East Wing, Station House
Broadclyst Station
Exeter, EX5 3AS

Tel: 01392 460800
E-mail: office@redrockgeo.co.uk
www.redrockgeo.co.uk

PROJECT NAME

ANSFORD, CASTLE CARY

REPORT

GEO-ENVIRONMENTAL DESK STUDY (GDS)

CLIENT

ANDREW HOPKINS

REFERENCE NO

RP7003

MARCH 2019

REVISION RECORD				
Revision	Reference	Date	Author(s)	Checked
00	RP7003	March 2019	RT	AC

Red Rock Geoscience Ltd
Registered in England No. 07503027
Registered Office: 1 Colleton Crescent, Exeter, EX24DG

EXECUTIVE SUMMARY	
Commission & Objectives	Red Rock Geoscience Ltd ('Red Rock') was commissioned by JRC Consulting, acting on behalf of Andrew Hopkins, to undertake a Desk Study Investigation for the proposed residential housing development site at Ansford, Castle Cary. The geo-environmental objectives of this assessment were to identify the site's historical land use, potential resulting contamination and associated risks, prior to more detailed intrusive investigations and determination of possible remediation requirements in order to enable the safe development of the site. This report comprises a desk study in general accordance with model procedures Environment Agency (2003) and publication R&D66. The desk study includes a conceptual model of the site which is intended for identification of specific areas where there could be the potential for ground contamination or geotechnical concerns.

Desk Study Findings & Recommendations	
Land Use	The review of the historic maps indicates that the site comprises undeveloped open fields from at least the 1890s. The layouts of the hedges have changed over the years and farm buildings (Hillcrest Farm) have developed on the southern boundary during the 1930s. The land surrounding the site was originally open fields and the town of Ansford from at least the 1880s. Throughout the 1900s, Ansford and Castle Cary underwent gradual expansion, with residential areas eventually surrounding the site to the south-east. Infrastructure was also advanced to support the expansion, including the development of many roads, bridges and railway lines. The surrounding area has also encompassed churches, schools and residential housing located within 500m from the site boundary.
Geology & Contaminant Background Levels	Published geological information from the British Geological Survey (1:625,000 scale Solid Geological Map) indicates that the solid geology beneath the site comprises the Lias Group, the Dyrham Formation and Marlstone Rock Formation (undifferentiated) of Jurassic and Triassic geological age. The Dyrham Formation and Marlstone Rock Formation typically comprise siltstone. The Lias Group typically comprises interbedded limestone and mudstone. Although not shown on the geological maps, this solid geology would typically be overlain by a mantle of Residual Soil derived from the insitu weathering of the underlying bedrock. River Terrace Deposits (undifferentiated) are shown to be in close proximity to the site associated with the River Brue.
Ground Gas	No Radon Protection or ground gas assessment required on site.

Hydrogeological Setting	The varied bedrock underlying the site is classified as 'Secondary A Aquifer' and 'Secondary B Aquifer' in accordance with the new Environment Agency designations for aquifer classification. Secondary A Aquifers are comprised of permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as Minor Aquifers. Secondary B Aquifers are comprised of predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.
Potential Contaminant Sources	There are no active or historical trade entries likely to have impacted the site. Based on an assessment of the Desk Study Data significant contamination on the site is unlikely to be present however localized contamination resulting from the sites historic agricultural may be possible. Localised hydrocarbon contamination may be present due to the historical and current use of farm vehicles on the site area. Asbestos containing materials (ACMs) may be present within the buildings present on site and a survey may be prudent prior to demolition.
Protected & Sensitive Land Use	The data obtained has no record of any active pollution prevention control sites and registered sites handling/storing radioactive or hazardous substances which are likely to have impacted upon the subject site. Discharge consents were recorded to be 136m north of the site, associated with Wessex Water Sewage Treatment Works.
Unidentified Contamination	Regular inspections should be carried out by ground workers during any excavation work, and advice should be sought in the event that unexpected ground conditions are encountered. Should any visual or olfactory signs of contamination be found during construction works, soils should be tested and assessed. Should further testing and assessment identify areas of unacceptable risk, appropriate remedial measures would need to be implemented. A detailed remediation strategy should be prepared, any remedial works and associated clean-up levels would need to be discussed with and approved by the Regulatory Authorities. Additionally, a Validation Statement would need to be prepared upon completion of any remedial works, detailing the works undertaken and the results of the associated validation testing.

TABLE OF CONTENTS

APPENDICES

LIST OF TABLES

1 INTRODUCTION

1.1 Commission

Red Rock Geoscience Ltd ('Red Rock') was commissioned by JRC Consulting, acting on behalf of Andrew Hopkins, to undertake a Desk Study Investigation for the proposed residential housing development site at Ansford, Castle Cary.

1.2 Development Proposals

The development proposals comprise residential properties with gardens, open areas, garages and associated access roads.

Outlines of the proposals are enclosed in Appendix A.

1.3 Objectives

The geo-environmental objectives of this assessment were to identify the site's historical land use, potential resulting contamination and associated risks, prior to more detailed intrusive investigations and determination of possible remediation requirements in order to enable the safe development of the site.

This report comprises a desk study in general accordance with model procedures Environment Agency (2003)[1] and publication R&D66[2]. The desk study includes a conceptual model of the site which is intended for identification of specific areas where there could be the potential for ground contamination or geotechnical concerns.

It should be noted that this investigation is focused towards the proposed developments at the site and may need to be re-assessed should the development proposals be revised.

This assessment has been undertaken based on desk study findings of publicly available information on the geological and geo-environmental aspects of the site. Information from a Landmark Envirocheck™ survey report was utilised in the preparation of the desk study sections of this report.

Environmental regulators use the Source-Pathway-Receptor (SPR) pollution linkage concept when assessing the risk posed by a contaminated site. For a liability to arise, each stage of the pollution linkage must be present. The desk study details the historical and current site uses and establishes environmental sensitivity of the site thus allowing a preliminary conceptual site model identifying potential contaminant sources, migration pathways, and possible receptors to be developed. An assessment of pollutant linkages based on the findings of the desk study and investigation works is also presented.

It should be noted that references to the word 'contamination' in this report do not relate to the statutory definition of Part IIA Contaminated Land (amended in 2000) in accordance with the Department of the Environment, Transport and the Regions[3]. In the context of this report a wider term is used to cover all cases where the actual or suspected presence of substances in, on or under the land may cause risks to people, property, human activities or the environment, regardless of whether or not the land meets the current statutory definition of Part IIA.

---

1 Environment Agency, 2003, Model procedures for the management of land contamination. Contaminated Land Report 11, Part 1 – Procedures.

2 NHBC, Environment Agency & Chartered Institute of Environmental Health, 2008, R&D Publication 66 - Guidance for the Safe Development of Housing on Land Affected by Contamination.

3 Department of the Environment, Transport & the Regions, 2000, Environmental Protection Act 1990: Part IIA.

Reference should be made to the 'General Notes and Limitations' included in Appendix D at the end of this report, which provide information on the procedures followed in the investigation and data assessment, and explains the context within which this report should be read.

The current report was developed on the basis of the various current publications by UK policy makers, in particular the NHBC Standards[4] and model procedures by DEFRA[5].

This report only addresses potential ground contamination issues and does not include issues pertaining to ecology, habitat, or wider environmental concerns. Appropriate professionals with expertise in these areas should be consulted.

[4] NHBC, 2019, Standards.

[5] Department of Environment, Food and Rural Affairs (DEFRA) & Environment Agency, 2004, Contaminated Land Report 11 Model Procedures for the Management of Contamination.

2 DESK STUDY

2.1 Site Description and Site Walkover

The site is located in Ansford, Castle Cary, and is centred on National Grid Reference 363457, 133335.

The site is formed of three irregularly shaped fields of different sizes, and is approximately 9.63 Ha in total. The site dips between 5° and 10° to the north and 5° to the west. The largest field contains a large oak tree within the eastern half of the field, as well as several telegraph poles which trend east-west and north-south which connects to the train station and residential housing. Active farm buildings and structures are present within the south-easterly corner of the field, which are made of concrete blocks and timber panels. As well as this, there are stables for horses and donkeys present within one of the smaller fields within the south west of the site area.

The site area is mostly bounded by hedgerows and mature trees, as well as infrastructure including Ansford Hill Road (southern border), Station Road (western border) and Castle Cary Train Station (northern border). The site is bordered by residential housing and gardens to the west and south-east, to the south by new housing developments, industrial yards and agricultural land and to the north and east by additional agricultural grassy fields.

No visual or olfactory evidence of significant contamination were noted during the walkover survey.

2.2 Potentially Contaminative Land Use

Assessment of Historical Mapping

The site history has been assessed using various Ordnance Survey historical maps from source scales 1:1,250, 1:2,500, 1:10,000, and 1:10,560. Copies of these maps are enclosed in electronic format in Appendix B. A sequential summary of the historical land use of the site and the land within 1km of it is presented in the table below.

TABLE 2.1: ASSESSMENT OF HISTORICAL MAPPING

	On Site	Within 1000m of the Site
1880-1890s	The site area consists of 4 undeveloped open fields. Within the north-eastern section of the site, a road runs north to west connecting the Castle Cary Station to the town of Ansford.	Generally open fields and farmland within and around the town of Ansford located along the southern border of the site area. Within 1000m of the site area, several hills are present north-west (Acres Hill) and south-west (Blackworthy Hill) of the site area. Additionally, infrastructure such as a Great Western Railway line (Wilts Somerset and Weymouth Branch), major roads (Mill Lane and Maggs Lane), bridges (Ansford Bridge) and residential housing are located between 20m and 1000m north and south of the site area. The River Brue runs east to west, which is located 122m north of the site area.
1900s	No significant changes noted.	Expansion of the town of Castle Cary, situated 705m from the site area.
1930s	The edition of farm buildings situated along the southern edge of the site, as well as the division of the site into 5 open fields.	The development of Station Road, situated on the western boundary of the site. The expansion of the Great Western Railway, an additional branch line travelling west

TABLE 2.1: ASSESSMENT OF HISTORICAL MAPPING		
1960s	Further division of the open fields, from 5 to 6.	Further development of the town of Ansford, addition of a school 472m east of the site area.
1970s	Development of farm buildings in the southern area of the site.	Increased development of the town of Ansford, increased housing development on the southern border of the site area.
1980s	Several fields are combined together to create 2 main open fields which make up the site area.	No significant changes noted.
1990-2000s	Development of Hillcrest Farm within the south-east corner.	Further development of the town of Ansford.

Trade Entries, Permits and Discharges

An assessment of current potential contaminative land use is based on the information contained within the Envirocheck Report and is summarised in the following table.

TABLE 2.2: TRADE ENTRIES, PERMITS AND DISCHARGES	
Trade Entries	A former Tyre Dealers and Garage Services industry premises is recorded to be present up to 22m west of the site. Whilst this could represent a potential contamination source, because it is located downslope (anticipated down hydraulic gradient) from the site it is not likely to pose a significant risk to the site. The Envirocheck Report lists no active fuel stations located sufficiently close (within 250m) to the site to pose a risk A former fuel station is recorded to be present west of the site. Whilst this could represent a potential contamination source, because it is located downslope (anticipated down hydraulic gradient) from the site it is not likely to pose a significant risk to the site.
Pollution Prevention and Control Sites	The Envirocheck Report lists no historical or active pollution prevention control sites (PPC) on the site. There are recorded historical and active PPC sites outside the site but at locations likely to impact upon it. The nearest a Petrol Filling Station which is 405m north of the site.
Discharge Consents	The Envirocheck Report lists a Discharge Consents (DCs) 136m north of site, associated with Wessex Water Sewage Treatment Works.
Environment Agency Recorded Pollution Incidents	The Envirocheck Report lists no pollution incidents to controlled waters on the site. The Envirocheck Report lists a pollution incident occurring 980m south-east of the site in 1996. This was associated with agricultural practices.
Waste Management	The Envirocheck Report lists no active or historic landfill sites within 250m of the site.
Registered Radioactive Substances	The Envirocheck Report lists no sites registered to handle or hold radioactive substances on or in close proximity to the site.
Sites Storing Hazardous Substances	The Envirocheck Report lists no sites storing hazardous substances within 500m of the site.

2.3 Geological Setting

Solid Geology

Published geological information from the British Geological Survey (1:625,000 scale Solid Geological Map) indicates that the solid geology beneath the site comprises the Lias Group, the Dyrham Formation and Marlstone Rock Formation (undifferentiated) of Jurassic and Triassic geological age. The Dyrham Formation and Marlstone Rock Formation typically comprise siltstone. The Lias Group typically comprises interbedded limestone and mudstone.

Although not shown on the geological maps, this solid geology would typically be overlain by a mantle of Residual Soil derived from the insitu weathering of the underlying bedrock.

Superficial Geology

River Terrace Deposits (undifferentiated) are shown to be in close proximity to the site associated with the River Brue.

Natural and Mining Cavities

Preliminary information on the presence of natural and mining cavities on the site was obtained from the Envirocheck Report which indicates no natural or man-made cavities are present within 1000m of the site.

Natural Subsidence Hazards

Information on subsidence hazards for the site obtained from the Envirocheck Report indicates that the site is of generally very low risk with regards to subsidence hazards. However, this information is based on large scale mapping and, consequently, a low level of detail is achieved with regard to the assessment of potential for subsidence hazards.

Estimated Soil Geochemistry

Potentially harmful chemical elements (PHEs) include arsenic (As), cadmium (Cd), chromium (Cr), nickel (Ni), and lead (Pb). They can occur naturally elevated in the environment or as a result of contaminative land use, and under certain circumstances can be harmful to plants, animals, or people.

The estimated soil geochemistry is based on the National Soil Chemistry dataset maps geometric mean ambient background concentrations (ABCs) for PHEs in rural topsoil's. These classifications are created by mapping British Geological Survey (BGS) rural soil chemistry data within delineations of parent material (bedrock and superficial geology). This allows the estimation of PHE concentrations based on local averages for each geological unit.

The following table shows a comparison between the current guideline values for residential land use (with plant uptake) and the BGS estimated background concentrations in topsoil's of natural origin.

TABLE 2.3: POTENTIALLY HARMFUL CHEMICAL ELEMENTS (PHES) IN TOPSOIL

PHE	BGS Estimated Concentrations	Residential Land Use with Plant Uptake Criteria Values	Comments
Arsenic	15 – 25 mg/kg	37mg/kg	Below guideline value
Cadmium	<1.8 mg/kg	10mg/kg	Below guideline value
Chromium	90 – 180 mg/kg	910mg/kg	Below guideline value
Nickel	15 – 45 mg/kg	130mg/kg	Below guideline value
Lead	<100 mg/kg	210mg/kg	Below guideline value

The British Geological Survey (BGS) states in their Estimated Soil Chemistry Data V3 supporting documentations that "…whether or not a particular PHE constitutes a hazard depends on a variety of factors including its chemical form, concentration, behaviour and the extent to which it may be taken up by living organisms; the size of the mineral particles in which the element occurs; soil or water acidity (pH); the type of vegetation cover; the extent of exposure to the element; and the dose received. Such concentrations do not necessarily imply a significant health risk; however they do highlight the need to consider whether or not there may be a risk."

The estimated soil geochemistry maps are included in the Envirocheck Report in Appendix B.

2.4 Ground Gas

The CIRIA 665[6] Publication identifies the most likely sources of ground gas which are varied and are assessed below in view of the conditions of the subject site.

TABLE 2.4: GROUND GAS POTENTIAL

Ground Gas	Comments Relevant to the Site
Radon Gas Radon is a radioactive gas which occurs naturally and has no taste. It can be harmful to human health.	The site is located within an area where less than 1% of homes are above the action level, and No Radon protective measures are required.
Waste Sites (Landfills etc.) Landfill gas is the product of the biodegradation of organic materials contained within the landfill waste. The main gases produced from landfill biodegradation are methane and CO2, but other trace gases such as hydrogen, hydrogen sulphide, and VOCs can also be present.	There are no active or historical landfill sites recorded within 250m of the site.
Burial Grounds Gases typically generated from corpse decomposition are predominantly CO2 and methane. Other gases can be generated if the burial ground is in waterlogged or moist / damp conditions. The distance to which gas migrates depends on the ground conditions. Long-distance migration tends to occur through fissures / fractures within consolidated geological materials while unconsolidated deposits tend to encourage short-distance migration.	There are no large burial grounds recorded within 250m of the site.

[6] CIRIA C665, 2007, Assessing risks posed by hazardous ground gases to buildings.

TABLE 2.4: GROUND GAS POTENTIAL	
Ground Gas	**Comments Relevant to the Site**
Made Ground Made Ground containing degradable material such as wood, paper, rags and vegetation with ash, clinker, brick, and concrete fragments etc., could potentially be a source of ground gas. The potential for gas generation from Made Ground materials tend to be low although there is a potential for small but sustained volumes of gas. Where the Made Ground contains elevated concentrations of carbon-rich materials, there is a potential for the ground gas (i.e. methane, CO2, etc.) to be higher.	There are no significant areas of Made Ground recorded within 250m of the site.
Spills, Leaks and Discharges Spillages or leakages of petroleum hydrocarbons from vehicles, machinery, and trams can give rise to contaminated soils but also their associated volatile components may cause hydrocarbon vapour emissions. Hydrocarbons in the ground at elevated concentrations can also be highly flammable.	There are no recorded spillages, leaks or discharges of hydrocarbons on or in close proximity to the site, or any industries with which such instances are commonly associated.
Organic-Rich Deposits (Alluvium, peat, marshland or tidal areas) Methane from these sources is produced by microbial decay of the organic content under anaerobic conditions (i.e. waterlogged vegetation). CO2 is the result of acid reaction on the carbonate fraction of alluvial soils and also by methane oxidation. Potential trace gases include hydrogen sulphide and light hydrocarbons.	The site is not located within an area of Alluvium, marshland, or organic-rich materials.
Ground Gas Assessment Required?	No

2.5 Groundwater and Surface Water Setting

Groundwater Vulnerability

Geological strata which contain groundwater (Aquifers) vary in their general and hydraulic characteristics. These variations determine the vulnerability of the groundwater to pollution. The new designations are in accordance with the Water Framework Directive and reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply) but also their role in supporting surface water flows and wetland ecosystems.

The new aquifer designation data is based on geological mapping provided by the British Geological Survey and the maps are divided into two different type of aquifer designation:

- Superficial (Drift) - permeable unconsolidated (loose) deposits (i.e. sands and gravels);
- Bedrock - solid permeable formations (i.e. sandstone, chalk and limestone).

The varied bedrock underlying the site is classified as 'Secondary A Aquifer' and 'Secondary B Aquifer' in accordance with the new Environment Agency designations for aquifer classification. Secondary A Aquifers are comprised of permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as Minor Aquifers. Secondary B Aquifers are comprised of predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.

Abstraction Licenses

The nearest potable water abstraction is located 956m to the south-east of the site, a location which is both upslope and therefore likely to be up hydraulic-gradient of the site. The abstraction is from groundwater used for "Spray Irrigation and Agriculture" purposes. Due to the distance from the site and the fact it is both upslope and up groundwater gradient, any contamination arising from the development site is unlikely to impact the abstraction. Furthermore the underlying geology is unlikely to allow the rapid migration of contaminants.

Groundwater Protection Zones

The site is not within a Source Protection Zone (SPZ).

Surface and Groundwater Flows

Topographically the site slopes gently down from south-east to north-west. The surrounding area slopes down in the same direction. Surface water flows are likely to largely mimic the topographical gradients, and flow to the east and west.

The nearest surface water feature is River Brue, which is located approximately 122m north of the site. This flows towards the west.

2.6 Protected Sensitive Land Use

There are no protected areas at locations likely to be impacted by contaminant migration from the subject site.

3 CONCEPTUAL MODEL

3.1 Introduction

Environmental regulators use the 'Source-Pathway-Receptor (SPR) pollution linkage' concept when assessing the risk posed by a contaminated site. For a liability or risk to arise each stage of the pollution linkage must be present.

The following Conceptual Site Model (CSM) is based on the findings of the desk study research detailed above. The CSM identifies potential contaminant sources at the site, the possible pathways for these contaminants to leave the site, and the human and environmental receptors in the vicinity of the site.

The main functions of the CSM are to establish the nature and potential impact of any ground contamination present, to provide a tool for assessing risk by identifying where a complete pollution linkage is present and, where necessary, to provide a basis for planning effective targeted investigations.

3.2 Potential Contamination Sources

The review of the historic maps indicates that the site comprises undeveloped open fields from at least the 1890s. The layouts of the hedges have changed over the years and farm buildings (Hillcrest Farm) have developed on the southern boundary during the 1930s.

The land surrounding the site was originally open fields and the town of Ansford from at least the 1880s. Throughout the 1900s, Ansford and Castle Cary underwent gradual expansion, with residential areas eventually surrounding the site to the south-east. Infrastructure was also developed to support the expansion, including the development of many roads, bridges and railway lines. The surrounding area has also encompassed churches, schools and residential housing located within 500m from the site boundary.

There are no active or historical trade entries likely to have impacted the site.

The data obtained has no record of any active pollution prevention control sites and registered sites handling/storing radioactive or hazardous substances which are likely to have impacted upon the subject site. Discharge consents were recorded to be 136m north of the site, associated with Wessex Water Sewage Treatment Works.

Based on an assessment of the Desk Study Data significant contamination on the site is unlikely to be present however localized contamination resulting from the sites historic agricultural may be possible. Localised hydrocarbon contamination may be present due to the historical and current use of farm vehicles on the site area. Asbestos containing materials (ACMs) may be present within the buildings present on site and a survey may be prudent prior to demolition.

3.3 Potential Critical Receptors & Pathways

In view of the outline residential proposals, the site is being considered within a residential land use with plant uptake scenario which considers the following critical receptors.

Critical Receptors	Pathways

Human Receptors	Future Site Residents / Users Site Workers Neighbours	Ingestion, dermal contact and inhalation of contaminated soils, home-grown vegetables, dust, water, and gas
Fauna & Flora	On-site Fauna and Flora Off-site Fauna and Flora	Contaminant uptake and ingestion of contaminated plants and water
Water Resources	Nearby streams and surface water bodies Groundwater table / Aquifer Water abstractions	Leakages of contaminated drains and contaminant migration through the soils into surface water, groundwater, or water abstractions
Future Built Environment	Damage to concrete structures and pipe-work by potential aggressive substances within the groundwater and soils	Damage to physical integrity of future built structures

3.4 Potential Exposure Pathways and Assessment of Pollutant Linkages

A number of exposure pathways link the contamination to the receptor and potential risks are dependent on active pathways. The qualitative assessment of potential pollutant linkages based on the Desk Study information involves the matching of the identified sources of contamination to the receptors through the possible migration pathways. These links must be completed for there to be any risk associated with the site and its development.

This assessment is presented in terms of the Source (S), Pathway (P) and Receptor (R) concept and applying a qualitative value judgement to this appraisal. The assessment assigns a level of risk to each SPR link based on the probability and potential consequence of the risk being realised. A final level of risk is assessed assuming control measures are in place during the development or recommendations are followed.

A detailed conceptual model and the assessment of pathways and pollutant linkage tables are enclosed in C together with associated risk phrases and matrices. A summary is presented in the following table.

TABLE 3.1: RISK ASSESSMENT SUMMARY

Receptors	Risk Assessment	Recommendations
Human Health	Risk to human health was considered generally LOW	Significant levels of contamination are unlikely on this site. Although the likelihood of contamination is expected to be low, geo-environmental testing is recommended in any areas that are to be soft landscaped, or on any material that is to be used in soft landscaped areas.
Flora and Fauna	Risk to Flora and Fauna was considered NEGLIGIBLE	No visual signs of vegetation distress or any indication that soils may be toxic to Fauna or Flora. Any impact to vegetation would be localised in nature. Further assessment not required.
Water Resources	Risk to water resources was considered NEGLIGIBLE	Presence of contamination in concentrations likely to pose a risk to water resources not expected. Contaminant percolation, leaching, and migration unlikely to be extensive in view of the underlying geology. Further assessment not required.

TABLE 3.1: RISK ASSESSMENT SUMMARY		
Receptors	**Risk Assessment**	**Recommendations**
Future Built Environment	Risk to the future built environment was considered VERY LOW	Contamination unlikely to be extensive or in concentrations likely to pose a risk to future concrete structures or pipework.
Ground Gas	Risk to human health and the future built environment was considered VERY LOW	No Radon Protection or ground gas assessment required on site.
New Water Mains	Risk to human health was considered potentially LOW	Significant levels of contamination are unlikely. Whilst extensive contamination is not expected, in the absence of previous investigations on the site, service providers are likely to require additional testing in accordance with UKWIR along the routes of any new water mains to determine risks to mains water. On this basis, testing in accordance with UKWIR is recommended along any new water mains section to determine the most adequate water mains pipework.

4 ENGINEERING CONSIDERATIONS

Based on the information obtained for the Desk Study, several ground engineering considerations have been identified in relation to the development proposals.

4.1 Geomorphology

During the walk over survey, it was noted that the site area consists of large undulations, which generally dip between 5 and 10° to the north and 5° to the west. Based on this, it is assumed that retaining structures are therefore needed for the development proposals.

4.2 Geological Setting

Published geological information from the British Geological Survey (1:625,000 scale Solid Geological Map) indicates that the solid geology beneath the site comprises the Lias Group. The Lias Group is recognized as having many engineering hazards, these include; containing the clay mineral smectite, which is prone to swelling and shrinking. The smectite content of the Lias Group is variable; however overall has a 'medium' volume change potential rating, with some formations having a 'high' rating. Additionally, the Lias Group are known to contain evaporates, which are linked to collapsible soils.

4.3 Excavations

Based on the information obtained from the Desk Study, it is envisaged that there will be no issues with excavating the materials underlying the site area; however the depth to the founding strata is unknown, as well as the weathering profile.

Temporary dewatering and ground water control measures may be required. The ground water level will be investigated as part of the ground investigation to aid groundwater control.

Modification and diversion of any existing services on the site (telegraph poles which trend east-west and north-south which connect to the train station and residential housing, north and south of the site area) will be necessary for the permanent works.

4.4 Buried Concrete

The Lias Group is recognized as having a high sulphate content, which is responsible for high levels of thaumasite concrete attack. The materials underlying the site area should be tested in order to gain a better understanding of the sulphate levels.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 General

The review of the historic maps indicates that the site comprises undeveloped open fields from at least the 1990s. The layout of the hedges has changed over the years and farm buildings (Hillcrest Farm) developed on the southern boundary during the 1930s.

The land surrounding the site was originally open fields and the town of Ansford from at least the 1880s. Throughout the 1900s, Ansford and Castle Cary underwent gradual expansion, with residential areas eventually surrounding the site to the south-east. Infrastructure was also advanced to support the expansion, including the development of many roads, bridges and railway lines. The surrounding area has also encompassed churches, schools and residential housing located >500m from the site boundary.

The site is located within an area where less than 1% of homes are above the action level. Radon protective measures are not required.

The following are general recommendations:

- Adequate precautions and appropriate personal hygiene and safety protocols should be employed by all construction workers on site at all times.
- Guidance on the selection of materials for water supply pipes can be sought from the UK Water Industry Research (UKWIR) publication “PE Pipes for Contaminated Land”, 2010.
- Regular inspections should be carried out by ground workers during any excavation work, and advice should be sought in the event that unexpected ground conditions are encountered. Should any visual or olfactory signs of contamination be found during construction works, soils should be tested and assessed.
- Should testing and assessment identify areas of unacceptable risk, appropriate remedial measures would need to be implemented. A detailed remediation strategy should be prepared, any remedial works and associated clean-up levels would need to be discussed with and approved by the Regulatory Authorities. Additionally, a Validation Statement would need to be prepared upon completion of any remedial works, detailing the works undertaken and the results of the associated validation testing. It is emphasised that such works are unlikely to be necessary on the basis of the assessments undertaken.