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HS2

High Speed Rail (Crewe – Manchester) Environmental Statement

Volume 5: Appendix LQ-001-OR003

Land quality

Off-route works: Annandale depot

Land quality report

M222

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Department for Transport

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1 Introduction

1.1.1 This report is an appendix to the land quality assessment for the Proposed Scheme off-route works at the Annandale depot, it comprises:

- a summary of engagement undertaken;
- details on committed developments relevant to land quality that form part of the future baseline; and
- detailed risk assessments associated with land contamination.

1.1.2 This appendix should be read in conjunction with:

- Volume 4, Off-route effects;
- Volume 5, Appendices; and
- Background Information and Data (BID) (BID LQ-002-OR003)[1].

1.1.3 Maps referred to throughout this report are contained in the Volume 5: Land quality Map Book (Maps LQ-01-803 to LQ-01-804).

1.1.4 Further information regarding receptors in relation to each site or group of sites is set out in the BID.

1.1.5 Minerals baseline data, information about Local Geological Sites and geological Sites of Special Scientific Interest (SSSI) are set out in the BID document.

1.1.6 The Environmental Impact Assessment (EIA) Scope and Methodology Report (SMR), (see Volume 5, CT-001-00001) should be referred to for details of the Land quality assessment.

[1] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Background and Information Data, Land quality baseline data.* BID LQ-002-OR003. Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

2 Engagement

2.1.1 Table 1 sets out the organisations that have been engaged with during the preparation of the land quality section of the Environmental Statement (ES) for the Annandale depot area, the types of information that have been provided to the assessment team and any specific concerns raised.

Table 1: Engagement on land quality issues undertaken for the Annandale depot area

Organisation	Method/dates of contact	Information provided and/or specific concerns
Animal and Plant Health Agency (APHA)	Data request to APHA	Request for Animal Burial Sites dataset for study area
	Data transmittal from APHA (25 November 2019)	Confirmation that no animal burial sites are present within the study area
Dumfries and Galloway Council (DGC)	Telephone call to DGC Contaminated Land Officer (27 November 2019)	Discussion on the scope of requirements for land quality engagement
	Email to DGC (28 November 2019)	Provision of study area and confirm scope of request
	Email from DGC (06 December 2019)	DGC sent requested land quality priority sites data as shapefile and further information in a table in the email text

3 Risk assessment

3.1.1 A four-stage process, comprising stages A to D, has been carried out in accordance with the methodology set out in the SMR. At each stage, professional judgement has been used to check that the screening and assessment process is highlighting significant sites.

3.1.2 Stage A highlights potentially contaminative sites based on their potential impact. Sites with a moderate to high potential impact move through to stage B where they are assessed based on receptor proximity.

3.1.3 Sites with a high potential impact pass through stage B to detailed assessment irrespective of receptor proximity. Sites with a moderate potential impact and moderate to high receptor proximity also go through to detailed assessment.

3.1.4 For those sites which pass through stage B, a further detailed risk assessment (stages C and D) has been carried out.

3.1.5 The results of stage C are presented in three conceptual site models (CSM) as qualitative risk assessments covering baseline, construction and post-construction scenarios. Stage D then compares the risk of impact at construction and post-construction stages with the baseline to determine the change in risk and hence the potential for a significant effect.

3.1.6 Sections 3.2 to 3.5 present assessments for potentially contaminated sites which have passed through the screening process within the study area. For each site the following data are presented:

- baseline risk assessment;
- construction risk assessment;
- post-construction risk assessment;
- assessment of temporary (construction) effects; and
- assessment of permanent (post-construction) effects.

3.1.7 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.

3.1.8 Where nearby sites present a similar contamination risk, they have been grouped and considered together. For example, in rural areas, small historical backfilled ponds and pits have been grouped together for assessment purposes.

3.1.9 Where sites have been grouped together, only one CSM has been prepared for those sites. The sites in the Annandale depot area have been listed as follows in Table 2.

3.1.10 For clarity, ‘on-site’ in this document means ‘within the land required for the construction of the Proposed Scheme’ and ‘off-site’ refers to ‘land beyond this boundary, but within the study area’.

Table 2: Sites included in the risk assessment within the Annandale depot area

Site group	Site title (site ID) and land use class[2]
On-site	
Railway land	West Coast Mainline railway (ADEP-02), Class 2
Storage yard	Storage yard (ADEP-05), Class 2
Potentially infilled reservoir	Former potentially infilled reservoir (ADEP-07), Class 2
Off-site	
Depot	Depot (ADEP-16), Class 2

3.1.11 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 8[3]. Although this report has been withdrawn by the Environment Agency, it remains technically valid and there has been no subsequent authoritative replacement.

3.1.12 The remainder of this section presents the risk assessment for the sites going through to stages C and D of the assessment. These sites are shown on Volume 5, Land quality Map Book, Maps LQ-01-803 to LQ-01-804.

3.1.13 The following abbreviations are used in these tables:

- PAH – polycyclic aromatic hydrocarbons;
- PCB – polychlorinated biphenyls;
- TPH – total petroleum hydrocarbons; and
- VOC – volatile organic compounds.

[2] As defined by the SMR.

[3] Department for Environment, Food and Rural Affairs and Environment Agency (2002), *Potential Contaminants for the Assessment of Land*. R&D Publication CLR 8.

3.2 Baseline risk assessment

Table 3: Baseline CSM and qualitative risk assessment for railway land (on-site)

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline phase
Residual contamination in made ground (e.g. ballast): PCB, metals, asbestos, PAH and chlorinated hydrocarbons; potentially low levels of ground gas (methane, carbon dioxide and VOC)	Existing site users – Railway staff/maintenance workers	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	Low likelihood	Medium	Moderate/low
		Inhalation of ground gases	Unlikely	Medium	Low
	Adjacent site users – Residents, school users, farm workers, workers on commercial/industrial sites, walkers	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	Unlikely	Medium	Low
		Inhalation of ground gases	Unlikely	Medium	Low
	Controlled waters – groundwater Moderate to high productivity alluvium and river terrace deposits	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Controlled waters – groundwater High productivity aquifer of the St Bees Sandstone Member	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Property receptors - buildings, foundations and services (existing and adjacent)	Direct contact with contaminated soils and waters	Low likelihood	Minor	Low
		Exposure to explosive gases	Unlikely	Medium	Low

Notes/assumptions:

• site assessed without construction of the Proposed Scheme;

• see BID document Section 2 Table 1 for details of receptors relevant to the site;

• existing site users and adjacent site users in the receptor column refer to users at or near to the areas assessed;

• aquifer designations in Scotland differ to those in England and Wales. Consequence from contamination has been assessed as that of a Principal Aquifer for the high productivity bedrock aquifer and as a Secondary A Aquifer for the moderate to high productivity superficial aquifer (http://nora.nerc.ac.uk/id/eprint/511413/1/OR15028.pdf);

• surface water receptors have not been included as none are present within 250m of sites; and

• ecological receptors have not been included as none are present within 250m of sites.

Table 4: Baseline CSM and qualitative risk assessment for storage yard (on-site)

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline phase
Potential contamination from former and current activities: contaminants could include petroleum and diesel range hydrocarbons, PAH, asbestos, metals and VOC	Existing site users – Railway staff/workers	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Adjacent site users – Residents, farm workers, railway staff, walkers	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	Unlikely	Medium	Low
	Controlled waters – groundwater High productivity aquifer of the St Bees Sandstone Member	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Property receptors - buildings, foundations and services, railway line (existing and adjacent)	Direct contact with contaminated soils and waters	Low likelihood	Minor	Low
		Exposure to explosive gases	Unlikely	Medium	Low

Notes/assumptions:

• site assessed without construction of the Proposed Scheme;

• see BID document Section 2 Table 2 for details of receptors relevant to the site;

• existing site users and adjacent site users in the receptor column refer to users at or near to the areas assessed;

• aquifer designations in Scotland differ to those in England and Wales. Consequence from contamination has been assessed as that of a Principal Aquifer for the high productivity bedrock aquifer (http://nora.nerc.ac.uk/id/eprint/511413/1/OR15028.pdf);

• surface water receptors have not been included as none are present within 250m of the site; and

• ecological receptors have not been included as none are present within 250m of the site.

Table 5: Baseline CSM and qualitative risk assessment for potentially infilled reservoir (on-site)

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline phase
Potential contamination from possible infilling activities. Composition of infill (if any) is unknown. Depending upon the source of the infill this could comprise inert materials or those that could include a range of organic and inorganic contaminants including: petroleum and diesel range hydrocarbons, PAH, metals and asbestos. Potentially low levels of ground gas (methane and carbon dioxide) if bio-degradable infill used	Existing site users – Hotel/venue guests and staff	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	Low likelihood	Medium	Moderate/low
		Inhalation of ground gases	Unlikely	Medium	Low
	Adjacent site users – Hotel/venue guests and staff	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	Low likelihood	Medium	Moderate/low
		Inhalation of ground gases	Unlikely	Medium	Low
	Controlled waters – groundwater High productivity aquifer of the St Bees Sandstone Member	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Property receptors - buildings, foundations and services (adjacent)	Direct contact with contaminated soils and waters	Low likelihood	Minor	Low
		Exposure to explosive gases	Unlikely	Medium	Low

Notes/assumptions:

• site assessed without construction of the Proposed Scheme;

• see BID document Section 2 Table 3 for details of receptors relevant to the site;

• existing site users and adjacent site users in the receptor column refer to users at or near to the areas assessed;

• aquifer designations in Scotland differ to those in England and Wales. Consequence from contamination has been assessed as that of a Principal Aquifer for the high productivity bedrock aquifer (http://nora.nerc.ac.uk/id/eprint/511413/1/OR15028.pdf);

• surface water receptors have not been included as none are present within 250m of sites; and

• ecological receptors have not been included as none are present within 250m of sites.

Table 6: Baseline CSM and qualitative risk assessment for depot (off-site)

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline phase
Potential contamination from former and current activities including petroleum and diesel range hydrocarbons, PAH, asbestos and metals/semi-metals	Existing site users – Workers	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Adjacent site users – School users and residential site users	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Controlled waters – groundwater High productivity aquifer of the St Bees Sandstone Member	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Controlled waters – surface water – Kirkpatrick Burn (Tributary of Kirtle Water)	Lateral migration through groundwater	Low likelihood	Minor	Low
	Property receptors - buildings, foundations and services (existing and adjacent)	Direct contact with contaminated soils and waters	Low likelihood	Minor	Low

Notes/assumptions:
• site assessed without construction of the Proposed Scheme;
• see BID document Section 2 Table 4 for details of receptors relevant to the site;
• existing site users and adjacent site users in the receptor column refer to users at or near to the areas assessed;
• aquifer designations in Scotland differ to those in England and Wales. Consequence from contamination has been assessed as that of a Principal Aquifer for the high productivity bedrock aquifer (http://nora.nerc.ac.uk/id/eprint/511413/1/OR15028.pdf); and
• ecological receptors have not been included as none are present within 250m of the site.

3.3 Construction risk assessment

Table 7: Construction CSM and qualitative risk assessment for railway land (on-site)

Source	Receptor	Pathway	Probability	Consequence	Risk at construction phase
Residual contamination in made ground (e.g. ballast): PCB, metals, asbestos, PAH and chlorinated hydrocarbons; potentially low levels of ground gas (methane, carbon dioxide and VOC)	Existing site users – Railway staff/maintenance workers	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	Low likelihood	Medium	Moderate/low
		Inhalation of ground gases	Unlikely	Medium	Low
	Adjacent site users – Residents, school users, farm workers, workers on commercial/industrial sites, walkers	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	Unlikely	Medium	Low
		Inhalation of ground gases	Unlikely	Medium	Low
	Controlled waters – groundwater Moderate to high productivity aquifer of the alluvium and river terrace deposits	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Medium	Moderate
	Controlled waters – groundwater High productivity aquifer of the St Bees Sandstone Member	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Property receptors - buildings, foundations and services (existing and adjacent)	Direct contact with contaminated soils and waters	Low likelihood	Minor	Low
		Exposure to explosive gases	Unlikely	Medium	Low

Notes/assumptions:

• site investigation will be required prior to construction of the Proposed Scheme;

• sites which lie within the land required for construction of the Proposed Scheme may require remediation;

• remediation will be restricted to mitigation of land quality effects arising from the Proposed Scheme;

• existing site users and adjacent site users in the receptor column refer to users at or near to the potentially contaminated area;

• during construction, standard mitigation procedures are assumed to be implemented in accordance with the draft CoCP (Volume 5, Appendix CT-002-00000). Construction workers have been excluded from assessment due to the use of PPE/risk management protocols and in accordance with the SMR;

• while 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

• railway workers/staff and property receptors are assumed to remain present on-site during the construction phase.

Table 8: Construction CSM and qualitative risk assessment for storage yard (on-site)

Source	Receptor	Pathway	Probability	Consequence	Risk at construction phase
Potential contamination from former and current activities: contaminants could include petroleum and diesel range hydrocarbons, PAH, asbestos, metals and VOC	Existing site users – Railway staff/workers	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	N/A	N/A	N/A
	Adjacent site users – Residents, farm workers, railway staff, walkers	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	Unlikely	Medium	Low
	Controlled waters – groundwater High productivity aquifer of the St Bees Sandstone Member	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Property receptors - buildings, foundations and services, railway line (existing and adjacent)	Direct contact with contaminated soils and waters	N/A	N/A	N/A
		Exposure to explosive gases	N/A	N/A	N/A

Notes/assumptions:

• site investigation will be required prior to construction of the Proposed Scheme;

• sites which lie within the land required for construction of the Proposed Scheme may require remediation;

• sites located on the land required for the construction of the Proposed Scheme are assumed to be unoccupied during construction, therefore on-site construction risks to human health receptors are labelled as not applicable (N/A);

• it is assumed that existing properties will be demolished during the construction stage and so risks to them have not been assessed;

• remediation will be restricted to mitigation of land quality effects arising from the Proposed Scheme;

• existing site users and adjacent site users in the receptor column refer to users at or near to the potentially contaminated area;

• during construction, standard mitigation procedures are assumed to be implemented in accordance with the draft CoCP (Volume 5, Appendix CT-002-00000). Construction workers have been excluded from assessment due to the use of PPE/risk management protocols and in accordance with the SMR; and

• while 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.

Table 9: Construction CSM and qualitative risk assessment for potentially infilled reservoir (on-site)

Source	Receptor	Pathway	Probability	Consequence	Risk at construction phase
Potential contamination from possible infilling activities. Composition of infill (if any) is unknown. Depending upon the source of the infill this could comprise inert materials or those that could include a range of organic and inorganic contaminants including: petroleum and diesel range hydrocarbons, PAH, metals and asbestos. Potentially low levels of ground gas (methane and carbon dioxide) if bio-degradable infill used	Existing site users – Hotel/venue guests and staff	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	N/A	N/A	N/A
		Inhalation of ground gases	N/A	N/A	N/A
	Adjacent site users – Hotel/venue guests and staff	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	Unlikely	Medium	Low
		Inhalation of ground gases	Unlikely	Medium	Low
	Controlled waters – groundwater High productivity aquifer of the St Bees Sandstone Member	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Property receptors - buildings, foundations and services (adjacent)	Direct contact with contaminated soils and waters	Low likelihood	Minor	Low
		Exposure to explosive gases	Unlikely	Medium	Low

Notes/assumptions:

• site investigation will be required prior to construction of the Proposed Scheme;

• sites which lie within the land required for construction of the Proposed Scheme may require remediation;

• sites located on the land required for the construction of the Proposed Scheme are assumed to be unoccupied during construction, therefore on-site construction risks to human health receptors are labelled as not applicable (N/A);

• it is assumed that existing properties will be demolished during the construction stage and so risks to them have not been assessed;

• remediation will be restricted to mitigation of land quality effects arising from the Proposed Scheme;

• existing site users and adjacent site users in the receptor column refer to users at or near to the potentially contaminated area;

• during construction, standard mitigation procedures are assumed to be implemented in accordance with the draft CoCP (Volume 5, Appendix CT-002-00000). Construction workers have been excluded from assessment due to the use of PPE/risk management protocols and in accordance with the SMR; and

• while 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.

Table 10: Construction CSM and qualitative risk assessment for depot (off-site)

Source	Receptor	Pathway	Probability	Consequence	Risk at construction phase
Potential contamination from former and current activities including petroleum and diesel range hydrocarbons, PAH, asbestos and metals/semi-metals	Existing site users – Workers	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Adjacent site users – School users and residential site users	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Controlled waters – groundwater High productivity aquifer of the St Bees Sandstone Member	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Controlled waters – Surface Water – Kirkpatrick Burn (Tributary of Kirtle Water)	Lateral migration through groundwater	Low likelihood	Minor	Low
	Property receptors - buildings, foundations and services (existing and adjacent)	Direct contact with contaminated soils and waters	Low likelihood	Minor	Low

Notes/assumptions:

• site investigation will be required prior to construction of the Proposed Scheme;

• existing site users and adjacent site users in the receptor column refer to users at or near to the potentially contaminated area;

• during construction, standard mitigation procedures are assumed to be implemented in accordance with the draft CoCP (Volume 5, Appendix CT-002-00000). Construction workers have been excluded from assessment due to the use of PPE/risk management protocols and in accordance with the SMR; and

• while 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.

3.4 Post-construction risk assessment

Table 11: Post-construction CSM and qualitative risk assessment for railway land (on-site)

Source	Receptor	Pathway	Probability	Consequence	Risk at post-construction phase
Residual contamination in made ground (e.g. ballast): PCB, metals, asbestos, PAH and chlorinated hydrocarbons); potentially low levels of ground gas (methane, carbon dioxide and VOC)	Existing site users – Railway staff/maintenance workers	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	Low likelihood	Medium	Moderate/low
		Inhalation of ground gases	Unlikely	Medium	Low
	Adjacent site users – Residents, school users, farm workers, workers on commercial/industrial sites, walkers	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	Unlikely	Medium	Low
		Inhalation of ground gases	Unlikely	Medium	Low
	Controlled waters – groundwater Moderate to high productivity aquifer of the alluvium and river terrace deposits	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Controlled waters – groundwater High productivity aquifer of the St Bees Sandstone Member	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Medium	Moderate/low

Source	Receptor	Pathway	Probability	Consequence	Risk at post-construction phase
	Property receptors - buildings, foundations and services (existing and adjacent)	Direct contact with contaminated soils and waters	Low likelihood	Minor	Low
		Exposure to explosive gases	Unlikely	Medium	Low

Notes/assumptions:

• assumes construction works are complete and remediation has been carried out where necessary. No pathways are left open;

• existing site users and adjacent site users in the receptor column refer to users at or near to the areas assessed; and

• excludes rail passengers (as whilst within trains, will at all routine times be within a controlled environment) and maintenance workers; but includes people at stations/depots or in areas returned to its former use after construction.

Table 12: Post-construction CSM and qualitative risk assessment for storage yard (on-site)

Source	Receptor	Pathway	Probability	Consequence	Risk at post-construction phase
Potential contamination from former and current activities: contaminants could include petroleum and diesel range hydrocarbons, PAH, asbestos, metals and VOC	Existing site users – Railway staff/workers	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	N/A	N/A	N/A
	Adjacent site users – Residents, farm workers, railway staff, walkers	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	Unlikely	Medium	Low
	Controlled waters – groundwater High productivity aquifer of the St Bees Sandstone Member	Leaching, vertical and lateral migration from contaminated soils and waters	Unlikely	Medium	Low
	Property receptors - buildings, foundations and services (existing and adjacent)	Direct contact with contaminated soils and waters	Low likelihood	Minor	Low
		Exposure to explosive gases	Unlikely	Medium	Low

Notes/assumptions:

• assumes construction works are complete and remediation has been carried out where necessary. No pathways are left open;

• existing site users and adjacent site users in the receptor column refer to users at or near to the areas assessed;

• excludes rail passengers (as whilst within trains, will at all routine times be within a controlled environment) and maintenance workers; and

• existing human health receptors are labelled as not applicable (N/A) as the new depot workers will not be affected since the new development will be covered by planning guidance and operational risk assessments.

Table 13: Post-construction CSM and qualitative risk assessment for potentially infilled reservoir (on-site)

Source	Receptor	Pathway	Probability	Consequence	Risk at post-construction phase
Potential contamination from possible infilling activities. Composition of infill (if any) is unknown. Depending upon the source of the infill this could comprise inert materials or those that could include a range of organic and inorganic contaminants including: petroleum and diesel range hydrocarbons, PAH, metals and asbestos. Potentially low levels of ground gas (methane and carbon dioxide) if bio-degradable infill used	Existing site users – Hotel/venue guests and staff	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	N/A	N/A	N/A
		Exposure to explosive gases	N/A	N/A	N/A
	Adjacent site users – Hotel/venue guests and staff	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	Unlikely	Medium	Low
	Controlled waters – groundwater High productivity aquifer of the St Bees Sandstone Member	Leaching, vertical and lateral migration from contaminated soils and waters	Unlikely	Medium	Low
	Property receptors - buildings, foundations and services (adjacent)	Direct contact with contaminated soils and waters	Low likelihood	Minor	Low
		Exposure to explosive gases	Unlikely	Medium	Low

Notes/assumptions:
• assumes construction works are complete and remediation has been carried out where necessary. No pathways are left open;
• as existing human health receptors are no longer present at the post-construction stage the risks are labelled as not applicable (N/A);
• it is assumed that existing properties are no longer present on-site at the post-construction stage and so risks to them have not been assessed;
• existing site users and adjacent site users in the receptor column refer to users at or near to the areas assessed; and
• excludes rail passengers (as whilst within trains, will at all routine times be within a controlled environment) and maintenance workers; but includes people at stations/depots or in areas returned to its former use after construction.

Table 14: Post-construction CSM and qualitative risk assessment for depot (off-site)

Source	Receptor	Pathway	Probability	Consequence	Risk at post-construction phase
Potential contamination from former and current activities including petroleum and diesel range hydrocarbons, PAH, asbestos and metals/semi-metals	Existing site users – Workers	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Adjacent site users – School users and residential site users	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Controlled waters – groundwater High productivity aquifer of the St Bees Sandstone Member	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Controlled waters – Surface Water – Kirkpatrick Burn (Tributary of Kirtle Water)	Lateral migration through groundwater	Low likelihood	Minor	Low
	Property receptors - buildings, foundations and services (existing and adjacent)	Direct contact with contaminated soils and waters	Low likelihood	Minor	Low

Notes/assumptions:

- *assumes construction works are complete and remediation has been carried out where necessary. No pathways are open;*
- *assumes baseline conditions will not change at post-construction; and*
- *existing site users and adjacent site users in the receptor column refer to users within/near to the areas assessed.*

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

3.5.1 The significance of the effects of land contamination is assessed by comparing the difference in risk of each contaminant linkage at baseline to those at construction and at post-construction stages. This provides a way of assessing both the adverse and beneficial effects during construction and the post-construction period.

Table 15: Railway land (on-site) - significance of effect assessment

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction significance	Post-construction significance
Exposure of existing site users to contamination through direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of existing site users through inhalation of ground gases	Low	Low	Low	Neutral effect	Neutral effect
Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters impacting adjacent site users	Low	Low	Low	Neutral effect	Neutral effect
Exposure of adjacent site users through inhalation of ground gases	Low	Low	Low	Neutral effect	Neutral effect
Lateral and vertical migration of mobile contamination to groundwater (Moderate to High productivity aquifer)	Moderate/low	Moderate	Moderate/low	Minor adverse	Neutral effect
Lateral and vertical migration of mobile contamination to groundwater (High productivity aquifer)	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of property to via direct contact to contaminated soils and waters	Low	Low	Low	Neutral effect	Neutral effect

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction significance	Post-construction significance
Exposure of property and underground structures/services to explosive gases	Low	Low	Low	Neutral effect	Neutral effect
Overall significance				Neutral to minor adverse effect	Neutral effect

Notes/assumptions:

• the significance column may report a range of outcomes for a site. The draft CoCP is designed to mitigate effects, and it is considered that only temporary minor adverse effects during the construction period will occur from ground disturbance. Mitigation measures over and above the draft CoCP are detailed in the Volume 4 report for this study area.

Table 16: Storage yard (on-site) - significance of effect assessment

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction significance	Post-construction significance
Exposure of existing site users to contamination through direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	Moderate/low	N/A	N/A	Neutral effect	Neutral effect
Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters impacting adjacent site users	Low	Low	Low	Neutral effect	Neutral effect
Lateral and vertical migration of mobile contamination to groundwater (High productivity aquifer)	Moderate/low	Moderate/low	Low	Neutral effect	Minor beneficial
Exposure of property to via direct contact to contaminated soils and waters	Low	N/A	Low	Neutral effect	Neutral effect
Exposure of property and underground structures/services to explosive gases	Low	N/A	Low	Neutral effect	Neutral effect
Overall significance				Neutral effect	Neutral to minor beneficial effect

Notes/assumptions:

• the significance column may report a range of outcomes for a site. The draft CoCP is designed to mitigate effects, and it is considered that only temporary minor adverse effects during the construction period will occur from ground disturbance. Mitigation measures over and above the draft CoCP are detailed in the Volume 4 report for this study area.

• as human health and property receptors are no longer present during the construction stage the risks are labelled as not applicable (N/A); and

• it is assumed that existing properties are demolished during the construction and post-construction stages and so risks to them have not been assessed.

Table 17: Potentially infilled reservoir (on-site) - significance of effect assessment

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction significance	Post-construction significance
Exposure of existing site users to contamination through direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	Moderate/low	N/A	N/A	Neutral effect	Neutral effect
Exposure of existing site users through inhalation of ground gases	Low	N/A	N/A	Neutral effect	Neutral effect
Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters impacting adjacent site users	Moderate/low	Low	Low	Neutral effect	Minor beneficial
Exposure of adjacent site users through inhalation of ground gases	Low	Low	Low	Neutral effect	Neutral effect
Lateral and vertical migration of mobile contamination to groundwater (High productivity aquifer)	Moderate/low	Moderate/low	Low	Neutral effect	Minor beneficial
Exposure of property to via direct contact to contaminated soils and waters	Low	Low	Low	Neutral effect	Neutral effect
Exposure of property and underground structures/services to explosive gases	Low	Low	Low	Neutral effect	Neutral effect
Overall significance				Neutral effect	Neutral to minor beneficial effect

Notes/assumptions:

• the significance column may report a range of outcomes for a site. The draft CoCP is designed to mitigate effects, and it is considered that only temporary minor adverse effects during the construction period will occur from ground disturbance. Mitigation measures over and above the draft CoCP are detailed in the Volume 4 report for this study area.

Table 18: Depot (off-site) - significance of effect assessment

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction significance	Post-construction significance
Exposure of existing site users to contamination through direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and waters impacting adjacent site users	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Lateral and vertical migration of mobile contamination to groundwater (High productivity aquifer)	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Lateral migration through groundwater Direct runoff from site (surface water)	Low	Low	Low	Neutral effect	Neutral effect
Exposure of property to via direct contact to contaminated soils and waters	Low	Low	Low	Neutral effect	Neutral effect
Overall significance				Neutral effect	Neutral effect

Notes/assumptions:

• the significance column may report a range of outcomes for a site. The draft CoCP is designed to mitigate effects, and it is considered that only temporary minor adverse effects during the construction period will occur from ground disturbance. Mitigation measures over and above the draft CoCP are detailed in the Volume 4 report for this study area.

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