with hedgerow boundaries and drainage ditches.
- 10.41 The following technical reports have been reviewed whilst collating this assessment, the findings of which have been used to inform our overall assessment:

On site

- BGS Borehole Logsheets (via the BGS Borehole Scans website)
 - RoC Consulting Phase 1 Desktop Study (2018) ref: MN/AS/p1 3861 contained in **Appendix 10.1**.
 - Brownfield Solutions Ltd Geo-Environmental Assessment Report (2020) ref: NS/C4259/9441 Rev A contained in **Appendix 10.3**.
- 10.42 The above-mentioned Phase 1 Desk Top Study and Geo-Environmental Assessment Report cover an area to support the outline residential led applications for Application A and Application B.

Background Information and Site Setting

- 10.43 The Site is located 2.6km to the south of Preston city centre covering a total area of 51.8ha. [Topographically speaking the Site is relatively flat with levels of 33-34mAOD on the eastern extent falling to circa 26-27mAOD on the western extent. The Site is locally undulating towards its central extent with one area of note including a small mound circa 1.0m higher than the surrounding land in the field to the rear of Proctors Farm. The Site is bound to the south by agricultural fields, to the west by Penwortham Way, to the east by the West Coast mainline railway and to the north and by residential housing.
- 10.44 In addition to the aforementioned drainage ditches a number of pond features are noted on site including one that has been infilled on the Sites north western boundary. Mill Brook is a notable feature in the south western corner of the Site. An area of boggy saturated ground was noted between fields in the western portion of the Site indicative of poorly draining soils.
- 10.45 Livestock were noted across the Site as well as a number of crop fields. An auto repair garage 'Peter Hambilton Motor Engineer' is present to the north of Bee Lane and Coote Lane Garage is noted to the south of the Site.

On-site Historical Activity

10.46 The earliest mapping records for the area dated 1848 indicate the Site has remained largely undeveloped comprising fields of farmland with associated farmsteads until the present day. The only notable changes to historic land use on site are a slight increase in the number of farmsteads across the wider site along with the introduction of a drainage channel running east to west across the Site associated with an offsite mill building (1912) and residential development comprising terraced and detached houses on the Site's southern boundary (1931).

Adjacent Land Historical Activity

10.47 Records from 1848 indicate adjacent land use comprised mostly fields/farmland with railway lines present along the Sites north eastern boundary namely the Lancashire & North West and Lancashire & Yorkshire Joint Railway and 180m south of the Site in the Lancashire and Yorkshire Railway. Records dated 1894 indicate the expansion of the railway line to the north east with the addition of a single trackway along the Sites eastern border.

10.48 Post railway line construction the town of Farrington to the east of the Site becomes more industrial in nature with a clay pit and brick yard located 280m to the south east, Anchor rubber works noted 265m to the east (1912) and Tardy Gate Mill located circa 400m to the east (1912).

10.49 Residential development begins to appear from 1931 to the north west and south west of the Site. Substantial residential development is noted by 1975 to the north of the Site. Records from 1931 also indicate the construction of a gas works 930m to the north east of the Site remaining on historical records until 2004 where along with Tardy Gate Mill it appears to have been demolished.

10.50 Records from 1990 detail the construction of Penwortham Way along the Site's western boundary.

Site Geology

10.51 A review of publicly available BGS geological map records and recent Brownfield Solutions Ltd (2020) Geo-Environmental Assessment report indicate the Site is underlain by the following:

- Drift Geology: Till, Devensian - Diamicton
- Solid Geology: Singleton Mudstone Member - Mudstone

10.52 BGS borehole records indicate there are 39 historic boreholes on site which were completed for the Central Lancashire Development Corporation in June 1981. Encountered ground conditions generally comprised topsoil ranging in depth between 0.3m and 0.6mbgl overlying glacial clay deposits which extended beyond the termination depth of boreholes at 6.0-6.6mbgl. This ties in with more recent (2020) Brownfield Solutions Ltd site investigation data detailed below.

- 10.53 The 2020 Brownfield Solutions Ltd Geo-Environmental Assessment Report indicates ground conditions were found to comprise topsoil located across the majority of the Site from ground level to depths ranging between 0.10 and 0.70mbgl. Localised made ground deposits were encountered in areas of the Site ranging in depth from ground level to 0.10 to 0.99mbgl. Deposits were found to vary in composition and former ponds noted as present.
- 10.54 Natural soils were found to predominantly consist of medium to high strength clays with sand and gravel bands of greater thickness and density with depth. Natural soils were proven to a maximum depth of 20.45mbgl.
- 10.55 Peat deposits were encountered in localised areas across the Site (more predominantly in the northern and central portions) of varying thickness from 0.03m to 1.43m and generally located within the upper metre of site soils. The bedrock geology was not encountered.
- 10.56 There are no geological faults or features indicated within 500m of the Site.

Environmental Setting

- 10.57 The Envirocheck report indicates that the Site is not located in an area which may be affected by historic Coal Mining or Brine extraction and a Coal Authority report is not required.
- 10.58 The Envirocheck Groundwater Vulnerability Map indicates the drift geology is classified as a Secondary Undifferentiated Aquifer with the underlying bedrock classified as a Secondary A Aquifer. The Site is not said to be located within any Environment Agency Source Protection Zones or in close proximity to any sensitive water abstraction points (e.g. potable water supply well).
- 10.59 Numerous surface water features are noted on site in the form of drainage channels and ponds. A brook is noted crossing the Site from east to west and is believed to be a tributary of Mill Brook.
- 10.60 There are two discharge consents located on site associated with the discharge of sewage (final/treated) from residential properties into the tributary of Mill Brook and the River Ribble located 1.6km north of the Site. The status for both discharge consents is 'new consent', so it is considered that they are still active.
- 10.61 A number of historic pollution incidents have been noted in close proximity to the Site. The closest incident occurred 14m to the north east of the Site comprising a spillage of oils (diesel, including agricultural) into the lune catchment in 1995 and was recorded as a Category 3 Minor Incident¹. Three Category 2^{2**} Significant Incidents have been recorded within 250m of the Site comprising the discharge of animal waste into a tributary of Mill Brook (1992), discharge of slurry into a brook to the rear of Chain House Lane (1999) and discharge of an unknown pollutant into the Lostock catchment (1992).

¹ Category 3 Minor Incident is minor damage to nature conservation. Reversibly small scale, short term damage to non-statutory protected sites or BAP habitats and species. No effect on status or objectives of a WFD water body.

² Category 2 Significant Incident is significant damage to nature conservation. Damage to a protected site or species and temporary deterioration in status of a WFD water body (within 5 years reporting period). No implications under Environmental Damage Regulations.

- 10.62 There are no active Control of Major Accident Hazards Sites (COMAH), Explosive Sites, Notification of Installations Handling Hazardous Substances (NIHHS), Planning Hazardous Substance Consents, Radioactive Substances or Planning Hazardous Substance Enforcements within 250m of the Site.

Waste Disposal and Landfill Operations

- 10.63 There are no historic and registered landfills within a 250m radius of the Site.
- 10.64 There are no waste transfer or treatment stations located on or in the immediate vicinity of the Site.

Former Site Investigation Information

- 10.65 Brownfield Solutions Ltd undertook a site investigation in 2020. The geology encountered during the investigation works have been detailed above in 10.56 to 10.58. A summary of the remaining aspects of the findings of the Site investigation are provided below.

Refined Conceptual Site Model

- 10.66 With reference to the findings of the RoC Consulting (2018) Phase 1 Desk Top Study (**Appendix 10.1**) and Brownfield Solutions Ltd (2020) Geo-Environmental Assessment Report (**Appendix 10.3**) the following potential sources of contamination have been identified:

- On site hydrocarbons and PAHs associated with vehicle repair works and made ground and topsoil deposits as encountered during the Site investigation works.
- On site organic contaminants, heavy metals and pathogens associated with dairy and poultry farms;
- On site pesticides and herbicides associated with agricultural activities and crop yielding; and
- Localised on site ground gas generation associated with infilled pond and areas of infilled ground (noted evidence around access gates to fields also).
- Asbestos identified at a localised area in the north east of the Site during Brownfield Solutions Ltd site investigation works.

- 10.67 Risk is normally defined by the consequences of the risk (i.e. severity) and the probability of the risk occurring. For each pollutant linkage both the probability and severity is assessed to determine whether there may be an unacceptable risk. Risk is classified as follows:

- Low - no action required;
- Medium - some mitigation measures may be required; and
- High - mitigation measures definitely required.

- 10.68 Table 10.5 assesses and summarises the risks and potential pollutant linkages that may exist at the Site.

Table 10.5: Preliminary Conceptual Site Model

Potential Sources		
Contamination Source	Risks Posed	Comment
Current land use	Low	<p>Agricultural land (covering a large portion of the Site footprint) poses an (albeit limited) source of contamination through the use of herbicides and pesticides.</p> <p>Other potential hot spots of contamination noted are associated with site activities including dairy farming, poultry farming, vehicle repairs and localised areas of made ground.</p>
Historical land use	Low	<p>On Site</p> <p>The Site has remained largely undeveloped as fields or farmland until the present day. It is unlikely that historic operations on site will have had a significant impact on soil quality, though a risk remains from the use of herbicides and pesticides.</p>
	Low	<p>Off Site</p> <p>The Site has been predominantly surrounded by residential dwellings and farmsteads which are not considered to have introduced a source of contamination.</p> <p>Historic industrial activity noted within 500m of the Site includes clay pit, brick yard, rubber works and mill, however, given the distance from site they are considered negligible risk.</p>
Proposed land use	Low	<p>The Site is to be developed as predominantly low-rise residential dwellings and is not envisaged to impact site soils in its completed configuration.</p>
Ground Gas	Low	<p>Infilled pond features have the potential to generate ground gas and could pose a localised risk to future site users, however, given the size of ponds on site and gas monitoring undertaken by Brownfield Solutions Ltd and subsequent risk assessment classifying the Site as NHBC Green it is considered negligible risk.</p>
Off-site Sources	Low	<p>The Site is predominantly surrounded by residential housing and open fields, which are unlikely to introduce any contaminant sources on site.</p>

Potential Receptors		
Human Health – Construction Personnel	Construction persons are considered to be at the greatest risk of exposure to contaminants during the Site’s redevelopment. The use of full Personal Protective Equipment (PPE) and welfare facilities will be essential during the redevelopment process.	
Human Health – Site Users	Future site users are considered at risk of exposure to soil contamination (whilst using garden and landscaped areas).	
Off-site properties – Adjacent Residential Housing	Considered at risk of exposure to windblown contaminants during the Sites development process but unlikely to be at risk of exposure to contaminants post completion of construction works.	
Controlled waters - Surface waters	A number of minor water courses and drainage ditches have been noted across the Site and are potential receptors for contaminants. Mill Brook is a potential receptor as a tributary of this water course is noted on site.	
Controlled waters – Bedrock Aquifer	The bedrock is classified as a Secondary Aquifer and is therefore considered relatively low risk. In addition, the Site is not located within a Source Protection Zone or in close proximity to any sensitive water abstraction points. A substantial thickness of clay also overlies the aquifer preventing any vertical migration of contaminants.	
Ecological Receptors	The Site is not located in close proximity to any statutory protected area.	
Below Ground Infrastructure	Below ground water supply pipe work and concrete structures are considered at risk of damage or could have their integrity compromised by aggressive chemical conditions.	
Potential Pathways		
Pathway route	Likelihood of linkage	Reason
Direct dermal contact, ingestion and inhalation of contaminated soil / dust	Low	<p>Construction Workers:</p> <p>The presence of as yet, unreported sources of contamination cannot be precluded. It is considered the risks posed to construction personnel, by sources of contamination, can be adequately mitigated against via the use of full PPE and the adoption of good hygiene and site practises. As required, any suspected sources of contamination discovered during the Sites development should be brought to the immediate attention of RoC Consulting to enable the implications to be established and appropriate remedial recommendations made. In the event of such a discovery, the</p>

		scope and findings of the current assessment will require re-assessment and revision.
	Low	Future site users: The Site is predominantly undeveloped fields or farmland and is unlikely to present a risk to future site residents.
Off-site receptors	Low	There is the potential for generation of dust during the construction works, it is recommended dust generation be kept to a minimum in accordance with general best practice.
Leaching of contaminated soil and impact to Aquifer beneath site	Low	The Brownfield Solutions Ltd site investigation revealed a lack of any significant contamination on site. Furthermore, impermeable clay deposits are likely to be present beneath the Site overlying the bedrock aquifer which reduces the risk of contaminant migration.
Migration of contaminated groundwater into surface water features	Low	It is recommended that all construction contractors take suitable precautions during the redevelopment process to ensure the ongoing protection of surface soils / water features as the drainage channels and tertiary rivers running across the Site could be in hydraulic connectivity to a primary river (e.g. River Ribble).
Below ground structures and pipe works	Low	The desk-based assessment and subsequent site investigation has identified the Site has a low contaminative potential and the need for protective water supply pipe work is considered unlikely. However, naturally occurring elevations of sulphate concentrations may be present and all below ground concrete structures should be designed with reference to site specific soil chemical testing information.
Ground Gas	Low	Infilled pond features have the potential to generate ground gas, though the size of these are not considered substantial and the ground conditions are likely to comprise impermeable deposits to depth reducing ground gas flow. Gas monitoring undertaken by Brownfield Solutions Ltd and subsequent risk assessment classified the Site as NHBC Green. it is considered low likelihood.

Embedded Mitigation

10.69 There are no embedded mitigation measures envisaged in regard to site ground conditions.

Assessment Methodology and Significance Criteria

Demolition and Construction

- 10.70 This section provides a summary of the potential risks that may arise during the construction of the Proposed Development. The assessment is based on construction activities involved in the Site's development.
- 10.71 The assessment of contaminated land related impacts has been conducted based on existing information about the Site and adjacent sites. The assessment considers potential pathways and receptors as previously described in the context of the construction phase.
- 10.72 Potential impacts arising from site preparation and construction activities are summarised in Tables 10.6 and 10.7.
- 10.73 Demolition and construction activities with the potential to impact ground conditions include:
- Clearance of vegetation, hedgerows and fencing across the Site;
 - Stripping of topsoil and any paths across the Site;
 - Excavation of site soils for the formation of new building foundations, drainage runs and other infrastructure; and
 - Construction of new network infrastructure and structures as part of the Site's Proposed Development.
- 10.74 Demolition and construction activities with the potential to impact ground conditions relating to contaminated ground include:
- Excavation of natural soils for the formation of new building foundations, drainage runs and other infrastructure and the disturbance and release of contaminants;
 - Generation of dust through the movement and transportation of soils across site;
 - Excavation, storage and disposal of potential contamination hotspots encountered during the construction process;
 - Spillages of fuel or other construction related products during development works onto site soils;
 - Potentially contaminated surface water runoff from the construction site into drainage networks and nearby watercourse; and
 - Presence of asbestos containing materials within buildings to be demolished and that encountered in site soils during site investigation works and possible impacts on site soils.
- 10.75 The following potential pathways / exposure mechanisms relating to contaminated land may exist during the demolition and construction phase:
- Direct contact, inhalation and / or ingestion of contaminated hotspots in soils, dusts and gases / vapours;

- Infiltration of contaminants into site soils and / or bedrock aquifer;
- Windborne transport of soil and dust from exposed contaminated soils; and
- Contaminated surface water run-off into surface water features.

10.76 The following receptors have been identified during the construction phase:

- Construction personnel;
- Off-site receptors including residents at nearby residential housing, employees at nearby businesses and members of the public;
- Secondary (A) bedrock aquifer; and
- Surface water features across the Site in the form of drainage ditches.

10.77 It is noted that there is limited demolition works (eight smaller structures across Application A) and therefore the potential impacts are considered very limited.

10.78 With reference to the 5plus architects' Proposed Development Indicative Phasing Plan (MP-02_1200), It is considered unlikely that any significant enabling or site preparatory works will be required in order to facilitate development, from an earthworks perspective (over and above those that would typically be required as part of a proposed residential scheme). Similarly, should Proposed Development Phasing Strategy be amended at a later date, it is considered unlikely any additional impacts (over and above those noted within the current assessment) may arise.

Table 10.6: Construction Impacts (Soils, Surface and Groundwater)

Activity	Potential Impact	Effect of Potential Impact			Need for Mitigation	Comments
		Sensitivity / Value	Magnitude (Probability)	Significance		
Soils						
Site clearance, enabling works and construction	Permanent / temporary damage to soil quality	Very Low	Low	Negligible	✓	Soil stripping for reuse and working practices will be adopted to minimise long term degradation of soils. Areas previously occupied by tree cover are likely to be at risk of greater amounts of soil degradation.
	Introduction of contaminants from the demolition of existing structures	Medium	Low	Minor	✓	A theoretical risk of sources of contamination being introduced into site soils is present during site clearance and demolition due to poor site management and practices.
Geology						
Site clearance, enabling works and construction	Permanent loss of geological materials	Very Low	Very Low	Negligible	X	Earthworks may be required in areas across the Site to create level development platforms i.e. the aforementioned small mound to the rear of Proctors Farm and The Barn. However, it is likely that any cut materials will be reused in areas of fill across the Site and therefore there will be no direct and permanent loss of geological materials.

Activity	Potential Impact	Effect of Potential Impact			Need for Mitigation	Comments
		Sensitivity / Value	Magnitude (Probability)	Significance		
Surface and Groundwater						
Construction phase	Disruption of groundwater flow in Aquifers	Low (Secondary A Aquifer)	Low	Minor	X	Any dewatering during construction phase may disrupt groundwater levels, though this is likely to be a temporary effect. In addition, the bedrock aquifer is not considered to be a sensitive receptor owing to its aquifer classification.
Site activities such as the storage of fuel	Spillages and leakages of oil, fuel and other potentially polluting substances that could impact on surface and groundwater	Low	Low	Minor	✓	A theoretical exposure pathway between contaminants associated with construction works and site soils / groundwater is present. However, it is assumed that best environmental practices will be used at site.

Table 10.7: Construction Impacts (Contaminated Land)

Contaminant Source	Potential Impact	Effect of Potential Impact			Need for Mitigation	Comments
		Sensitivity / Value	Magnitude (Probability)	Significance		
Contaminated Land						
Potentially contaminated site soils	Adverse impacts on health of workers through direct contact, inhalation, ingestion	Medium	Low	Minor	✓	The Brownfield Solutions Ltd site investigation revealed minor contamination present in site soils with some localised hotspots present in made ground and topsoil deposits in the south east of the Site and a single encounter with asbestos in the northeast of the Site. In addition, the potential for ground gas generation has been investigated with a subsequent ground gas risk assessment undertaken. Following this risk assessment the Site was classified as NHBC Green with no mitigation measures required.
	Adverse impacts on health of workers and general public from generation of contaminated dust and exposure to wind-blown contaminants	Medium	Low	Minor	✓	Potential for dust to be generated during excavation works on site. Regular dampening down will be required to mitigate risks posed with any material movements completed using covered wagons.

Contaminant Source	Potential Impact	Effect of Potential Impact			Need for Mitigation	Comments
		Sensitivity / Value	Magnitude (Probability)	Significance		
	Pollution of surface water by discharge of contaminated groundwater	Low	Low	Minor	✓	Minor hotspots of contamination in site soils were encountered during site investigation this should be accounted for during any dewatering works which may result in the pumping of waters into surface water drains.
	Discharge of contaminated groundwater	Low	Low	Minor	✓	Dewatering may result in pumping of contaminated waters. Appropriate remedial measures will be required to control groundwater / leachate and treat any leachate pumped from excavations.

10.79 The significance of impacts arising during the demolition and construction phase of the Proposed Development are considered negligible or minor, and therefore Not Significant in EIA terms. Nevertheless, given the potential for non-significant impacts appropriate mitigation measures may be required. Mitigation measures include the employment of good environmental site practices such as the production of a CEMP and the use of full PPE by construction personnel. Mitigation measures are further detailed in sections 10.88 – 10.97.

Completed Development

10.80 This section provides a summary of the potential risks that may arise during the completed operational phase of the Proposed Development. The assessment is based on operational activities involved in the Site's use as detailed in Chapter 5: The Proposed Development of this ES.

10.81 The assessment of contaminated land related impacts has been conducted based on existing information about the Site and adjacent sites. The assessment considers potential pathways and receptors as previously described in the context of the construction phase.

10.82 Changes in site soils and geology implemented during the construction phase of the Proposed Development are likely to remain throughout the operational phase of the project and as such any impacts are considered to be long-term. Potential impacts arising from site preparation and construction activities are summarised in Tables 10.6 and 10.7.

10.83 Operational activities with the potential to impact ground conditions include:

- Long-term presence of hardstanding, foundations and drainage runs across the Site.

10.84 Operational activities with the potential to impact ground conditions relating to contaminated ground include:

- On-site areas of carparking; and
- New access roads across the Site.

10.85 The following potential pathways / exposure mechanisms relating to contaminated land may exist during the operational phase:

- Direct contact, inhalation and / or ingestion of contaminated soils, dusts and gases / vapours;
- Infiltration of contaminants into site soils and / or bedrock aquifer; and
- Contaminated surface water run-off into surface water features.

10.86 The following receptors have been identified during the operational phase:

- Residents within dwellings;
- Workers occupying retail / commercial buildings;

- Off-site receptors including employees at nearby businesses, members of the public and residents at nearby residential housing;
- Secondary A aquifer; and
- Surface water features noted across the Site.

10.87 In addition to the accidental introduction of contaminants into site soils, sources of contamination that may be present at the Site potentially include hotspots remaining at the Site following the construction phase (e.g. from intensive farming activities).

Table 10.8: Completed Development Impacts (Soils, Surface and Groundwater)

Activity	Potential Impact	Effect of Potential Impact			Need for Mitigation	Comments
		Sensitivity / Value	Magnitude (Probability)	Significance		
Soils						
Car parking in areas of the Site / access roads	Introduction of hydrocarbon contamination into site soils	Low	Very Low	Negligible	✓	Accidental spillage of fuel may impact site soils and infiltrate to groundwater or surface water drainage. The use of hardstanding in areas of car parking / road will mitigate against this, however, it is noted that likely site coverage of these operations is not extensive.
Surface and Groundwater						
Operational phase	Disruption of groundwater flow in Aquifers	Low (Secondary A Aquifer)	Low	Minor	X	The degree of hardstanding coverage, building foundations and drainage runs across the Site may impact on drainage rates and groundwater recharge rates at the Site.

Table 10.9: Completed Development Impacts (Contaminated Land)

Contaminant Source	Potential Impact	Effect of Potential Impact			Need for Mitigation	Comments
		Sensitivity / Value	Magnitude (Probability)	Significance		
Contaminated Land						
Contaminated site soils	Adverse impacts on Health of future site users through direct contact, inhalation, ingestion	Medium	Low	Minor	✓	Minor localised sources of contamination were noted in made ground and topsoil deposits in the south eastern area of the Site although below screening values for the Proposed Development. Asbestos was encountered in a single trial pit in the north eastern portion of the Site. In addition, the potential for ground gas investigation has been investigated and a subsequent ground gas risk assessment undertaken by Brownfield Solutions Ltd with the Site being characterised as NHBC Green with no further mitigation measures envisaged.
	Pollution of surface water and groundwater aquifers by discharge of contaminated groundwater	Low	Low	Minor	✓	Minor localised contamination is present within some site soils and may exist at the Site during its operational use. The continued migration of contaminants into surface water features and groundwater may need to be considered although migration into the underlying bedrock aquifer is considered unlikely due to the substantial low permeability clay deposits that overly it.

- 10.88 The significance of impacts arising during the completed development phase of the Proposed Development are considered **negligible or minor**, and therefore **Not Significant** in EIA terms. Nevertheless, given the potential for non-significant impacts appropriate mitigation measures may be required. Mitigation measures are further detailed in sections 10.98 – 10.101.

Additional Mitigation / Enhancement Measures

- 10.89 This section describes the measures which are required to mitigate any of the identified minor environmental effects with a need for mitigation in regard to ground conditions.

Demolition and Construction

- 10.90 Following the findings of the Brownfield Solutions Ltd site investigation works an outline remediation strategy was recommended including the soil capping of made ground deposits left in situ in garden and public open space areas and supplementary investigation in the area where asbestos was encountered in the north east of the Site to properly investigate its spatial extent.
- 10.91 It is recommended that full PPE, including personal gas protection measures, and good hygiene / site practices are utilised by construction workers to mitigate against risks of contaminated soils.
- 10.92 Any sources of contamination within soils or contaminant ingress within surface waters / ground water should be brought to the immediate attention of RoC Consulting for assessment of severity and advise any remedial measures that may be required.
- 10.93 It is recommended a Construction Environmental Management Plan (CEMP) is produced and implemented during the construction phase. The plan should outline how adverse effects on the environment and surrounding area will be avoided or mitigated against during construction in accordance with current environmental legislation.
- 10.94 A Soil Management Plan (SMP) for soil excavation, handling and storage should be implemented in accordance with the Environment Agency Pollution Prevention Guidelines (PPG1). It is noted that any excavated soils are likely to remain on-site.
- 10.95 With regards to clean soil removal and reinstatement, good practice states that soils should be returned in a state that is as close as possible to their original state after disturbance.
- 10.96 Fuel and other chemicals should be stored in accordance with the Control of Pollution (Oil Storage) Regulations. Storage containers should be regularly inspected for leaks or damage. It is recommended a management plan is put in place to minimise effects in the event of accidental fuel spillage on-site.

- 10.97 All works should be carried out in accordance with current legislation and standards, specifically EA Pollution Prevention Guidance (PPG) documents. These documents provide information on protecting the environment from pollution during construction operations.
- 10.98 All site clearance works will require pre-demolition asbestos surveys on existing buildings to be demolished. It is also assumed that best environmental practice will be adopted by demolition specialists during these works in order to prevent additional sources of contamination being introduced to site soils.

Completed Development

- 10.99 Minor localised areas of contamination were encountered during the Site investigation works undertaken by Brownfield Solutions Ltd. It is recommended that in areas of sensitive land use such as gardens and public open space that soil capping is employed to break any potential contaminant pathway. The spatial extents of asbestos encountered in soils within the north eastern portion of the Site should also be properly investigated.
- 10.100 The use of a chemically resistant water supply pipe may be required, and concrete and other underground structure may also require to be designed specific to the chemical composition of site soils.
- 10.101 The assessment has identified the potential for accidental spillage of fuel into site soils and / or controlled waters. The use of fuel interceptors and a suitable management plan may be required to control this risk.
- 10.102 No further mitigation measures are envisaged.

Likely Residual Effects of the Development and their Significance

- 10.103 The residual impact assessment assumes that the mitigation described in the section above has been implemented.

Construction Phase

- 10.104 A residual risk remains with the presence of minor contaminant hotspots within site soils encountered during the Site investigation and any that may have not yet been discovered and the exposure of these contaminants to construction workers during the construction phase. It is considered the risks posed to construction personnel can be adequately mitigated against by the use of full PPE (including personal gas protection measures) and the adoption of good hygiene and site practises.
- 10.105 Any sources of contamination uncovered during site development works should be brought to the immediate attention of RoC Consulting for consideration and comment. As a result, the residual impact significance is **negligible**, which is **Not Significant**.

Completed Development

- 10.106 A residual risk remains of the presence of identified and unidentified contaminant hotspots within site soils and the subsequent direct contact, ingestion or inhalation by future site users. It is considered that this can be adequately mitigated against through introduction of clean soil capping layers to a suitable depth in areas of sensitive land use such as in residential gardens and public open space.
- 10.107 There is a risk of release of fuel hydrocarbon contamination to site soils and (and possibly surface / groundwater) through the accidental spillage of fuel from vehicular operations (e.g. road / car parking etc. However, it is likely areas of site susceptible to these impacts will be formed of hard standing, with controlled drainage / attenuation networks, making the likelihood actual impacts occurring to soils relatively low. As such, the residual effect of this is considered **negligible**, which is **Not Significant**.
- 10.108 It is anticipated that overall, there is a **negligible** impact significance during the operational phase with regards to the ground conditions, which is **Not Significant**.

Table 10.10: Residual Effects Summary

Description of Effect	Potential impact including significance	Mitigation	Residual effects including significance
Construction and Demolition			
Exposure to sources of contamination hotspots within soils or groundwater and / or ground gas during construction process	Minor	✓	Negligible, which is Not Significant.
Pollution of site soils and / or surface and groundwater as a result of construction activities such as spillages of fuel	Minor	✓	Minor, which is Not Significant.
Completed Development			
Impact of soil or groundwater quality during the Sites operational phase	Negligible	✓	Negligible, which is Not Significant.

Conclusions

- 10.109 The baseline of ground conditions at the Site has been assessed utilising available information for the current study site. As such, a number of geological, hydrogeological and contaminated land related impacts have been identified. Of which, the main points of focus are the potential minor localised contamination reported following

site investigation works and the risk of this to human health, soil and controlled waters receptors, as well as the direct loss of agricultural land.

- 10.110 The effect of the aforementioned potential impacts has been assessed in the context of the construction phase, operational phase and through consideration of the accumulative effects of other Proposed Developments. A number of risks have been identified associated with the ground conditions and the potential for contaminated land. A number of mitigation measures have been recommended to reduce these risks.
- 10.111 Mitigation measures recommended include the use of best environmental practices during the construction and operational phase, employment of soil capping in areas of sensitive use and investigation of the spatial extent of asbestos encountered in the north eastern portion of the Site.
- 10.112 Following the aforementioned mitigation measures, the assessment indicates that the residual impact of the Proposed Development will have a **negligible** to **minor** impact in terms of geology, groundwater and any contaminated land concerns.

References

- 1) RoC Consulting (2018) Phase 1 Desk Top Study. (ref: MN/AS/p1 3861).
- 2) Brownfield Solutions Ltd (2020) Geo-Environmental Assessment Report (ref: NS/C4259/9441 Rev A)
- 3) Preston City Council, South Ribble Borough Council and Chorley Council (2012) Central Lancashire Adopted Core Strategy Local Development Framework.
- 4) South Ribble Borough Council (2015) Local Plan.