

10 Geology, Hydrogeology, Ground Conditions and Contamination (including UXO)

Introduction

- 10.1 This chapter appraises the likelihood of impacts on the geological and hydrogeological resources underlying the site, taking into account the existing ground conditions and potential for contamination (including unexploded ordnance (UXO) contamination) from the proposed FAB Link HVDC converter station development near Exeter Airport. This chapter draws on relevant guidance and consultation to inform the appraisal and sets out the proposed measures to mitigate any potential adverse impacts.
- 10.2 Whilst the focus of the chapter is on the site of the proposed converter station, consideration has been given to the temporary lay down area to the immediate west.

Assessment Methodology

Policy and Relevant Guidance

National Planning Policy

- 10.3 The National Planning Policy Framework (NPPF) (DCLG, 2012) together with the National Planning Practice Guidance set out the government's national planning policies and guidance for new development. With regard to contaminated land, the NPPF states that planning policies and decisions should ensure that the site is suitable for its new use taking account of ground conditions, including pollution arising from previous uses and proposed mitigation.

Legislation

- 10.4 The list below sets out the main legislative drivers for managing risks to human health and the environment from land contamination:
- Part IIA of the Environmental Protection Act (EPA) (1990);
 - Environment Act (1995);
 - Contaminated Land (England) Regulations (2006);
 - Groundwater Regulations (2008), which transpose the EC Groundwater Directive 80/68/EC into UK law;
 - Groundwater (England and Wales) Regulations (2009);
 - Water Environment (Water Framework Directive) (England and Wales) Regulations (2003), which transpose the Water Directive 2000/60/EC into UK law;
 - Environmental Permitting (England and Wales) Regulations (2010) as amended; and
 - Environmental Liability Directive (2004/35/EC).

10.5 Under Part IIA of the EPA, sites are identified as 'contaminated land' if they are causing or if there is a significant possibility of causing significant harm to human health or significant pollution of controlled waters. 'Controlled waters' are defined in Section 104 of the Water Resources Act (1991) as including both inland freshwaters (e.g. lakes, ponds, rivers) and groundwaters (i.e. any waters contained in underground strata).

Guidance

10.6 The assessment also has regard to the following relevant guidance:

- Environmental Protection Act 1990: Part 2 A Contaminated Land Statutory Guidance (Defra, 2012);
- British Standards BS 10175 (2011) Investigation of Potentially Contaminated Sites;
- Contaminated Land Report 11 (CLR11) (Environment Agency, 2004); and
- Groundwater Protection: Principles and Practice (GP3) (Environment Agency, 2012).

Consultation

10.7 No consultation with stakeholders or consultees has been undertaken in respect of geology, hydrogeology or ground conditions. An Envirocheck report was obtained for the site from Landmark (2016), which contains data from databases operated by the Environment Agency, British Geological Survey and East Devon District Council.

Methodology

10.8 The assessment of baseline conditions and contamination risks follows a 2 stage process (Phase 1 and 2). A Phase 1 assessment comprises a historical research element - a Desk Top Study (DTS) and a first-pass conceptual model of risk - a Preliminary Risk Assessment (PRA). The PRA is based on the Source-Pathway-Receptor principles (see below). Phase 2 would comprise Intrusive Investigations and an Interpretive Investigation Report (also incorporating the findings of the DTS and PRA). However, where risks are found to be low at Phase 1 (as is the case here), the second phase can be avoided.

10.9 The DTS and PRA are used establish the site sensitivity, ground conditions (including ground stability issues) and potential contaminated land issues at the site and reflect the requirements of the relevant parts of the Model Procedures for the Management of Land Contamination (CLR11) and the National Planning Policy Framework (NPPF) mentioned above.

10.10 The DTS and PRA for the converter station site have included the following elements:

- The purchase of a 'GroundSure' report;
- Review of historical maps of the site and surrounding area to determine the likelihood of historical contamination to be present in soils and groundwater;

- Review of available information including geology, hydrogeology and hydrology to provide an understanding of the environmental setting of the site;
- Review of environmental databases to further characterise the environmental setting of the site, including the assessment of any nearby pollution incidents, environmental permitting, IPC sites and waste handling / disposal sites;
- Review of Environment Agency (EA) and the Local Authority (LA) records to identify if the site has been the subject to any reported pollution incidents;
- Review of local authority planning records for adjacent developments and associated technical reports to refine the understanding of ground conditions and associated geotechnical parameters; and
- A site walkover visit to identify and photograph any visual evidence of potential contaminant sources and identify key site features.

10.11 The assessment reported in this chapter has determined that the DTS and PRA are sufficient to characterise the risks of contamination on site and therefore a Phase 2 survey and report would be unnecessary.

10.12 As stated above, the methodology for the assessment of baseline conditions and contamination at the site follows the phased approach presented in CLR 11 (EA, 2004). The baseline characterisation of the site is used to develop a Conceptual Site Model (CSM), which identifies the existing ground conditions using the source-pathway-receptor pollutant linkage approach:

- Source: potential contaminant sources;
- Pathway: the mechanism by which the source may affect a receptor; and
- Receptor: identified features that may be affected, based on the sensitivity of the site.

10.13 The assessment considers the potential risk to environmental receptors and the pathways by which the receptors may be affected. This includes an evaluation of the probability of harm occurring, taking into account potential sources of contamination and receptors that may be affected by such contamination.

10.14 A separate assessment of risks posed by Unexploded Ordnance (UXO) has been carried out for the site which is reported as Appendix 10.1. The risks posed to humans during construction from undiscovered UXO are not discussed further in this chapter.

Limitations of the Assessment

10.15 It has not been necessary to undertake a site visit and ground truthing of the desk-based information has been made from photographs and observation notes taken by a member of the Environment Reporting team.

- 10.16 Given the historical and current uses across the majority of the site, there are not considered to be any widespread contamination sources. Therefore, there are no data limitations that would affect the conclusions of this assessment.

Assessment of Construction Impacts

Baseline Conditions

Published Geological Information

- 10.17 British Geological Survey (BGS) data (1:50,000) shows that the site is directly underlain by Aylesbeare Mudstone Group. No superficial deposits are present, however the geological maps identify several small areas of Made Ground in the local area including a small area on the site close to the site's western boundary and also, in the area of the proposed temporary compound.
- 10.18 Aylesbeare Mudstone Group comprises reddish-brown silty mudstone and clayey siltstone with local occurrences of clayey fine-grained sandstone. In the Exeter area, the mudstone is approximately 400 metres (m) in thickness and is typically underlain by the Exmouth Mudstone and Sandstone Formation.

Hydrogeology

- 10.19 The underlying bedrock is classified as a Secondary B aquifer, which comprise predominantly low permeability layers which may store and yield limited amounts of groundwater from localised features such as fissures and thin permeable horizons.
- 10.20 Groundwater Source Protection Zones (SPZs) are defined by the Environment Agency around areas where groundwater is abstracted to provide potable water supplies. The SPZs are used to monitor the risk of contamination to groundwater from potentially polluting activities and the accidental release of pollutants. There are no SPZs within 2 kilometres (km) of the site.

Groundwater Abstractions

- 10.21 Environment Agency records show there are four licensed groundwater abstractions within 1 km of the site, all of which are used for general agricultural purposes. The closest of the abstractions is located approximately 360 m north east of the site.

Discharge Consents

- 10.22 The closest discharge consent to the site is located approximately 300 m to the west and relates to the discharge of final/treated effluent to a drain leading to the River Clyst.

Site History

- 10.23 Historical Ordnance Survey (OS) maps dating back from 1889 to 2016 have been reviewed as part of the assessment (available in Appendix 10.2).
- 10.24 Historical maps indicate that the site has predominantly been used for agriculture comprising a large single field with a pond close to the western boundary. There are other ponds in the vicinity of the site to the north, south and west. The southern boundary of the site is delineated by a road and a spring was shown on the northern boundary (1969 edition map only). From the 1991 map edition onwards, the pond on the site and those in the immediate vicinity are no longer shown.

They are likely to have been infilled and this corresponds with the Landmark map, which identifies these areas as “potentially infilled land (water)”. The BGS maps also show these areas to comprise “Made Ground”.

- 10.25 The area surrounding the site also comprises predominantly agricultural land. A depot (formerly the Devon River Authority Depot) is located approximately 80 m to the west and was first shown on the 1962 OS map edition, which identifies a number of unlabelled buildings in the east of the depot. By 1971, most of these buildings had been cleared and replaced by a smaller building in the eastern corner and a water tower. By 1991, the water tower had been cleared and the site was occupied by larger buildings in the east, centre and north west. These buildings are still shown on the 2016 map edition and are used as a depot by the Environment Agency and industrial units by a signage company.
- 10.26 Further industrial units and residential units are located approximately 180 m west. Higher Southwood Farm is located 200 m to the north east and the boundary of Exeter Airport is located approximately 300 m north west.

Radon

- 10.27 According to the Envirocheck Report (Landmark, 2016), the site is located in a lower probability radon area (classified on the basis that less than 1% of homes are above the radon Action Level of 200 becquerels per cubic metre (Bq m^{-3}) averaged over a year).

Waste Sites

- 10.28 There are no licensed operational waste management facilities within 1 km of the site. Environment Agency records identify a former waste transfer station was located approximately 215 m west of the site, however the licence was revoked in August 2010.

Pollution Incidents

- 10.29 A number of pollution incidents were reported in the mid-1990s, however none of incidents directly related to the site. The closest reported pollution incident to the site occurred at a farm approximately 190 m north east and involved the discharge of animal waste into a stream as a result of poor operational practice. The incident was classified as ‘minor’.

Designated Sites

- 10.30 There are no Sites of Special Scientific Interest (SSSI) or other ecological, geological or archaeological designations on the site or within the immediate vicinity. The site is located within a Nitrate Vulnerable Zone (NVZ), i.e. land which drains to and contributes to surface and groundwater that contains at least 50 milligrams per litre (mg/l) of nitrate.

Preliminary Environmental Risk Assessment

Preliminary Conceptual Site Model

- 10.31 A preliminary Conceptual Site Model (CSM) has been developed using the baseline information to identify the potential contaminant sources, pathways and receptors (i.e. potential pollutant linkages) on the site. The CSM is described below.

Source - On Site

- 10.32 The site has been used for agricultural purposes since at least the late 19th century and comprises a large open field. Historic maps identified ponds in the west of the site close to the site boundary, and on the proposed compound area which have been infilled (Appendix 10.2). The nature and source of the material used to infill the ponds is unknown and therefore, may contain elevated levels of contaminants.

Source - Off Site

- 10.33 The surrounding land use is predominantly agricultural with the main potential for contaminants to be located in and around farm buildings (for example, storage and maintenance of farm vehicles, fuel storage, pesticide stores, animal sheds and slurry stores). The closest farm is located approximately 200 m north east.
- 10.34 A depot is located approximately 80 m to the west (and adjacent to the proposed compound), which was formerly occupied by Devon Rivers Authority and now by the Environment Agency. There is no information available on the activities undertaken at the depot, however there is the potential for oils, chemicals and possibly fuel to have been stored/used. Similarly, oils and chemicals may also be stored/used in the industrial units further to the west. However, given the size and use of the industrial units the amounts of oils and chemicals are likely to be relatively small.
- 10.35 A number of infilled ponds are also located in the vicinity of the site and there is the potential for localised contamination as a result of the infill material.

Pathways

- 10.36 The direct ingestion and dermal contact pathways would be active across the site for construction workers. However, the pathways would be inactive for the future users of the site, where buildings and hardstanding cover are proposed.
- 10.37 There are no surface watercourses on the site that could act as a pathway. The underlying Aylesbeare Mudstone Group has a predominantly low permeability and the leaching of any potential contaminants would be limited.

Receptors

- 10.38 The receptors identified in the CSM are listed below:
- construction workers,
 - future users; and
 - Secondary B aquifer associated with the Aylesbeare Mudstone Group.

Preliminary Risk Assessment

- 10.39 The table below presents an assessment of the potential risks with respect to contaminated land issues and the receptor group based on the intended development of the site. The assessment

uses the CIRIA C552 criteria (Rudland *et al.*, 2001) to define the level of risk based on the classification of probability and consequence of occurrence (available in Appendix 10.3).

Table 10.1 Preliminary Risk Assessment

Receptor	Probability of Exposure	Consequence of Exposure	Risk	Key Potential Contamination Linkages
Human Health				
Construction workers	Unlikely (Low likelihood in area of former pond)	Mild	Very low risk (low risk in area of former pond)	None identified. Minor risk from localised contamination associated with infilling of former ponds.
Future users	Unlikely	Minor	Very low risk	None identified.
Controlled Waters				
Secondary B Aquifer	Unlikely	Minor	Very low risk	None identified..

Construction Impacts

Disturbance to the Secondary B Aquifer

- 10.40 Construction of the proposed converter station requires levelling the site and the excavation of the foundations for the building and equipment. The Secondary B aquifer (in the form of the Aylesbeare Mudstone Group) is unlikely to be impacted in terms of disturbance given that the aquifer is not an important groundwater resource and does not support any abstractions on site or in the immediate vicinity.

Contamination of the Secondary B Aquifer

- 10.41 The potential for significant widespread contamination on the site as a result of former land uses is considered to be low, therefore there is unlikely to be an impact in terms of mobilising existing contaminants during construction. Elevated levels of contaminants may be encountered in the vicinity of the infilled pond due to the unknown source and nature of the infill material. Geotechnical testing undertaken during detailed design will characterise ground conditions and identify if further soil analysis is required.
- 10.42 Localised contamination of the soil and possibly groundwater (where permeable layers of the Secondary B Aquifer are present) may occur during construction as a result of leaks or spills of fuels, oils and chemicals. The potential for contamination to occur will be reduced by implementing the pollution control mitigation measures as set out later in this section.

Assessment of Operational Impacts

- 10.43 Routine maintenance of the converter station is likely to require the use of oils and chemicals. There is the potential for spillages to occur which could cause localised soil and possibly groundwater contamination (where permeable layers of the Secondary B aquifer are present).

The impact will be reduced by following good practice in the storage, use and disposal of oils and chemicals, and by following the recommended mitigation measures below. There is also the potential for leakages of oil to occur from the transformers, however the drainage design of the converter station will include oil interceptor tanks to ensure that any oil lost from a transformer is prevented from entering the storm water discharge system.

Proposed Mitigation Measures

10.44 The following mitigation measures are proposed:

- Store oil in accordance with The Control of Pollution (Oil Storage) (England) Regulations 2001.
- Implement measures to prevent and control the spillage of oil, chemicals and other potentially harmful liquids. For example, provide a designated storage area with impervious hardstanding and an oil interceptor; provide secondary containment system that can hold at least 110% of the oil volume stored; locate the storage area away from springs, wells or borehole and areas at risk of flooding.
- Refuel machinery in designated areas only.
- Undertake routine checks of machinery, tanks and pipework.
- Provide appropriate spill kits on the construction site and laydown areas and train staff in their use.
- The results of the Preliminary Risk Assessment and the desk study indicate that the risk of pollution linkages existing on the site is low to very low. Further information is not needed to clarify elements of potential pollution linkages and therefore, an intrusive investigation for contamination purposes is not considered necessary.
- Inform construction workers of the location of the infilled pond and the potential for localised contamination. Provide training on the olfactory and visual signs to be aware of and the procedure to follow if contamination is suspected.
- The UXO risk assessment report at Appendix 10.1 should be referred to for specific advice regarding mitigation of risks to humans during construction of the converter station.

Future Monitoring

10.45 No future monitoring is considered necessary.

Summary

10.46 The site comprises open land which has been used for agricultural purposes. The potential for widespread contamination to have occurred as a result of this use is considered to be low. The site is underlain by the Aylesbeare Mudstone Group which is categorised as a Secondary B aquifer and is not considered to be a sensitive groundwater resource. Disturbance of the aquifer

and mobilisation of existing contaminants during construction is considered unlikely to occur given the former land use and the characteristics of the underlying aquifer.

- 10.47 The likelihood for localised soil contamination and groundwater to occur during construction and operation as a result of spillages and leaks would be low following the implementation of good practice and the recommended mitigation measures.

References

British Standard BS 10175 (2011) Investigation of Potentially Contaminated Sites

Department for Environment, Food and Rural Affairs (Defra) (2012) Environmental Protection Act 1990: Part 2A- Contaminated land Statutory Guidance

Department for Communities and Local Government (DCLG) (2012) National Planning Policy Framework.

Environment Agency (2012) Groundwater Protection: Principles and Practice (GP3)

Environment Agency (2004) Contaminated Land Report 11

Landmark (2016) Envirocheck Report (87562931)

Rudland, D.J., Lancefield, R.M. & Mayell, P.N. (2001) CIRIA Report C552, Contaminated Land Risk Assessment, A Guide to Good Practice. London, January 2001.