



High Speed Rail (West Midlands - Crewe)

Environmental Statement

Volume 5: Technical appendices

CA3: Stone and Swynnerton

Land quality report (LQ-001-003)



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Department for Transport

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1 Introduction

1.1.1 This document is an appendix to the land quality assessment for the Stone and Swynnerton study community area (CA3), it comprises:

- a summary of engagement undertaken (Section 2);
- detailed risk assessment (Section 3);
- geological sites of special scientific interest (SSSI) and local geological sites (Section 4); and
- mining and minerals data (Section 5).

1.1.2 Maps referred to throughout this land quality Appendix are contained in the Volume 5 Land Quality Map Book (map references LQ-01-109b to LQ-01-113a).

2 Engagement

2.1.1 Table 1 sets out the local authorities and other organisations that have been engaged with during the preparation of the land quality section of the Environmental Statement for the Stone and Swynnerton area, the types of information that have been provided to the assessment team and any specific concerns of those engaged with.

Table 1: Engagement on land quality issues undertaken for the Stone and Swynnerton area

Local authority or other organisation	Method/ dates of contact	Information provided and/or specific concerns
British Geological Survey (BGS)	Meeting (23 February 2016)	A meeting was held to discuss technical geological issues affecting the Proposed Scheme, including aquifer information (groundwater chemistry and vulnerability) and mineral resources.
Staffordshire County Council (SCC)	Meeting (23 March 2016)	SCC provided access to their library of ground investigation and contamination surveys. Reports on sites in the vicinity of the Proposed Scheme were reviewed and information within them used in the land quality assessment. Provided information on the then emerging Minerals Local Plan and progress towards its adoption.
Stafford Borough Council (SBC)	Meeting (14 April 2016)	SBC provided a list of recorded burial and pyre sites relating to the 2001 foot and mouth disease (FMD) outbreak.
Environment Agency	Meeting (10 May 2016)	The Environment Agency provided information relating to recorded historical landfill sites within the study area and confirmed there were no SSSI (as defined in Part 2A of the Environmental Protection Act (1990) within the study area. Water abstractions and groundwater resource sensitivity was discussed in relation to the Proposed Scheme.
Food and Environment Research Agency (FERA)	Meeting (16 May 2016)	FERA provided information on the nature and location of foot and mouth disease (FMD) burial and pyre sites relating to the 2001 outbreak within the study area.

3 Detailed risk assessment

- 3.1.1 This section presents assessments for the higher risk potentially contaminated sites within the study area. For each site the following data is presented:
- baseline risk assessment;
 - construction risk assessment;
 - post-construction risk assessment; and
 - assessment of temporary (construction) and permanent (post-construction) effects.
- 3.1.2 A two stage screening process, stage A and stage B, has been carried out in accordance with the methodology set out in the Scope and Methodology Report (SMR) and its Addendum which are set out in Volume 5: Appendix CT-001-001 and CT-001-002. The SMR Addendum contains the Land Quality Technical Note: Detailed methodology for contaminated land assessment.
- 3.1.3 At each of the above stages professional judgement has been used to check that the screening system is highlighting the most significant sites.
- 3.1.4 For those sites which pass through stage B, a further two stage (stages C and D) detailed risk assessment has been carried out in accordance with the methodology set out in the SMR.
- 3.1.5 The results of stage C are presented in three conceptual site models (CSM) as qualitative risk assessments (baseline, construction and post-construction). The construction and post-construction risk assessments assume that appropriate mitigation has been undertaken and that the operation of the railway is in accordance with environmental legislation.
- 3.1.6 Where nearby sites present a similar contamination risk, they may be grouped and considered together. This may be the case in the more urban areas where, for example, a light industrial estate may be considered as one site, rather than a number of individual sites. Similarly, in rural areas, small historical backfilled ponds and pits might be grouped together.
- 3.1.7 Where sites have been grouped together, only one CSM is prepared for the grouped sites.
- 3.1.8 The sites assessed in this study area are set out in Table 2. The site reference is the unique identifying number for the site, shown on the Volume 5, Land Quality Map Book.

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Table 2: Sites included in the detailed risk assessment within the Stone and Swynnerton area

Site reference	Name
3-50	Near Micklow House Historical Landfill
3-70	Existing railway (Norton Bridge to Stone Railway)
3-118	Historical gasworks Swynnerton
3-123 and 3-124	Common Lane Cold War bunkers and historical tank
3-130	Existing railway (West Coast Main Line (WCML))
3-138	Former Stableford garage / petrol filling station
3-107 and 3-120	Infilled pits and ponds
3-165	Home Farm Historical Landfill

3.1.9 Contaminant types included within the risk assessments are based on the Department of the Environment, Farming and Rural Affairs (DEFRA) and Environment Agency (2002); Priority Contaminants Report CLR 8¹. Although this report has been withdrawn by the Environment Agency, there is no authoritative document to replace it.

3.1.10 The remainder of this section presents the risk assessment for the sites going through to stage C and D of the assessment. These sites are shown on Maps LQ-01-109b to LQ-01-113a, (Volume 5, Land Quality Map Book).

3.1.11 The following abbreviation is used in these tables:

- PCB – polychlorinated biphenyls; and
- PAH – polycyclic aromatic hydrocarbon.

¹ Department for Environment, Food and Rural Affairs and Environment Agency (2002), *Potential Contaminants for the Assessment of Land*. R&D Publication CLR8

3.1 Baseline risk assessment

Table 3: 3-50 Near Micklow House Historical Landfill - site baseline CSM and qualitative risk assessment

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
<p>Soil, leachate, ground gas and groundwater contamination from the historical landfill</p> <p>There is the potential for a range of organic and inorganic contaminants including but not limited to heavy metals, ammonia, ground gases (methane, carbon dioxide) and organics such as PAH</p>	On-site users Agricultural workers	Direct contact, ingestion of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
		Inhalation of ground gases	Low likelihood	Medium	Moderate/low
	Off-site users Residential/farming	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of ground gases	Low likelihood	Medium	Moderate/low
	Controlled waters – groundwater Secondary B bedrock aquifer	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Minor	Low
	Controlled waters - surface water Unnamed body of water (approximately 100m from site)	Lateral migration through groundwater Direct run-off from site	Unlikely	Minor	Very low
	Property receptors – buildings, foundations and services (off-site)	Exposure to explosive gases	Low	Severe	Moderate
Direct contact with contaminated soils and waters		Unlikely	Medium	Low	

Description

The main characteristics of this site are:

- near Micklow House Historical Landfill is located south of Eccleshall Road. It is located within the area required for construction;
 - superficial deposits are absent in this area, and the underlying bedrock is classified as a Secondary B aquifer;
 - the site is not located in a groundwater source protection zone; and
 - there are no sensitive receptors within 10m of the site.
-

Table 4: 3-70 Existing railway (Norton Bridge to Stone Railway) - site baseline CSM and qualitative risk assessment

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
<p>Soil, leachate, and groundwater contamination from railway running line operations</p> <p>There is the potential for a range of organic and inorganic contaminants including but not limited to PAH, creosote (containing PAH), PCBs, heavy metals, ethylene glycol, herbicides, ash and sulphate</p>	On-site users	Direct contact, ingestion of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
	Railway workers	Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
	Off-site users	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
	Estate/agricultural workers, golf course users	Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
	Controlled waters – groundwater	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Minor	Low
	Secondary A superficial aquifer				
	Secondary B bedrock aquifer	Lateral migration through groundwater	Low likelihood	Minor	Low
	Controlled waters –surface water				
Filly Brook, immediately adjacent to the existing railway	Direct run-off from site				
Property receptors – buildings, foundations and services (off-site)	Direct contact with contaminated soils and waters	Unlikely	Minor	Very low	

Description

The main characteristics of this site are:

- the existing railway (Norton Bridge to Stone Railway) is located south of Pool House Farm and runs parallel with Yarnfield Lane. It is located within the area required for construction;
 - superficial deposits are present beneath part of this site, where they are present they are classified as a Secondary A aquifer, and the underlying bedrock is classified as a Secondary B aquifer;
 - the site is not located in a groundwater source protection zone; and
 - there are sensitive receptors within 10m of the site, including housing.
-

Table 5: 3-118 Historical gasworks at Swynnerton - site baseline CSM and qualitative risk assessment

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
Soil, leachate, and groundwater contamination from historical gas works There is potential for a range of organic and inorganic contaminants	On-site users	Direct contact, ingestion of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
	Residential	Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
	Off-site users	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
	Residential	Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
	Controlled waters – groundwater Principal bedrock aquifer	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Controlled waters – surface water Unnamed pond 250m from the site	Lateral migration through groundwater Direct run-off from site	Unlikely	Minor	Very low
	Property receptors – buildings, foundations and services (off-site)	Direct contact with contaminated soils and waters	Low likelihood	Minor	Low

Description

The main characteristics of this site are:

- the historical gasworks is located west of Early Lane, Swynnerton. It is not located within the area required for construction;
 - superficial deposits are absent in this area and the underlying bedrock is classified as a Principal aquifer;
 - the site is located in a groundwater protection zone; and
 - there are sensitive receptors within 10m of the site, including housing.
-

Table 6: 3-123 Common Lane Cold War bunkers and 3-124 historical tank - site baseline CSM and qualitative risk assessment

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
<p>Historical bunkers, potentially used by the military in the past</p> <p>There is potential for a range of contaminants including but not limited to metals and metal compounds, inorganic compounds, organic contaminants (including fuels) and potential ordnance</p>	On-site users Estate/agricultural workers	Direct contact, ingestion of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
		Inhalation of ground gases	Low likelihood	Medium	Moderate/low
	Off-site users Estate/agricultural workers	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of ground gases	Low likelihood	Medium	Moderate/low
	Controlled waters – groundwater Principal bedrock aquifer Superficial unproductive geology under part of the site	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Controlled waters - surface water Unnamed drain approximately 60m from the site	Lateral migration through groundwater Direct run-off from site	Unlikely	Minor	Very low
	Property receptors – buildings, foundations and services (off-site)	Exposure to explosive gases	Unlikely	Severe	Moderate/low
		Direct contact with contaminated soils and	Unlikely	Medium	Low

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
		waters			

Description

The main characteristics of this site are:

- the Common Lane Cold War bunkers and historical tank are located to the east of Common Lane. They are partially located within the area required for construction;
 - superficial deposits are absent beneath part of this site. Where they are present they are classified as unproductive strata, and the underlying bedrock is classified as a Principal aquifer;
 - the site is located in a groundwater protection zone; and
 - there are no sensitive receptors within 10m of the site.
-

Table 7: 3-130 Existing railway (WCML) - site baseline CSM and qualitative risk assessment

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
<p>Soil, leachate, and groundwater contamination from railway running line operations</p> <p>There is potential for a range of organic and inorganic contaminants including but not limited to PAH, creosote (containing PAH), PCBs, heavy metals, ethylene glycol, herbicides, ash and sulphate</p>	On-site users Railway workers.	Direct contact, ingestion of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
	Off-site users Residential/farming	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
	Controlled waters – groundwater Principal bedrock aquifer Secondary A superficial aquifer under part of the site	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Severe	Moderate
	Controlled waters - surface water Meece Brook is adjacent to the site	Lateral migration through groundwater Direct run-off from site	Low likelihood	Minor	Low
	Property receptors – buildings, foundations and services (off-site)	Direct contact with contaminated soils and waters	Unlikely	Negligible	Very low

Description

The main characteristics of this site are:

- the WCML running lines are located at Stableford, and run beneath Stableford Bridge on the A51 Stone road. Part of this site is located within the area required for construction;
 - superficial deposits are classified as a Secondary A aquifer and the underlying bedrock is classified as a Principal aquifer;
 - the site is located in a groundwater protection zone; and
 - there are sensitive receptors within 10m of the site, including housing.
-

Table 8: 3-138 Former Stableford Garage / petrol filling station - site baseline CSM and qualitative risk assessment

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
Soil and groundwater contamination from former garage / petrol station There is potential for a range of organic contaminants (fuels, oils etc)	On-site users Commercial workers	Direct contact, ingestion of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of vapours (volatile substances)	Low likelihood	Medium	Moderate/low
	Off-site users Residential	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of vapours (volatile substances)	Unlikely	Medium	Low
	Controlled waters – groundwater Principal bedrock aquifer Secondary A superficial aquifer	Leaching, vertical and lateral migration from contaminated soils and waters	Unlikely	Medium	Low
	Controlled waters –surface water Meece Brook is 120m from the site	Lateral migration through groundwater Direct run-off from site	Unlikely	Negligible	Very low
	Property receptors – buildings, foundations and services (on and off-site)	Exposure to vapours	Unlikely	Medium	Low
		Direct contact with contaminated soils and waters	Unlikely	Negligible	Very low

Description

The main characteristics of this site are:

- the former Stableford Garage / petrol filling station is located at Stableford, to the south of Stableford Bridge. It is not located within the area required for construction;
 - superficial deposits are classified as a Secondary A aquifer and the underlying bedrock is classified as a Principal aquifer;
 - the site is located in a groundwater protection zone; and
 - there are sensitive receptors within 50m of the site, including housing.
-

Table 9: 3-107 and 3-120 infilled pits and ponds - site baseline CSM and qualitative risk assessment

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
<p>Soil, leachate, ground gas and groundwater contamination from potential historical infill</p> <p>There is potential for a range of organic and inorganic contaminants including but not limited to heavy metals, ammonia, ground gases (methane, carbon dioxide) and organics such as PAH</p>	<p>On-site users</p> <p>Agricultural workers</p>	Direct contact, ingestion of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
		Inhalation of ground gases	Low likelihood	Medium	Moderate/low
	<p>Off-site users</p> <p>Residential/farming</p>	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of ground gases	Unlikely	Medium	Low
	<p>Controlled waters – groundwater</p> <p>Principal bedrock aquifer at both sites. Unproductive superficial strata beneath Calloway Pit</p>	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	<p>Controlled waters - surface water</p>	<p>Lateral migration through groundwater</p> <p>Direct run-off from site</p>	Unlikely	Minor	Very low
	<p>Property receptors – buildings, foundations and services (off-site)</p>	Exposure to explosive gases	Unlikely	Severe	Moderate/low
		Direct contact with contaminated soils and waters	Unlikely	Medium	Low

Description

The main characteristics of this site are:

- the infilled pits and ponds are located to the north of the A51 Stone road. Cash's Pit is located within the area required for construction. Calloway Pit is not located within the area required for construction;
 - the superficial deposits beneath Calloway Pit are classified as unproductive strata and the underlying bedrock is classified as a Principal aquifer. Superficial deposits are absent beneath Cash's Pit and the underlying bedrock is classified as a Principal aquifer;
 - both sites are located in a groundwater protection zone; and
 - there are no sensitive receptors within 10m of the sites.
-

Table 10: 3-165 Home Farm Historical Landfill - site baseline CSM and qualitative risk assessment

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
<p>Soil, leachate, ground gas and groundwater contamination from historical landfill</p> <p>There is potential for a range of organic and inorganic contaminants including but not limited to heavy metals, ammonia, ground gases (methane and carbon dioxide) and organics such as PAH</p>	On-site users	Direct contact, ingestion of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
	Open space, occasional recreational users	Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
		Inhalation of ground gases	Low likelihood	Medium	Moderate/low
	Off-site users – Residential	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of vapours (volatile substances)	Unlikely	Medium	Low
	Controlled waters – groundwater Secondary B bedrock aquifer Unproductive superficial aquifer	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Minor	Low
	Controlled waters - surface water Unnamed pond approximately 55m from site Culverted stream may also be in the vicinity	Lateral migration through groundwater Direct run-off from site	Low likelihood	Minor	Low
	Property receptors –	Exposure to explosive gases	Unlikely	Severe	Moderate/low

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
	buildings, foundations and services (off-site)	Direct contact with contaminated soils and waters	Unlikely	Negligible	Very low

Description

The main characteristics of this site are:

- Home Farm Historical Landfill is located adjacent to the south of Eccleshall Road. It is not located within the area required for construction;
- superficial deposits are classified as unproductive strata, and the underlying bedrock is classified as a Secondary B aquifer;
- the site is not located in a groundwater protection zone; and
- there are sensitive receptors within 50m of the site, including housing.

3.2 Construction risk assessment

Table 11: 3-50 Near Micklow House Historical Landfill - construction CSM and qualitative risk assessment

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
<p>Soil, leachate, ground gas and groundwater contamination from the historical landfill</p> <p>There is potential for a range of organic and inorganic contaminants including but not limited to heavy metals, ammonia, ground gases (methane, carbon dioxide) and organics such as PAH</p>	On-site users Agricultural workers	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of ground gases	Unlikely	Medium	Low
	Off-site users Residential/farming	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
		Inhalation of ground gases	Low likelihood	Medium	Moderate/low
	Controlled waters – groundwater Secondary B bedrock aquifer	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Minor	Moderate/low
	Controlled waters - surface water Unnamed body approximately 100m from the site	Lateral migration through groundwater Direct run-off from site	Low likelihood	Minor	Low
	Property receptors – buildings, foundations and services (off-site)	Exposure to explosive gases	Low likelihood	Severe	Moderate

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
		Direct contact with contaminated soils and waters	Low likelihood	Medium	Moderate/low

Description

Notes/assumptions

- Micklow House Historical Landfill is located within the area required for construction and as such there is a potential for ground disturbance and requirement for remediation during the construction phase;
- during construction standard mitigation procedures are assumed to be implemented in accordance with the draft Code of Construction Practice² (CoCP). Construction workers have been excluded from assessment due to the use of personal protective equipment (PPE)/risk management protocols and in accordance with the Land quality Technical Note in the SMR Addendum (Volume 5: Appendix CT-001-002);
- whilst the draft CoCP will make it unlikely that there will be adverse consequences associated with construction e.g. the control of surface runoff and dust, it is considered that there may still be temporary minor adverse effects during the construction period from ground disturbance in these areas. The adoption of the draft CoCP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline;
- historical infill exists without any lining, impermeable capping. Ground (landfill) gas or leachate control systems will be put in place; and
- dewatering during construction could draw contamination into the groundwater, causing a temporary worsening in groundwater quality compared to baseline.

² Draft Code of Construction Practice, Volume 5: Appendix CT-003-000

Table 12: 3-70 Existing railway (Norton Bridge to Stone Railway) - construction CSM and qualitative risk assessment

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
<p>Soil, leachate, and groundwater contamination from railway running line operations</p> <p>There is the potential for a range of organic and inorganic contaminants including but not limited to PAHs, creosote (containing PAH), PCBs, heavy metals, ethylene glycol, herbicides, ash and sulphate</p>	On-site users	Direct contact, ingestion of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
	Railway workers	Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
	Off-site users	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
	Estate/agricultural workers, golf course users	Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
	Controlled waters – groundwater	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Minor	Moderate/low
	Secondary A superficial aquifer				
	Secondary B bedrock aquifer				
	Controlled waters –surface water	Lateral migration through groundwater	Likely	Minor	Moderate/low
Filly Brook immediately adjacent to the existing railway	Direct run-off from site				
Property receptors – buildings, foundations and services (off-site)	Direct contact with contaminated soils and waters	Low likelihood	Minor	Low	

Description

Notes/assumptions

- portions of the existing railway (Norton Bridge to Stone) are located within the area required for construction and as such there is a potential for ground disturbance and requirement for remediation during the construction phase;
 - during construction standard mitigation procedures are assumed to be implemented in accordance with the draft CoCP. Construction workers have been excluded from assessment due to the use of PPE/risk management protocols and in accordance with the Land quality Technical Note in the SMR Addendum (Volume 5: Appendix CT-001-002);
 - whilst the draft CoCP will make it unlikely that there will be adverse consequences associated with construction e.g. the control of surface runoff and dust, it is considered that there may still be temporary minor adverse effects during the construction period from ground disturbance in these areas. The adoption of the draft CoCP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline; and
 - dewatering during construction could draw contamination into the groundwater, causing a temporary worsening in groundwater quality compared to baseline.
-

Table 13: 3-118 Historical gasworks Swynnerton - construction CSM and qualitative risk assessment

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
Soil, leachate, and groundwater contamination from historical gas works There is potential for a range of organic and inorganic contaminants	On-site users Residential	Direct contact, ingestion of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
	Off-site users Residential	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
	Controlled waters – groundwater Principal bedrock aquifer	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Medium	Moderate
	Controlled waters – surface water Unnamed pond approximately 250m from the site	Lateral migration through groundwater Direct run-off from site	Unlikely	Minor	Very low
	Property receptors – buildings, foundations and services (off-site)	Direct contact with contaminated soils and waters	Low likelihood	Minor	Low

Description

Notes/assumptions

- the historical gasworks at Swynnerton is not located within the area required for construction and as such minimal impact from construction is anticipated, including minimal requirement for remediation;
 - during construction standard mitigation procedures are assumed to be implemented in accordance with the draft CoCP. Construction workers have been excluded from assessment due to the use of PPE/risk management protocols and in accordance with the Land quality Technical Note in the SMR Addendum (Volume 5: Appendix CT-001-002); and
 - whilst the draft CoCP will make it unlikely that there will be adverse consequences associated with construction e.g. the control of surface runoff and dust, it is considered that there may still be temporary minor adverse effects during the construction period from ground disturbance in these areas. The adoption of the draft CoCP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline.
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Table 14: 3-123 Common Lane Cold War bunkers and 3-124 historical tank - construction CSM and qualitative risk assessment

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
<p>Historical bunkers, potentially used by the military in the past</p> <p>There is potential for a range of contaminants including but not limited to metals and metal compounds, inorganic compounds, organic contaminants (including fuels) and potential ordnance</p>	<p>On-site users</p> <p>Estate/agricultural workers</p>	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Likely	Medium	Moderate
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Likely	Medium	Moderate
		Inhalation of ground gases	Likely	Medium	Moderate
	<p>Off-site users</p> <p>Estate/agricultural workers</p>	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
		Inhalation of ground gases	Low likelihood	Medium	Moderate/low
	<p>Controlled waters – groundwater</p> <p>Principal bedrock aquifer. Superficial unproductive under part of the site</p>	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Medium	Moderate
	<p>Controlled waters - surface water</p> <p>Unnamed drain approximately 60m from the site</p>	<p>Lateral migration through groundwater</p> <p>Direct run-off from site</p>	Low likelihood	Minor	Low
	<p>Property receptors – buildings, foundations and services (off-site)</p>	Exposure to explosive gases	Low likelihood	Severe	Moderate
		Direct contact with contaminated soils and waters	Low likelihood	Medium	Moderate/low

Description

Notes/assumptions

- the Common Lane bunkers and historical tank are partially located within the area required for construction and as such there is a potential for ground disturbance and requirement for remediation during the construction phase;
 - during construction standard mitigation procedures are assumed to be implemented in accordance with the draft CoCP. Construction workers have been excluded from assessment due to the use of PPE/risk management protocols and in accordance with the Land quality Technical Note in the SMR Addendum (Volume 5: Appendix CT-001-002);
 - whilst the draft CoCP will make it unlikely that there will be adverse consequences associated with construction e.g. the control of surface runoff and dust, it is considered that there may still be temporary minor adverse effects during the construction period from ground disturbance in these areas. The adoption of the draft CoCP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline; and
 - dewatering during construction could draw contamination into the groundwater, causing a temporary worsening in groundwater quality compared to baseline.
-

Table 15: 3-130 Existing railway (WCML) - construction CSM and qualitative risk assessment

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
<p>Soil, leachate, and groundwater contamination from railway running line operations.</p> <p>There is potential for a range of organic and inorganic contaminants including but not limited to PAH, creosote (containing PAH), PCBs, heavy metals, ethylene glycol, herbicides, ash and sulphate</p>	On-site users	Direct contact, ingestion of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
	Railway workers	Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
	Off-site users	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
	Residential/farming	Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
	Controlled waters – groundwater	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Severe	High
	Principal bedrock aquifer				
	Secondary A superficial aquifer under part of the site				
	Controlled waters - surface water	Lateral migration through groundwater	Likely	Minor	Moderate/low
Meece Brook adjacent to the site	Direct run-off from site				
Property receptors – buildings, foundations and services (off-site)	Direct contact with contaminated soils and waters	Unlikely	Negligible	Very low	

Description

Notes/assumptions

- portions of the existing railway (WCML) are located within the area required for construction and as such there is a potential for ground disturbance and requirement for remediation during the construction phase;
 - during construction standard mitigation procedures are assumed to be implemented in accordance with the draft CoCP. Construction workers have been excluded from assessment due to the use of PPE/risk management protocols and in accordance with the Land quality Technical Note in the SMR Addendum (Volume 5: Appendix CT-001-002);
 - whilst the draft CoCP will make it unlikely that there will be adverse consequences associated with construction e.g. the control of surface runoff and dust, it is considered that there may still be temporary minor adverse effects during the construction period from ground disturbance in these areas. The adoption of the draft CoCP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline; and
 - dewatering during construction could draw contamination into the groundwater, causing a temporary worsening in groundwater quality compared to baseline.
-

Table 16: 3-138 Former Stableford Garage / petrol filling station - construction CSM and qualitative risk assessment

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
Soil and groundwater contamination from former garage / petrol station There is potential for a range of organic contaminants (fuels, oils)	On-site users Commercial workers	Direct contact, ingestion of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of vapours (volatile substances)	Low likelihood	Medium	Moderate/low
	Off-site users Residential	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of vapours (volatile substances)	Unlikely	Medium	Low
	Controlled waters – groundwater Principal bedrock aquifer Secondary A superficial aquifer	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Controlled waters –surface water Meece Brook is approximately 120m from the site	Lateral migration through groundwater Direct run-off from site	Unlikely	Negligible	Very low
	Property receptors – buildings, foundations and services (on and off-site)	Exposure to vapours	Unlikely	Medium	Low
Direct contact with contaminated soils and waters		Unlikely	Negligible	Very low	

Description

Notes/assumptions

- the former Stableford Garage / petrol filling station is not located within the area required for construction so minimal impact from construction is anticipated, including minimal requirement for remediation;
 - during construction standard mitigation procedures are assumed to be implemented in accordance with the draft CoCP. Construction workers have been excluded from assessment due to the use of PPE/risk management protocols and in accordance with the Land quality Technical Note in the SMR Addendum (Volume 5: Appendix CT-001-002);
 - whilst the draft CoCP will make it unlikely that there will be adverse consequences associated with construction e.g. the control of surface runoff and dust, it is considered that there may still be temporary minor adverse effects during the construction period from ground disturbance in these areas. The adoption of the draft CoCP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline;
 - dewatering during construction could draw contamination into the groundwater, causing a temporary worsening in groundwater quality compared to baseline; and
 - the site is no longer in use as a garage, therefore source term is assumed to be finite and declining.
-

Table 17: 3-107 and 3-120 infilled pits and ponds - construction CSM and qualitative risk assessment

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
<p>Soil, leachate, ground gas and groundwater contamination from potential historical infill</p> <p>There is potential for a range of organic and inorganic contaminants including but not limited to heavy metals, ammonia, ground gases (methane, carbon dioxide) and organics such as PAH</p>	On-site users Agricultural workers	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of ground gases	Unlikely	Medium	Low
	Off-site users Residential/farming	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
		Inhalation of ground gases	Low likelihood	Medium	Moderate/low
	Controlled waters – groundwater Principal bedrock aquifer beneath both sites Unproductive strata associated with superficial deposits beneath Calloway Pit	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Medium	Moderate
	Controlled waters - surface waters	Lateral migration through groundwater Direct run-off from site	Low likelihood	Minor	Low
	Property receptors – buildings, foundations and services (off-site)	Exposure to explosive gases	Low likelihood	Severe	Moderate
Direct contact with contaminated soils and waters		Low likelihood	Medium	Moderate/low	

Description

Notes/assumptions

- Cash's Pit is located within the area required for construction and as such there is a potential for ground disturbance and requirement for remediation during the construction phase. Calloway's Pit is not located within the area required for construction so minimal impact from construction is anticipated, including minimal requirement for remediation;
 - during construction standard mitigation procedures are assumed to be implemented in accordance with the draft CoCP. Construction workers have been excluded from assessment due to the use of PPE/risk management protocols and in accordance with the Land quality Technical Note in the SMR Addendum (Volume 5: Appendix CT-001-002);
 - whilst the draft CoCP will make it unlikely that there will be adverse consequences associated with construction e.g. the control of surface runoff and dust, it is considered that there may still be temporary minor adverse effects during the construction period from ground disturbance in these areas. The adoption of the draft CoCP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline;
 - assumed that historical infill exists without any lining, impermeable capping. Ground (landfill) gas or leachate control systems will be put in place; and
 - dewatering during construction could draw contamination into the groundwater, causing a temporary worsening in groundwater quality compared to baseline.
-

Table 18: 3-165 Home Farm Historical Landfill - construction CSM and qualitative risk assessment

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
<p>Soil, leachate, ground gas and groundwater contamination from historical landfill</p> <p>There is potential for a range of organic and inorganic contaminants including but not limited to heavy metals, ammonia, ground gases (methane and carbon dioxide) and organics such as PAH</p>	On-site users	Direct contact, ingestion of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
	Open space, occasional recreational users	Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
		Inhalation of ground gases	Low likelihood	Medium	Moderate/low
	Off-site users Residential	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of vapours (volatile substances)	Low likelihood	Medium	Moderate/low
	Controlled waters – groundwater Secondary B bedrock aquifer Unproductive strata associated with superficial geology	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Minor	Low
	Controlled waters - surface water Unnamed pond approximately 55m from the site Potential for a culverted stream to be in the vicinity	Lateral migration through groundwater Direct run-off from site	Low likelihood	Minor	Low
	Property receptors – buildings, foundations and services (off-site)	Exposure to explosive gases	Low likelihood	Severe	Moderate
		Direct contact with contaminated soils and	Unlikely	Negligible	Very low

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
		waters			

Description

Notes/assumptions

- assumes Home Farm Historical Landfill is not located within the area required for construction so minimal impact from construction is anticipated, including minimal requirement for remediation;
- during construction standard mitigation procedures are assumed to be implemented in accordance with the draft CoCP. Construction workers have been excluded from assessment due to the use of PPE/risk management protocols and in accordance with the Land quality Technical Note in the SMR Addendum (Volume 5: Appendix CT-001-002);
- whilst the draft CoCP will make it unlikely that there will be adverse consequences associated with construction e.g. the control of surface runoff and dust, it is considered that there may still be temporary minor adverse effects during the construction period from ground disturbance in these areas. The adoption of the draft CoCP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline;
- assumes historical infill exists without any lining, impermeable capping. Ground (landfill) gas or leachate control systems will be put in place; and
- dewatering during construction could draw contamination into the groundwater, causing a temporary worsening in groundwater quality compared to baseline.

3.3 Post-construction risk assessment

Table 19: 3-50 Near Micklow House historical landfill site - post-construction CSM and qualitative risk assessment

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
Soil, leachate, ground gas and groundwater contamination from historical landfills Potential for a range of organic and inorganic contaminants including but not limited to heavy metals, ammonia, ground gases (methane, carbon dioxide) and organics such as PAH	On-site users Agricultural workers	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of ground gases	Unlikely	Medium	Low
	Off-site users Residential/farming	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of ground gases	Unlikely	Medium	Low
	Controlled waters – groundwater Secondary B bedrock aquifer associated with the MMG	Leaching, vertical and lateral migration from contaminated soils and waters	Unlikely	Minor	Very low
	Controlled waters - surface water Unnamed body approximately 100m distance From the site	Lateral migration through groundwater Direct run-off from site	Unlikely	Minor	Very low
	Property receptors – buildings, foundations and services (off-site)	Exposure to explosive gases	Unlikely	Severe	Moderate/low
		Direct contact with contaminated soils and	Unlikely	Medium	Low

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
		waters			

Description

Notes/assumptions

- assumes any identified contaminated material encountered will be removed during construction; and
- 'on-site users' excludes rail passengers (as whilst within trains, they will at all routine times be within a controlled environment) and maintenance workers; but includes people at stations/depots or in areas returned to public land after construction.

Table 20: 3-70 Existing railway (Norton Bridge to Stone Railway) - post-construction CSM and qualitative risk assessment

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
<p>Soil, leachate and groundwater contamination from railway running line operations</p> <p>There is potential for a range of contaminants including but not limited to PAH, creosote (containing PAH), PCBs, heavy metals, ethylene glycol, herbicides, ash and sulphate</p>	On-site users Railway workers	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
	Off-site users Estate/agricultural workers, golf course users	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
	Controlled waters – groundwater Secondary A superficial aquifer Secondary B bedrock aquifer	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Minor	Low
	Controlled waters - surface water Filly Brook, immediately adjacent to the existing railway	Lateral migration through groundwater Direct run-off from site	Low likelihood	Minor	Low
	Property receptors – buildings, foundations and services (off-site)	Direct contact with contaminated soils and waters	Unlikely	Minor	Very low

Description

Notes/assumptions

- assumes any identified contaminated material encountered will be removed during construction; and
 - 'on-site users' excludes rail passengers (as whilst within trains, they will at all routine times be within a controlled environment) and maintenance workers; but includes people at stations/depots or in areas returned to public land after construction.
-

Table 21: 3-118 Historical gasworks Swynnerton - post-construction CSM and qualitative risk assessment

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
Soil, leachate, and groundwater contamination from historical gas works There is potential for a range of organic and inorganic contaminants	On-site users	Direct contact, ingestion of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
	Residential	Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
	Off-site users	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
	Residential	Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
	Controlled waters – groundwater (Principal bedrock aquifer)	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Controlled waters - surface water Unnamed pond approximately 250m from the site	Lateral migration through groundwater Direct run-off from site	Unlikely	Minor	Very low
	Property receptors – buildings, foundations and services (off-site)	Direct contact with contaminated soils and waters	Low likelihood	Minor	Low

Description

Notes/assumptions

- assumes that the condition of the site is the same as that pre-construction, since it is not anticipated to be remediated as part of the works; and
 - 'on-site users' excludes rail passengers (as whilst within trains, they will at all routine times be within a controlled environment) and maintenance workers; but includes people at stations/depots or in areas returned to public land after construction.
-

Table 22: 3-123 Common Lane bunkers and 3-124, historical tank - post-construction CSM and qualitative risk assessment

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
<p>Historical bunkers, potentially used by the military in the past</p> <p>There is potential for a range of contaminants including but not limited to metals and metal compounds, inorganic compounds, organic contaminants (including fuels) and potential ordnance</p>	<p>On-site users</p> <p>Estate/agricultural workers</p>	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of ground gases	Unlikely	Medium	Low
	<p>Off-site users</p> <p>Estate/agricultural workers</p>	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of ground gases	Unlikely	Medium	Low
	<p>Controlled waters – groundwater</p> <p>Principal bedrock aquifer</p> <p>Superficial unproductive strata under part of the site</p>	Leaching, vertical and lateral migration from contaminated soils and waters	Unlikely	Medium	Low
	<p>Controlled waters - surface water</p> <p>Unnamed drain approximately 60m from the site</p>	<p>Lateral migration through groundwater</p> <p>Direct run-off from site</p>	Unlikely	Minor	Very low
	<p>Property receptors – buildings, foundations and services (off-site)</p>	Exposure to explosive gases	Unlikely	Severe	Moderate/low

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
		Direct contact with contaminated soils and waters	Unlikely	Medium	Low

Description

Notes/assumptions

- assumes any identified contaminated material encountered will be removed during construction; and
- 'on-site users' excludes rail passengers (as whilst within trains, they will at all routine times be within a controlled environment) and maintenance workers; but includes people at stations/depots or in areas returned to public land after construction

Table 23: 3-130 Existing Railway (WCML) - post-construction CSM and qualitative risk assessment

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
Soil, leachate, and groundwater contamination from railway running line operations Potential for a range of organic and inorganic contaminants including but not limited to PAH, creosote (containing PAH), PCBs, heavy metals, ethylene glycol, herbicides, ash and sulphate	On-site users	Direct contact, ingestion of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
	Railway workers	Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
	Off-site users	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
	Residential/farming	Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
	Controlled waters – groundwater Principal bedrock aquifer Secondary A superficial aquifer under part of the site	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Severe	Moderate
	Controlled waters - surface water Meece Brook adjacent to the site	Lateral migration through groundwater Direct run-off from site	Low likelihood	Minor	Low
	Property receptors – buildings, foundations and services (off-site).	Direct contact with contaminated soils and waters	Unlikely	Negligible	Very low

Description

Notes/assumptions

- assumes any identified contaminated material encountered will be removed during construction; and
 - 'on-site users' excludes rail passengers (as whilst within trains, they will at all routine times be within a controlled environment) and maintenance workers; but includes people at stations/depots or in areas returned to public land after construction.
-

Table 24: 3-138 Former Stableford Garage / petrol filling station - post-construction CSM and qualitative risk assessment

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
Soil and groundwater contamination from former garage / petrol station. There is potential for a range of organic contaminants (fuels, oils etc)	On-site users Commercial workers	Direct contact, ingestion of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of vapours (volatile substances)	Low likelihood	Medium	Moderate/low
	Off-site users Residential	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of vapours (volatile substances)	Unlikely	Medium	Low
	Controlled waters – groundwater Principal bedrock aquifer Secondary A superficial aquifer	Leaching, vertical and lateral migration from contaminated soils and waters	Unlikely	Medium	Low
	Controlled waters –surface water Meece Brook approximately 120m from the site	Lateral migration through groundwater Direct run-off from site	Unlikely	Negligible	Very low
	Property receptors – buildings, foundations and services (on and off-site)	Exposure to vapours	Unlikely	Medium	Low
		Direct contact with contaminated soils and waters	Unlikely	Negligible	Very low

Description

Notes/assumptions

- assumes that the condition of the site is the same as that pre-construction, since it is not anticipated to be remediated as part of the works; and
 - 'on-site users' excludes rail passengers (as whilst within trains, they will at all routine times be within a controlled environment) and maintenance workers; but includes people at stations/depots or in areas returned to public land after construction.
-

Table 25: 3-107 and 3-120 infilled pits and ponds - post-construction CSM and qualitative risk assessment

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
<p>Soil, leachate, ground gas and groundwater contamination from potential historical infill</p> <p>There is potential for a range of organic and inorganic contaminants including but not limited to heavy metals, ammonia, ground gases (methane, carbon dioxide) and organics such as PAH</p>	On-site users Agricultural	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of ground gases	Unlikely	Medium	Low
	Off-site users Residential/farming	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of ground gases	Unlikely	Medium	Low
	Controlled waters – groundwater Principal bedrock aquifer associated with both sites Unproductive strata associated with the superficial deposits beneath Calloway pit	Leaching, vertical and lateral migration from contaminated soils and waters	Unlikely	Medium	Low
	Controlled waters - surface water	Lateral migration through groundwater Direct run-off from site	Unlikely	Minor	Very low
	Property receptors – buildings, foundations and services (off-site)	Exposure to explosive gases	Unlikely	Severe	Moderate/low
		Direct contact with contaminated soils and waters	Unlikely	Medium	Low

Description

Notes/assumptions

- assumes any identified contaminated material encountered will be removed during construction. Where not in an area of construction, assumes that the condition of the site is the same as that pre-construction, since it is not anticipated to be remediated as part of the works; and
 - 'on-site users' excludes rail passengers (as whilst within trains, they will at all routine times be within a controlled environment) and maintenance workers; but includes people at stations/depots or in areas returned to public land after construction.
-

Table 26: 3-165 Home Farm Historical Landfill - post-construction CSM and qualitative risk assessment

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
<p>Soil, leachate, ground gas and groundwater contamination from historical landfill</p> <p>There is potential for a range of organic and inorganic contaminants including but not limited to heavy metals, ammonia, ground gases (methane and carbon dioxide) and organics such as PAH</p>	<p>On-site users</p> <p>Open space, occasional recreational users</p>	Direct contact, ingestion of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
		Inhalation of ground gas	Low likelihood	Medium	Moderate/low
	<p>Off-site users</p> <p>Residential</p>	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of vapours (volatile substances)	Unlikely	Medium	Low
	<p>Controlled waters – groundwater</p> <p>Secondary B bedrock aquifer</p> <p>Unproductive strata associated with superficial deposits</p>	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Minor	Low
	<p>Controlled waters - surface water</p> <p>Unnamed pond approximately 55m</p> <p>Potential culverted stream in the vicinity</p>	<p>Lateral migration through groundwater</p> <p>Direct run-off from site</p>	Low likelihood	Minor	Low

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
	Property receptors – buildings, foundations and services (off-site)	Exposure to explosive gases	Unlikely	Severe	Moderate/low
		Direct contact with contaminated soils and waters	Unlikely	Negligible	Very low

Description

Notes/assumptions

- assumes the condition of the site is the same as that pre-construction, since it is not anticipated to be remediated as part of the works; and
- 'on-site users' excludes rail passengers (as whilst within trains, they will at all routine times be within a controlled environment) and maintenance workers; but includes people at stations/depots or in areas returned to public land after construction.

3.4 Assessment of temporary (construction) and permanent (post-construction) effects

Table 27: 3-50 Near Micklow House historical landfill site - significance of effect assessment

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction significance	Post-construction significance
Exposure of on-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Moderate/low	Low	Low	Minor beneficial effect	Minor beneficial effect
Exposure of on-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Moderate/low	Low	Low	Minor beneficial effect	Minor beneficial effect
Exposure of on-site human receptors to inhalation of ground gases	Moderate/low	Low	Low	Minor beneficial effect	Minor beneficial effect
Exposure of off-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Low	Moderate/low	Low	Minor adverse effect	Neutral effect
Exposure of off-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Low	Moderate/low	Low	Minor adverse effect	Neutral effect
Exposure of off-site human receptors to inhalation of ground gases	Moderate/low	Moderate/low	Low	Neutral effect	Minor beneficial effect
Exposure of groundwater to vertical and lateral migration of contaminated groundwater/leachate	Low	Moderate/low	Very low	Minor adverse effect	Minor beneficial effect
Discharge of contaminants to surface water by lateral migration through groundwater and direct run-off from site	Very low	Low	Very low	Minor adverse effect	Neutral effect
Exposure of property to explosive gases	Moderate	Moderate	Moderate/low	Neutral effect	Minor beneficial effect
Direct contact of property with contaminants in soil and surface water/groundwater	Low	Moderate/low	Low	Minor adverse effect	Neutral effect
Main risk	Moderate	Moderate	Moderate/low		
Overall significance				Minor adverse to minor beneficial effect	Neutral to minor beneficial effect

Table 28: 3-70 Existing railway (Norton Bridge to Stone Railway) - significance of effect assessment

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction significance	Post-construction significance
Exposure of on-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of on-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of off-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Low	Low	Low	Neutral effect	Neutral effect
Exposure of off-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Low	Low	Low	Neutral effect	Neutral effect
Exposure of groundwater to vertical and lateral migration of contaminated groundwater/leachate	Low	Moderate/low	Low	Minor adverse effect	Neutral effect
Discharge of contaminants to surface water by lateral migration through groundwater and direct run-off from site	Low	Moderate/low	Low	Minor adverse effect	Neutral effect
Direct contact of property with contaminants in soil and surface water/groundwater	Very low	Low	Very low	Minor adverse effect	Neutral effect
Main risk	Moderate/low	Moderate/low	Moderate/low		
Overall significance				Neutral to minor adverse effect	Neutral effect

Table 29: 3-118 Historical gasworks Swynnerton - significance of effect assessment

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction significance	Post-construction significance
Exposure of on-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of on-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of off-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of off-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of groundwater to vertical and lateral migration of contaminated groundwater/leachate	Moderate/low	Moderate	Moderate/low	Minor adverse effect	Neutral effect
Discharge of contaminants to surface water by lateral migration through groundwater and direct run-off from site	Very low	Very low	Very low	Neutral effect	Neutral effect
Direct contact of property with contaminants in soil and surface water/groundwater	Low	Low	Low	Neutral effect	Neutral effect
Main risk	Moderate/low	Moderate	Moderate/low		
Overall significance				Neutral to minor adverse effect	Neutral effect

Table 30: 3-123 Common Lane bunkers and 3-124, historical tank - significance of effect assessment

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction significance	Post-construction significance
Exposure of on-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Moderate/low	Moderate	Low	Minor adverse effect	Minor beneficial effect
Exposure of on-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Moderate/low	Moderate	Low	Minor adverse effect	Minor beneficial effect
Exposure of on-site human receptors to inhalation of ground gases	Moderate/low	Moderate	Low	Minor adverse effect	Minor beneficial effect
Exposure of off-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Low	Moderate/low	Low	Minor adverse effect	Neutral effect
Exposure of off-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Low	Moderate/low	Low	Minor adverse effect	Neutral effect
Exposure of off-site human receptors to inhalation of ground gases	Moderate/low	Moderate/low	Low	Neutral effect	Minor beneficial effect
Exposure of groundwater to vertical and lateral migration of contaminated groundwater/leachate	Moderate/low	Moderate	Low	Minor adverse effect	Minor beneficial effect
Discharge of contaminants to surface water by lateral migration through groundwater and direct run-off from site	Very low	Low	Very low	Minor adverse effect	Neutral effect
Exposure of property to explosive gases	Moderate/low	Moderate	Moderate/low	Minor adverse effect	Neutral effect
Direct contact of property with contaminants in soil and surface water/groundwater	Low	Moderate/low	Low	Minor adverse effect	Neutral effect
Main risk	Moderate/low	Moderate	Moderate/low		
Overall significance				Neutral to minor adverse effect	Neutral to minor beneficial effect

Table 31: 3-130 Existing railway (WCML) - significance of effect assessment

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction significance	Post-construction significance
Exposure of on-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of on-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of off-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Low	Low	Low	Neutral effect	Neutral effect
Exposure of off-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Low	Low	Low	Neutral effect	Neutral effect
Exposure of groundwater to vertical and lateral migration of contaminated groundwater/leachate	Moderate	High	Moderate	Minor adverse effect	Neutral effect
Discharge of contaminants to surface water by lateral migration through groundwater and direct run-off from site	Low	Moderate/low	Low	Minor adverse effect	Neutral effect
Direct contact of property with contaminants in soil and surface water/groundwater	Very low	Very low	Very low	Neutral effect	Neutral effect
Main risk	Moderate	High	Moderate		
Overall significance				Neutral to minor adverse effect	Neutral effect

Table 32: 3-138 Former Stableford Garage / petrol filling station - significance of effect assessment

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction significance	Post-construction significance
Exposure of on-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Low	Low	Low	Neutral effect	Neutral effect
Exposure of on-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Low	Low	Low	Neutral effect	Neutral effect
Exposure of on-site human receptors to inhalation of ground gases	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of off-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Low	Low	Low	Neutral effect	Neutral effect
Exposure of off-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Low	Low	Low	Neutral effect	Neutral effect
Exposure of off-site human receptors to inhalation of ground gases	Low	Low	Low	Neutral effect	Neutral effect
Exposure of groundwater to vertical and lateral migration of contaminated groundwater/leachate	Low	Moderate/low	Low	Minor adverse effect	Neutral effect
Discharge of contaminants to surface water by lateral migration through groundwater and direct run-off from site	Very low	Very low	Very low	Neutral effect	Neutral effect
Exposure of property to explosive gases	Low	Low	Low	Neutral effect	Neutral effect
Direct contact of property with contaminants in soil and surface water/groundwater	Very low	Very low	Very low	Neutral effect	Neutral effect
Main risk	Moderate/low	Moderate/low	Moderate/low		
Overall significance				Neutral to minor adverse effect	Neutral effect

Table 33: 3-107 and 3-120 infilled pits and ponds - significance of effect assessment

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction significance	Post-construction significance
Exposure of on-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Moderate/low	Low	Low	Minor beneficial effect	Minor beneficial effect
Exposure of on-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Moderate/low	Low	Low	Minor beneficial effect	Minor beneficial effect
Exposure of on-site human receptors to inhalation of ground gases	Moderate/low	Low	Low	Minor beneficial effect	Minor beneficial effect
Exposure of off-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Low	Moderate/low	Low	Minor adverse effect	Neutral effect
Exposure of off-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Low	Moderate/low	Low	Minor adverse effect	Neutral effect
Exposure of off-site human receptors to inhalation of ground gases	Low	Moderate/low	Low	Minor adverse effect	Neutral effect
Exposure of groundwater to vertical and lateral migration of contaminated groundwater/leachate	Moderate/low	Moderate	Low	Minor adverse effect	Minor beneficial effect
Discharge of contaminants to surface water by lateral migration through groundwater and direct run-off from site	Very low	Low	Very low	Minor adverse effect	Neutral effect
Exposure of property to explosive gases	Moderate/low	Moderate	Moderate/low	Minor adverse effect	Neutral effect
Direct contact of property with contaminants in soil and surface water/groundwater	Low	Moderate/low	Low	Minor adverse effect	Neutral effect
Main risk	Moderate/low	Moderate	Moderate/low		
Overall significance				Minor beneficial to minor adverse effect	Neutral to minor beneficial effect

Table 34: 3-165 Home Farm Historical Landfill - significance of effect assessment

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction significance	Post-construction significance
Exposure of on-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of on-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of on-site human receptors to inhalation of ground gases	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of off-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Low	Low	Low	Neutral effect	Neutral effect
Exposure of off-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Low	Low	Low	Neutral effect	Neutral effect
Exposure of off-site human receptors to inhalation of ground gases	Low	Moderate/low	Low	Minor adverse effect	Neutral effect
Exposure of groundwater to vertical and lateral migration of contaminated groundwater/leachate	Low	Low	Low	Neutral effect	Neutral effect
Discharge of contaminants to surface water by lateral migration through groundwater and direct run-off from site	Low	Low	Low	Neutral effect	Neutral effect
Exposure of property to explosive gases	Moderate/low	Moderate	Moderate/low	Minor adverse effect	Neutral effect
Direct contact of property with contaminants in soil and surface water/groundwater	Very low	Very low	Very low	Neutral effect	Neutral effect
Main risk	Moderate/low	Moderate	Moderate/low		
Overall significance				Neutral to minor adverse effect	Neutral effect

4 Geological sites of special scientific interest and local geological sites

- 4.1.1 A local geological site (LGS) of local, county level importance has been identified in the Stone and Swynnerton study area. The Proposed Scheme will be located on the lower southern slopes of Hanchurch Hills north of Swynnerton. It is a historically important site associated with Charles Darwin's recognition of an igneous dyke. It is possible that the construction and operation of the Proposed Scheme would have an impact on the igneous dykes, since the route crosses the igneous dykes through the Swynnerton North cutting between approximately 650m and 1km south-east of Clifford's Wood. The Proposed Scheme is anticipated to remove only a small proportion of the igneous dykes and this is not considered to result in a significant effect. The location of the site is presented in Map LQ-01-112 (Volume 5, Land Quality Map Book).

5 Mining and minerals data

- 5.1.1 This section presents the following data relating to mining and minerals information:
- details of planning data for minerals sites; and
 - lists of marl pits in each study area.
- 5.1.2 The remainder of this appendix presents this data for relevant sites.
- 5.1.3 The Minerals Local Plan for Staffordshire 2015 to 2030 (adopted in 2017)³ shows that the route passes through one mineral safeguarding area (MSA) for sand and gravel extraction within a number of sections, shown in Maps LQ-01-109b to LQ-01-113a (Volume 5, Land Quality Map Book).
- 5.1.4 The Minerals Local Plan for Staffordshire 2015 to 2030 also indicates the route passes through the PEDL56 Petroleum Licence Area.
- 5.1.5 There are 12 historical marl pits, mostly very small, and no active marl pits in the study area. There is no evidence of current working of these pits. Many pits have filled with water and become ponds, and others have been backfilled with unspecified materials. Where the latter is the case, they have been assessed as potential contaminated sites as part of the overall baseline for the land quality study.

³ Staffordshire County Council (2017), *The Minerals Local Plan for Staffordshire 2015 to 2030*, adopted 16 February 2017

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