MetroWest

Portishead Branch Line (MetroWest Phase 1)

TR040011

Applicant: North Somerset District Council
6.13, Environmental Statement, Volume 2, Chapter 10 Geology, Hydrogeology, Ground Conditions and Contaminated Land
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CHAPTER 10

Geology, Hydrogeology, Ground Conditions, and Contaminated Land

10.1 Introduction

10.1.1 The Portishead Branch Line (MetroWest Phase 1) DCO Scheme ("the DCO Scheme") has the potential to give rise to likely significant effects on geology, hydrogeology, ground conditions and contaminated land. This chapter:

- describes the relevant legal and policy framework which informs the undertaking of the assessment;
- describes the methodology used for the identification and assessment of likely significant geology, hydrogeology, ground conditions and contaminated land effects in the Environmental Statement ("ES");
- describes the geology, hydrogeology, ground conditions and contaminated land baseline having regard to existing information;
- describes the measures that have been adopted as part of the DCO Scheme;
- identifies and assesses the likely significant environmental effects that could result from the DCO Scheme during construction and operation phases;
- considers mitigation of likely significant effects and assesses those residual effects that will result;
- considers the cumulative effects of other developments in combination with the DCO Scheme on geology, hydrogeology, ground conditions and contaminated land;
- identifies the limitations encountered in compiling the ES; and
- provides a summary of the residual effects for the mitigated DCO Scheme.

10.1.2 This chapter assesses the potential for impacts from the construction of the DCO Scheme on the underlying geology and associated groundwaters, and also any potential for impacts arising from ground conditions, such as the presence of contamination or mineral workings. Any potential for impacts on geological conservation sites present within the footprint of the DCO Scheme are also considered.

10.1.3 The National Policy Statement for National Networks (see paragraph 10.2.3) requires the applicant to assess and address significant land contamination issues as part of the development. It therefore follows that post construction, there will unlikely to be any significant effects relating to ground conditions. Paragraph 3.28 of the Scoping Opinion from the Planning Inspectorate states that the Secretary of State agrees that operational impacts on geology, hydrogeology, ground conditions and contaminated land can be scoped out (see Table 10.3).

10.1.4 It may be possible to re-use some waste materials within the DCO Scheme. This is very much dependent on there being a need for such materials and materials being suitable for use. Subject to this, where possible waste materials should be re-used within the DCO Scheme as this reduces waste going to landfill. Waste and material aspects of the DCO Scheme are discussed, to the extent possible at this stage of project design, in Chapter 12 Materials and Waste (DCO Document Reference 6.15).

10.1.5 This chapter should be read in conjunction with Chapter 4 Description of the Proposed Works (DCO Document Reference 6.7).

10.2 Legal and Policy Framework

EU and National Legislation

10.2.1 The protection of groundwaters is provided for at the European level by the Water Framework Directive (2000/60/EC) and the Groundwater Directive (2006/118/EC). Together these provide the framework within which much of the national legislation intended to secure the protection of groundwaters is established. National legislation relevant to the DCO Scheme comprises the Environmental Protection Act 1990, the Water Resources Act 1991, the Water Act 2003, the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 and the Environmental Permitting (England and Wales) Regulations 2016.

10.2.2 A statutory regime for the identification and remediation of land posing unacceptable risks on human health and the environment is set out in the Environment and Protection Act 1990 Part 2A.

National Policy

National Policy Statement for National Networks

10.2.3 The Planning Act 2008, Section 104(3) requires the Secretary of State to determine the application for the DCO Scheme in accordance with the National Policy Statement for National Networks ("NPSNN"), unless specified factors provide otherwise. The NPSNN advises on geology and geomorphological importance, land instability and contaminated land in the context of Nationally Significant Infrastructure Projects (“NSIP”) on road and rail networks. Table 10.1 below identifies NPSNN advice to applicants on the undertaking of assessments of the geological, geomorphological, ground conditions and contaminated land aspects of a NSIP and explains how this advice has been applied in this Chapter of the ES.

Table 10.1: Summary of relevant NPSNN advice regarding ground conditions

Summary of NPS provisions	Consideration within the ES
Paragraph 5.20 makes reference to sites that are designated for their geology and / or their geomorphological importance. Paragraph 5.21 notes that there is a range of international and national legislation that can impact on planning decisions that affect geological conservation issues set out in Government Circular: *Biodiversity and Geological Conservation – Statutory Obligations and their Impact within the Planning System* (Office of the Deputy Prime Minister 06/2005).	Geological and geomorphological sites are identified within Section 10.4 and an assessment of likely significant effects arising in respect of the DCO Scheme is presented in Section 10.6.
Paragraphs 5.116 to 5.119 advise on land instability. Paragraph 5.117 states that new developments need to be appropriate for the location and if land instability is likely to be an issue the applicant should seek appropriate expert advice. Paragraph 5.118 requires the Applicant to assess land instability. Mitigation measures to address land instability are identified in Paragraph 5.119.	A coal mining assessment has been undertaken. The works have been designed to stabilise cutting and embankment slopes along the railway to be regraded for the DCO Scheme. Slope and rock risk assessments have been undertaken on cliff faces through the Avon Gorge on Network Rail and third party land. Proposals for stabilisation works have been identified to be implemented during construction. During operations, Network Rail will continue with periodic inspections and further works as required. This activity is routinely undertaken in the Avon Gorge, as described in the baseline in Section 10.4. The assessment of impacts is described in Section 10.6.
Paragraph 5.168 states that for developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination and how it is proposed to address this. Reference is made to *Model Procedures for Management of Land Contamination* (CLR11) (Environment Agency, 2004)	The land-use history of the DCO Scheme has been documented and ground investigation undertaken to allow the design to allow for risks posed by land contamination. This is described in Section 10.4.

National Planning Policy Framework

10.2.4 The National Planning Policy Framework (“NPPF”) 2019 does not contain specific policies for NSIPs. NPPF paragraph 5 notes that applications for NSIPs are to be determined in accordance with a decision-making framework set out in the Planning Act 2008 and relevant National Policy Statements for major infrastructure "*as well as any other matters that are*

considered both important and relevant (which may include the National Planning Policy Framework)." Paragraph 170 states that the planning system should contribute to enhancing the local environment by protecting and enhancing geological value and remediating derelict, contaminated and unstable land where appropriate.

Local Policy

10.2.5 A description of local policy relevant to the DCO Scheme is provided in Chapter 6 Planning Framework (DCO Document Reference 6.9) and an assessment of compliance of the DCO Scheme against policy is provided in the Planning Statement submitted with the DCO application in DCO Document Reference 8.11. Table 10.2 summarises local policy related to ground conditions.

Table 10.2: Summary of local policy

Policy No.	Title	Policy Summary
North Somerset Council's Core Strategy (adopted January 2017),		
CS3	Environmental Impacts and Flood Risk Assessment (which applies to land contamination),	"*Development that, on its own or cumulatively, would result in air, water or other environmental pollution or harm to amenity, health or safety will only be permitted if the potential adverse effects would be mitigated to an acceptable level by other control regimes, or by measures included in the proposals, by the imposition of planning conditions or through a planning obligation."*
North Somerset Council's Sites and Policies Plan Part 1 Development Management Policies (adopted July 2016)		
DM8	Nature Conservation	"*Development within or in proximity to a Site of Special Scientific Interest (SSSI) or National Nature Reserve that is likely to have a direct or indirect adverse effect on its biodiversity or geological interest would not normally be permitted*."
Bristol City Council Site Allocations and Development Management Policies (adopted July 2014)		
DM19	Nature and conservation	"*…this policy provides further detailed criteria for the consideration of proposals affecting nature conservation sites and features of value in Bristol.*"
DM20	Regionally Important Geological Sites	"*Planning permission will not be permitted for development that would have a harmful impact on a Regionally Important Geological Site's features of value*." And "*In considering proposals on or adjacent to Regional Important Geological Sites account will be taken of how the proposal conserves and enhances the site's geological interest, through its design and placement*."

Table 10.2: Summary of local policy

Policy No.	Title	Policy Summary
DM34	Contaminated Land	"*New development should demonstrate that:* *i. Any existing contamination of the land will be addressed by appropriate mitigation measures to ensure that the site is suitable for the proposed use and that there is no unacceptable risk of pollution within the site or in the surrounding area; and* *ii. The proposed development will not cause the land to become contaminated, to the detriment of future use or restoration of the site or so that it would cause pollution in the surrounding area.*"
DM37	Unstable Land	"*On sites where there is reason to suspect unstable land and the risk of instability has the potential to materially affect either the proposed development or neighbouring uses/occupiers, development will only be permitted where:* *i. A desk-based study of available records has been carried out to assess the previous uses of the site and their potential for instability in relation to the proposed development; and* *ii. Where the study establishes that instability is likely but does not provide sufficient information to establish its precise extent or nature, site investigation and risk assessment are carried out to determine the standard of remediation required to make the site suitable for its intended use.* *Where remediation measures are necessary, conditions or obligations may be applied to ensure that the development does not take place until appropriate works are completed*."
Bristol City Council's, Bristol Development Framework Core Strategy (adopted June 2011)		
BCS9	Green Infrastructure	"*National and local sites of biological and geological conservation importance will be protected having regard to the hierarchy of designations and the potential for appropriate mitigation. The extent to which a development would contribute to the achievement of wider objectives of the Core Strategy will be carefully considered when assessing their impact on biological and geological conservation*."

Table 10.2: Summary of local policy

Policy No.	Title	Policy Summary
BCS23	Pollution	"*Development should be sited and designed in a way as to avoid adversely impacting upon:* • *environmental amenity or biodiversity of the surrounding area by reason of fumes, dust, noise, vibration, smell, light or other forms of air, land, water pollution, or creating exposure to contaminated land.* • *The quality of underground or surface water bodies.* *In locating and designing development, account should also be taken of:* • *The impact of existing sources of noise or other pollution on the new development; and* • *The impact of the new development on the viability of existing uses by reason of its sensitivity to noise or other pollution.* *Water quality and associated habitat of surface watercourses should be preserved or enhanced."*

10.2.6 Natural England produces guidance on management and operations likely to damage specific SSSIs, which they would take into consideration in reviewing development proposals affecting a SSSI. Each SSSI has a document detailing Natural England's "Views on Management" of that SSSI. (Ham Green - https://designatedsites.naturalengland.org.uk/PDFsForWeb/VAM/1001500.pdf, and Avon Gorge https://designatedsites.naturalengland.org.uk/PDFsForWeb/VAM/1003073.pdf).

10.3 Methodology

Guidance and Best Practice

10.3.1 In order to determine if there are any constraints presented by the ground conditions and contamination beneath the site with the potential to cause likely significant effects to human health, controlled waters, the environment or site structures, a risk based approach to the assessment of environmental impacts and effects has been adopted.

10.3.2 The risk based approach follows the guidance in the Environment Agency Publication CLR11 Model Procedures for the Management of Land Contamination, and the updated guidance, https://www.gov.uk/guidance/land-contamination-how-to-manage-the-risks, which advocates the source-pathway-receptor concept which, when all three are present, constitutes a contaminant linkage.

10.3.3 Should any element of the potential contaminant linkage not be present, then although a contaminant source may be present, the contaminant is not considered to pose a risk. Such contaminant linkages are identified through the development and iterative review of a Conceptual Site Model ("CSM").

Consultations

10.3.4 A summary of consultations undertaken to date is presented in Table 10.3. Further information on the consultation process is presented in Chapter 5 Approach to the Environmental Statement (DCO Document Reference 6.8). Responses to the consultations undertaken in 2015 and 2017 are available on the MetroWest project website at the following address http://travelwest.info/project/metrowest-phase-1 while the Consultation Report is provided in the DCO Document Reference 5.1.

Table 10.3: Summary of consultation responses

Organisation and date	Summary of response	Consideration within ES
Scoping Opinion Responses (August 2015)		
Planning Inspectorate	Paragraph 3.28. The Secretary of State agreed to scope out the operational effects of the scheme on geology, hydrogeology, ground conditions and contaminated land.	These topics are not considered in the ES.
	Para. 3.29. The Secretary of State considers that insufficient information was presented in the Scoping Report to scope out the cumulative effects of the DCO Scheme on the Bedminster Down Relief Line, Severn Beach / Avonmouth Signalling and Bathampton Turnback and other MetroWest Phase 1 works, including in relation to geology, hydrogeology, ground conditions and contaminated land.	Further information on the other works for MetroWest Phase 1 and the associated cumulative effects are presented in Section 8.8 and in Appendices 18.1 and 18.2 in the ES Volume 4 Technical Appendices (DCO Document Reference 6.25) regarding cumulative effects.
	Paragraph 3.54. The study area needs to be defined sufficiently to include the risk of effects beyond the red line boundary, for example due to the migration of contaminants.	The study area has been designed to include the risk of effects beyond the red line boundary, see paragraph 10.3.6.
	Paragraph 3.56 identifies activities reported in the Scoping Report as not likely to result in impacts on geology, hydrogeology, ground conditions and contaminated land. Paragraph 3.57 states that evidence needs to be provided to justify why these activities would not have an impact. The ES should describe the surveys / investigations undertaken to inform the assessment and support the conclusions.	Activities which may impact ground conditions have been evaluated, see Section 10.3 methodology and Section 10.6 assessment of effects.
	Paragraph 3.58. The assessment needs to address the concerns of the Coal Authority regarding any components of the project within the defined coalfield. It should also address concerns of the Environment Agency regarding the potential for changes in silt to cause pollution of watercourses.	A Coal Authority search was undertaken and mitigation proposed. See paragraphs 10.3.9, 10.4.4 and 10.4.35. The effects of drainage on watercourses is dealt with in Chapter 17

Table 10.3: Summary of consultation responses

Organisation and date	Summary of response	Consideration within ES
		Water Resources, Drainage and Flood Risk (DCO Document Reference 6.20).
	Paragraph 3.59 states that the assessment should consider the potential impacts on geology, hydrogeology, ground conditions, and contaminated land from widening of Avon Road underbridge, including impacts from any piling on underlying geology. Where piling works are proposed close to existing structures the ES should assess whether these might be affected by changes in the stability of land.	The works include a temporary earthworks cut to install retaining walls, partial excavation and benching of the existing earthworks and piling for a king post wall. The ground investigation undertaken to date did note some contamination at Avon Road Bridge, most notably asbestos, see paragraph 10.6.10 and Appendix 10.2 (DCO Document Reference 6.25). Detailed design will be undertaken at Governance for Railway Investment Projects ("GRIP 5").
	Paragraph 3.60 states that the ES should describe the methods to assess contamination present in the ballast and the results of this work. The measures proposed to remediate or address contaminants within the site should be discussed and agreed with the relevant consultees (e.g. the Environment Agency) and described in the ES. The potential impacts from implementing any proposed remediation measures should also be assessed.	Trackbed investigations undertaken to date indicate contamination by organic matter and pollutants. Chapter 4 Description of the Proposed Works (DCO Document Reference 6.7) identifies options for handling ballast, all of which envisage taking all removed ballast off-site to one of Network Rail's recycling centres, where it will be treated prior to re-use elsewhere or final disposal in accordance with Network Rail's standard procedures. Consequently, no further impact assessment has been undertaken on potential impacts or remedial measures.

Table 10.3: Summary of consultation responses

Organisation and date	Summary of response	Consideration within ES
The Coal Authority	The proposed works at Ashton Gate Level Crossing and Barons Close Pedestrian Crossing would be located within the defined coalfield and accordingly due consideration should be afforded to ground conditions and the potential for unstable land to be present. The Coal Authority has records of recorded mine entries in the vicinity and likely presence of historic unrecorded underground coal mining at shallow depth. The Authority considers that further consideration of ground investigations should apply to this potential area of coal mining legacy.	The DCO Scheme design comprising highway works on Winterstoke Road and a new pedestrian and cycle ramp between Ashton Vale Road and Ashton Road will not require further assessment for coal mining risk, see paragraphs 10.4.4,10.4.35 and 10.4.36.
Environment Agency	There is potential for contamination of controlled waters due to the mobilisation of historical contamination. Dealing with contamination on an *ad hoc* basis during construction may result in the unexpected disturbance of contaminants and the subsequent contamination of controlled waters. Prior site investigation and the preparation of an appropriate strategy for the management of contaminated land would reduce any potential impacts on controlled waters.	This is discussed in Section 10.4 baseline and 10.6 assessment of effects.
Public Health England	Details of any hazardous contamination present on site (including ground gas) should be included as part of the site condition report.	This is discussed in Section 10.4 baseline and 10.6 assessment of effects.
	Emissions to and from the ground should be considered in terms of the previous history of the site and potential of the site to give rise to issues once operational. Public health impacts of ground contamination and/or migration of material off-site should be assessed and control and mitigation measures should be outlined.	Section 10.6 includes an assessment of likely significant effects relating to ground contamination and human health.

Table 10.3: Summary of consultation responses

Organisation and date	Summary of response	Consideration within ES
	The assessment should consider effects from existing ground contamination, new ground contamination caused by the development and impacts associated with potential re-use of soils (on or offsite) and waste soils (e.g. disposal offsite).	This is discussed in Section 10.4 baseline and 10.6 assessment of effects. The development will be designed to ensure no new ground contamination is caused. At present very little re-use of soils is planned. Waste soils are mostly track ballast which will be cleaned and recycled by Network Rail.
Informal micro-consultation on DCO scheme boundary (22 June to 3 August 2015)		
The Coal Authority	Recorded mine entries and likely historic unrecorded coal mining at shallow depth in urban Bristol. Legacy risks should be considered within the ES.	The ground conditions were taken into account in the design of the highway works at Ashton Vale.
Formal Stage 2 Consultation (23 October to 4 December 2017)		

Table 10.3: Summary of consultation responses

Organisation and date	Summary of response	Consideration within ES
North Somerset Council	No comments on this topic.	No action.
Bristol City Council	In response to the PEI Report, the LPA's Land Contamination Officer supported the proposal for reused of ballast and noted that a site waste management plan was being prepared for the DCO application The Officer expressed concern for the protection of watercourses from pollution during construction, and while these will be subject to consents from the Environment Agency, more details would be required on these. Measures to mitigate pollution during the construction phase as part of a Construction Environmental Management Plan ("CEMP"), subject to consents form the Environment Agency, should be prepared and submitted with the DCO application. Overall the risks to human health are low during and after development, however consideration of the risk of pollution of the sensitive designated sites along the River Avon and of the watercourse should be included within the ES. The PEI Report only refers to historic landfill for the Bristol area, while much of the Parson Street to Ashton Gate Underpass area has been subject to a variety of historical uses. This should be updated.	It is no longer proposed to reuse the ballast on site, but remove it for treatment (see Section 10.6). Guidelines for a Site Waste Management Plan ("SWMP") are included in the ES Appendix 4.2 Master CEMP (DCO Document Reference 8.14). The SWMP will be prepared by the contractor. Guidance on the protection of watercourses is provide in the ES Appendix 4.2 Master CEMP (DCO Document Reference 8.14). Specific arrangements will be agreed with the EA as part of the permitting regime. Appendix 10.2 (DCO Document Reference 6.25) provides further details of the potential impacts on human health following the source-pathway-receptor model. Information on the Ashton Vale area has been updated in Section 10.4 and in Appendix 10.2 (DCO Document Reference 6.25). The works required along the section of the rail between Ashton Junction and Parson Street Junction will be undertaken under network Rail's permitted development rights and does not form part of the DCO application.

Table 10.3: Summary of consultation responses

Organisation and date	Summary of response	Consideration within ES
National Trust	The new passenger line runs adjacent to the National Trust Leigh Woods site and we are concerned that the removal of trees by Network Rail will cause wind blow to our own trees. We are also concerned of increased liability on the Trust for rockfalls onto the line. At the moment we manage this appropriately through rope works and surveys, fences and laser scanning the rock faces. We would ask for further information on Network Rail's responsibility for managing falls onto the line.	The risk of wind throw will be taken into consideration prior to the removal of trees along the railway. Appendix 9.11 Avon Gorge Vegetation Management Plan (DCO Document Reference 8.12) sets out the proposals for positive management of habitats on Network Rail land within the Avon Gorge Woodlands SAC, including land adjoining the National Trust's holdings. MetroWest Phase 1 and Network Rail are in discussion with the National Trust about the proposed geotechnical solutions for cliff instability. Further details are within Chapter 4 Description of the Proposed Works (DCO Document Reference 6.7), Appendix 4.4 Summary of Works in the Avon Gorge Woodlands Special Areas of Conservation ("SAC") (DCO Document Reference 6.25) and the Construction Strategy (DCO Document Reference 5.4). We do not consider the additional trains would lead to a greater geotechnical risk.

Definition of the Study Area

The study area for the baseline data collection for contaminated land has been based on a 500 m boundary from the railway, which is considered wide enough to capture the risk of horizontal contamination beyond the construction footprint itself and potential impacts on abstraction sources based on professional judgement. The study considers impacts to receptors beyond the DCO Scheme red line boundary. The Construction Industry Research and Information Association ("CIRIA") report No. 522 *Contaminated Land Risk Assessment. A Guide to Good Practice* (CIRIA 2001) states in *Section 4.3.1 – "….it should be recognised that the effects of contamination could be apparent off site; alternatively contamination originating from an off-site source could impact upon the study site. The Phase 1 study should be flexible enough to allow for collection of information beyond the site boundaries as appropriate*"). Guidance for the Safe Development of Housing on Land Affected by Contamination (Environment Agency, 2008) recommends that in most cases obtaining historical data within 250 m of the site boundary is sufficient (page 24). The proposed study area of 500 m is a conservative but sensible approach in the context of the DCO Scheme, taking into account the distance over which contamination can migrate.

10.3.5 The study area for source protection zones ("SPZ") was extended to 2 km to reflect the public health risk of contamination to groundwater drinking water supplies.

Key Receptors

10.3.6 The key receptors are considered to be:

1. Nearby residents, site workers and end users (passengers and staff);
2. Groundwater and surface waters;
3. Geological SSSIs (Ham Green and Avon Gorge); and
4. Buildings and infrastructure (both on and off site).

Defining the Baseline

10.3.7 The following sources of information have been used in determining the likely ground conditions:

1. British Geological Survey ("BGS") online mapping tool;
2. Environment Agency "What's in your backyard" online data warehouse;
3. Coal Authority Interactive Map Viewer;
4. BGS Online Lexicon;
5. Landmark EnviroCheck report covering Portishead, the disused section of the railway and parts of Pill;
6. Coal Authority data held on their website;
7. MAGIC online data (www.magic.gov.uk); and
8. Engineering studies, including ground investigation at Portishead Station, Pill Station, Avon Road Bridge.

9. Previous work for Bristol City Council MetroBus Scheme, around the Ashton Gate Junction area. This includes a Preliminary Sources Study Report, which collates desk study, coal mining risk assessments and ground investigation data for this area.

10.3.8 These sources of information have been summarised and interpreted, including an examination of source-pathway-receptor conceptual model, in Appendix 10.2 (DCO Document Reference 6.25).

Assessment of Construction Impacts

10.3.9 The majority of impacts related to ground conditions are predicted to occur during the construction phase. Baseline conditions are examined, and the construction options presented in Network Rail's Construction Strategy (DCO Document Reference 5.4) and in Chapter 4 Description of the Proposed Works (DCO Document Reference 6.7) are assessed using the significance criteria below. It should be noted that the majority of ground conditions impacts are mitigated as part of the DCO Scheme design, for example if contamination is encountered, it is assessed and, if required, remediated as part of the works.

Assessment of Operational Impacts

10.3.10 As agreed by the Secretary of State in paragraph 3.28 of the Scoping Opinion, the operational impacts of the DCO Scheme on Geology, Hydrogeology, Ground Conditions and Contaminated Land have been scoped out. Following construction, there will be no material changes in the underlying soils and geology. While there is a risk of contaminants from the trains accidently discharging onto the track, any effects on the underlying geology from pollutants entering the ground would be managed through standard maintenance practices. This is the case for all railways.

Assessment of Decommissioning Impacts

10.3.11 Chapter 4 Description of the Proposed Works (DCO Document Reference 6.7) explains that consideration has been given to likely significant effects arising during the decommissioning phase. However, owing to the nature and life span of the proposed development, the regulated process of any closure in the future, which would be overseen by the Office of Rail and Road, and there being no reasonably foreseeable decommissioning proposals such that likely impacts could be identified and assessed, these effects are not considered further in this chapter.

Assessment of Cumulative Effects

10.3.12 As this Chapter is concerned only with the identification and assessment of likely significant effects during construction, the potential for cumulative effects in respect of other schemes is restricted to this phase of the DCO Scheme and no other schemes have been identified that could, with the DCO Scheme give rise to likely significant effects on geology, hydrogeology, ground conditions and contaminated land. The potential for any likely significant effects arising in combination with other works for the full MetroWest Phase 1, namely Parson Street Junction (including Liberty Lane Sidings), Parson Street Station, the Bedminster Down Relief Line and Bathampton Turnback, are considered in Section 10.8.

10.3.13 Severn Beach / Avonmouth Signalling works are also part of MetroWest Phase 1, but these works have been completed and so are not included in this cumulative effects assessment, as they are considered as part of the baseline.

Use of Significance Criteria

10.3.14 The assessment has followed a two stage approach for defining the environmental impacts and determining the significance of effect relating to Ground Conditions and Contamination. This been undertaken by comparing the Baseline CSM / Preliminary Risk Assessment with the Construction and Operational Phase CSMs and Preliminary Risk Assessments.

10.3.15 The impact assessment has taken into account those remediation measures that form an integral of the development process where they are known to be effective and any associated risks will be managed and controlled through the requirements of the DCO. This CSM comparison approach therefore allows any changes in land contamination status during construction of the proposed development to be identified together with the remediation measures required to reduce the level of risk.

10.3.16 For example, land that presents a very low contamination risk under baseline site conditions which subsequently becomes a high or very high risk during construction or operation of the proposed development would equate to a 'Major Adverse Effect' (or a rise of 4 or 5 risk levels).

10.3.17 The risk level is based on the risk matrix presented in Table 10.4 and the relevant tables and definitions provided in Appendix 10.1 in the ES Volume 4 Appendices (DCO Document Reference 6.25).

Table 10.4: Comparison of consequence against probability and related categorisation of risks

		Consequence or risk			
		Severe	**Medium**	**Mild**	**Minor**
Probability of risk	***High Likelihood***	Very High Risk	High Risk	Moderate Risk	Moderate/Low Risk
	Likely	High Risk	Moderate Risk	Moderate/Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate/Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate/Low Risk	Low Risk	Very Low Risk	Very Low Risk

10.3.18 The impact assessment is reported as either beneficial, neutral or adverse effects and consideration of whether they are major, moderate or minor. Table 10.5 presents an explanation of these criteria.

Table 10.5: Significance of effect criteria – ground conditions and contaminated land risk

Significance criteria	Definition
Major adverse effect	An increase in contamination risk from the existing baseline conditions of 4 or 5 risk levels in the risk matrix, for example, land that has a very low contamination risk in the baseline becomes a high or very high risk. Land that does not meet the statutory definition of Contaminated Land in the existing baseline becomes capable of being determined under Part 2A. Ground is considered to be at serious risk of collapse because of mine workings or significant instability and is unsafe. Would not be able to support a structure or collapse would result in structural failure. Material direct impact on a geological SSSI.
Moderate adverse effect	An increase in contamination risk from the existing baseline conditions of 2 or 3 risk levels in the risk matrix, for example, land that has a low contamination risk in the baseline becomes a moderate or high risk. Land that does not meet the statutory definition of Contaminated Land in the existing baseline becomes capable of being determined under Part 2A. Ground is considered to be at moderate risk of collapse because of mine workings or significant instability and is unsafe. The ground would not be able to support a structure.
Minor adverse effect	An increase in contamination risk from the existing baseline conditions of 1 risk level in the risk matrix, for example, land that has a low contamination risk in the baseline becomes a moderate/low risk. Ground is considered to be at a slight risk of collapse because of mine workings or localised instability. Would not be able to support a structure without ground improvement.
Neutral effect	No change in contaminated land or geotechnical risks.
Minor beneficial effect	A reduction in contamination risk from the existing baseline conditions of 1 risk level in the risk matrix, for example, land that has a moderate/low contamination risk in the baseline becomes a low risk. Localised improvement of stability of slopes.

Table 10.5: Significance of effect criteria – ground conditions and contaminated land risk

Significance criteria	Definition
Moderate beneficial effect	A reduction in contamination risk from the existing baseline conditions of 2 or 3 risk levels in the risk matrix, for example, land that has a high contamination risk in the baseline becomes a moderate/low or low risk. Land that meets the statutory definition of Contaminated Land in the existing baseline is no longer capable of being determined under Part 2A. Ground which was previously at moderate risk of instability or collapse is now considered stable.

10.3.19 Where unacceptable risks are identified, these are appropriately mitigated through design and/or the development of a remediation strategy and its subsequent validation. The residual risks are determined and assessed based on the likelihood and consequence of their occurrence.

10.3.20 The significance of the effects of the DCO Scheme on ground conditions has been completed for this ES based on available information. There are plans to undertake further testing to determine the potential contaminated land at the proposed construction compounds to be able to define the baseline conditions. However, as these sites are agricultural land which have not been developed previously, the sites are not expected to be contaminated.

10.3.21 Effects are considered to be significant in terms of the environmental impact assessment Infrastructure Planning (Environmental Impact Assessment Regulations 2017 (“the EIA Regulations”) if they are evaluated as being of moderate or major significance.

10.4 Baseline, Future Conditions and Value of Resource

Geology

10.4.1 The geological sequence underlying the DCO Scheme is described in Table 10.6.

10.4.2 The Portishead to Pill section of the Portishead Branch Line lies on sediments of the Mercia Mudstone Group for the most part overlain by Tidal Flat Deposits. The Mercia Mudstone Group comprises dominantly red, less commonly green-grey, mudstones and subordinate siltstones with thin beds of gypsum/anhydrite and sandstones also present. Tidal Flat Deposits comprise clay with sand, gravel and peat. There are deposits of artificial ground along the section of the route within Portishead.

Table 10.6: The geological sequence underlying the DCO Scheme

Period	Strata	Description
Triassic	Mercia Mudstone Group	Dominantly red, less commonly green-grey, mudstones and subordinate siltstones. Thin beds of gypsum/anhydrite widespread; sandstones are also present.
Carboniferous	Pennant Sandstone Formation	Green-grey and blue-grey sandstones with thin mudstone/ siltstone and seatearth interbeds and mainly thin coals.
	South Wales Middle Coal Measures Formation	Grey coal-bearing mudstones/siltstones, with seatearths and minor sandstones.
	Cromhall Sandstone Formation	Brown and red fine- to coarse-grained quartzitic sandstone with subordinate mudstone and limestone.
	Oxwich Head Limestone Formation	Thick bedded fine- to coarse-grained, limestones. Units of dark grey, irregularly bedded skeletal packstones with shaly partings are developed at intervals.
	Clifton Down Limestone Formation	Mudstones and limestones. Sandy limestone at base in Bristol area.
	Goblin Combe Oolite Formation	Massive, medium to coarse grained oolitic limestone with lenses of crinoidal limestone.
	Clifton Down Mudstone Formation	Thin- to medium-bedded calcite and dolomite mudstones. A unit of crinoidal and oolitic limestones occurs in the middle of the Formation, and a 15 m-thick unit of oolitic and crinoidal limestone occurs in the upper part of Formation.
	Gully Oolite Formation	Medium- to thick-bedded oolitic grainstone with fine-grained skeletal packstones. Locally in the north Bristol to Tytherington area 6-21 m of grey crinoidal limestones, the Sub-Oolite Bed, occurs at the base of the Formation.
	Black Rock Limestone Subgroup	Thin to thick-bedded fine to coarse grained packstones with subordinate thin beds of argillaceous packstone and mudstone.
	Avon Group Mudstone and Limestone	Interbedded grey mudstones and thin- to medium-bedded skeletal packstones with one to several thick units of ooidal and skeletal grainstones. Thin units of calcite mudstone and mudstone locally present. Sparse thin ironstones.

Table 10.6: The geological sequence underlying the DCO Scheme

Period	Strata	Description
	Avon Group Limestone	Interbedded grey mudstones and thin- to medium-bedded skeletal packstones with one to several thick units of ooidal and skeletal grainstones. Thin units of calcite mudstone and mudstone locally present. Sparse thin ironstones.
	Shirehampton Formation	Interbedded, thin- to medium-bedded red, green and grey mudstone, limestone, sandstone and siltstone with a thick red crinoidal limestone.
Devonian	Portishead Formation	Red-green mudstones and marls, red siltstones and red-yellow, hard, fine-grained quartzose sandstones, with conglomerate locally.
	Black Nore Sandstone Formation	Sandstones

10.4.3 The Portbury Freight Line crosses River Terrace Deposits comprising sands and gravels and Head deposits comprising clay, silt, sand and gravel around Pill and crosses an area of alluvial clays and silts associated with a small stream tributary of the River Avon north of Ashton Gate.

10.4.4 The Portbury Freight Line crosses coal bearing strata the surface along the southernmost section around Ashton Gate (which lies within the Red Line Boundary for the DCO Scheme). An old coal pit is marked on the 1884 Ordnance Survey ("OS") map, some 300 m to the west from the railway which survives on mapping editions up to 1955 when the area is developed as allotments. At Ashton Gate the earliest OS map dated 1886 shows Frayne's Colliery as being disused and a colliery associated with the Ashton Vale Ironworks to the north which remains until sometime in the 1940s. Given the long-established nature of the railway no impacts are considered from mining.

10.4.5 The Portbury Freight Line passes through a railway cutting at Ham Green (Figure 10.1) which has been designated as a SSSI due to the geological sequence exposed in the cutting. The citation for the SSSI is reproduced below.

"The cutting shows a section through Pleistocene sediments, which include two to three metres of red-brown, gritty, stony silts, with abundant Greensand chert and other far-travelled rock-types. These deposits appear to be heavily-cryoturbated terrace gravels or presumed fluvial origin, although a fluvio-glacial origin has also been suggested. Such deposits cap a number of flat-topped hills at around 30 metres O.D. A number of Acheulian handaxes have been found in the area, mostly in the early part of this century. This site is one of the last good exposures of "high" terrace deposits along the Bristol Avon. This site's great research potential and its fine exposures make it one of considerable importance."

10.4.6 Ham Green SSSI is also designated for its geological interests as it hosts a complete local succession of the Carboniferous Limestone. The classic work of Vaughan and Reynolds on the marine fossils of the limestones, and the adoption of the sections as the standard for the 'Avonian', makes this one of Britain's historic geological sites, important for both the study and development of stratigraphy. The section spans (with gaps) the entire Tournaisian and Visean series (Courceyan-Brigantian stages), and also includes the Old Red Sandstone Portishead Beds below.

10.4.7 Natural England published their views on the management of this SSSI on line, and this states, "*Activities which can cause damage to static geomorphological interest features include developments, coastal protection schemes, removal of material and tree planting. Collecting of geological specimens may also be damaging on some of these sites. A precautionary approach should be adopted before removing or allowing any material to be removed or undertaking any other activity which may cause damage*."

10.4.8 The Portbury Freight Line also passes through the Avon Gorge (shown on Figure 10.1) which is designated as a SSSI primarily for reasons of ecology but part of the citation is reproduced below:

"The Gorge has natural cliffs and quarry exposures of Carboniferous limestone, which are of great geological interest…"

10.4.9 The Avon Gorge affords one of the best opportunities for the study of Carboniferous rocks in Britain, studies which have continued since the early 19th century.

10.4.10 According to Natural England, operations likely to damage the Avon Gorge SSSI include:

- Construction, removal or destruction of roads, tracks, walls, fences, hand-stands, banks, ditches or other earthworks, or the laying, maintenance or removal of pipelines and cables, above or below ground
- Clearance of boulders, large stones, loose rock or scree and battering, buttressing or grading rock-faces and cuttings, infilling of pits and quarries.

10.4.11 Two Regionally Important Geological and Geomorphological Site ("RIGS") have been designated by the locally authorities within 500 m of the DCO Scheme (Figure 10.1). North Somerset District Council has designated an area centred on the Ashton Estate as a RIGS which extends eastwards as far as the Rownham Plantation. Bristol City Council has designated part of the Avon Gorge as a RIGS. However, the DCO Scheme does not cross either designation.

10.4.12 The SSSIs are accorded a high value and the RIGS are accorded a medium value.

Hydrogeology

10.4.13 The Mercia Mudstone is classified as a Secondary B aquifer - predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.

10.4.14 The Carboniferous sediments are classified as a Principal aquifer; these are layers of rock having high permeability and can provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.

10.4.15 The Devonian sandstones are classified as Secondary A aquifers; permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

10.4.16 The River Terrace Deposits are classified as Secondary A aquifers and are likely to provide limited water resources due to their limited catchment, being isolated over less permeable lithologies.

10.4.17 There are no SPZ along or within 2 km of the DCO Scheme.

Land Use History

10.4.18 Historical mapping and environmental regulator information obtained for the disused railway and the potential sources of contamination are summarised on Figure 10.1.

10.4.19 Key potential sources of contamination (starting from Portishead) have been identified as follows:

- A small gasworks, nail factory, paper bag factory, phosphorus factory – all located outside the footprint of the DCO Scheme and since redeveloped, so not considered further;
- Priory Farm Landfill located between the A369 and the disused railway. The railway forms the northern boundary of the landfill. This is an historical landfill operating in the late 1980s;
- Former coal mining activities, and various former mills and metal works in the Ashton Vale area;
- Landfills near Ashton Gate (Bedminster Down, South Liberty Lane Brickworks, Cala Trading Estate, Viridor Long Ashton, Land at Parsonage Farm, Phase 2 of Landfill site at Parsonage Farm, and Phase 3 landfill at Ashton Vale);
- Track ballast – elevated levels of lead have been identified, particularly in the disused section of track;
- Portishead Station and Car Park site – elevated levels of contaminants (lead and chloromethane) and leachable metals have been identified in soils. There is some minor contamination of groundwater (ammoniacal nitrogen and boron). Additionally, elevated levels of carbon dioxide gas above long term exposure limits (“LTEL”) and short term exposure limits (“STEL”) guidelines has been identified from Made Ground and underlying strata at the site of the proposed new Portishead Station. The site is close to the power station ash landfill, located to the north of the railway, east of Haven View;
- Avon Road Bridge – elevated levels of polycyclic aromatic hydrocarbons (“PAH”) contaminants and leachable metals have been identified in soils. Asbestos has also been detected; and

- Pill Station site – elevated levels of leachable metals have been identified in soils. Some metal and PAH contamination has been identified in groundwater.

Route Section

10.4.20 The railway corridor was established along its present route in the 1860s, prior to the first edition of the OS map in 1884. The historic maps show that no changes to the railway route have occurred since that time. However, the railway services were stopped, with the line closed to passenger services in 1964 and for freight in 1981. The Portbury Freight Line was re-opened in 2002 to Portbury Dock for freight only.

10.4.21 The Priory Farm Landfill, is located to the south of the railway, bounded to the west by Sheepway Road and to the south by the A369. The EnviroCheck report indicates that it may have received inert and non-hazardous wastes (although these may not be consistent with the modern definitions of wastes). The Environment Agency website indicates that the Priory Farm Landfill had leachate and gas controls.

10.4.22 Another landfill, Elm Tree Farm, is located in Sheepway approximately 250 m to the north of the disused railway. Housing is present between the landfill and the railway.

10.4.23 Between 1850 and 1949, there was open cast coal mining around the proposed site of pedestrian and cycle ramp Ashton Vale Road. The 1894 OS map shows there was a colliery, shaft, an iron works and a tank between 50 m and 150 m from the site. There was also disused colliery approximately 150 m south of the site (Frayne's Colliery) and an old coal pit approximately 500 m south of the site in Aston Vale. The Bristol and Portishead Railway is shown running through Ashton Vale. From the 1887 and 1904 – 1905 OS maps, there was a smithy 100 m northeast of the site on Ashton Road, a nail works 100 m southeast of the site and rolling mills 200 m southeast of the site in the area of Ashton Gate. The 1930 OS map shows tanks within 50 m of the site, a brick and tile works in the area of Ashton Vale Road at 250 m west of the site and saw mills with timber yards 100 m to the south in the area of the present day Cala Trading Estate. Warehouses and stores developed in this area from the 1950s to present. The Envirocheck report (Appendix 10.2, DCO Document Reference 6.25) indicates infilled land in the area of the open cast coal mining which extends from the site and westwards for up to 280m. The site today is surrounded by commercial and industrial properties of the Cala Trading Estate.

10.4.24 There are three historical landfills near on Ashton Vale Road between 10 m and 450 m of the site. There is no information available about the Cala Trading Estate landfill located closest to the site on Ashton Vale Road regarding input dates and waste types accepted. 'Phase 2 landfill Site at Parsonage Farm' and 'Phase 3 landfill site at Ashton Vale' at 450 m west of the site received inert, industrial and commercial waste types between the early 1980s and 1991.

10.4.25 A trackbed investigation was carried out in 2014, along the trackbed of the disused railway between Portbury Dock Junction and Portishead to assess the current condition of the trackbed and to confirm the depth to the underlying natural ground beneath the track. 24 samples were collected and

underwent chemical testing. A subsequent trackbed investigation was undertaken between September and August 2015 throughout the DCO Scheme whereby 108 samples were taken from within the 4ft of the existing track. A total of 35 samples were also taken from shallow and deep trial pits within 4ft of the existing track. Selected samples were scheduled for chemical testing.

10.4.26 The results of the chemical analysis have been compared to Category 4 Screening Levels ("C4SL") and Suitable for Use Levels ("S4UL") (unless otherwise stated) for a Public Open Space (not near residential) scenario (see Appendix 10.2, DCO Document Reference 6.25). The only exceedances are for lead, which was recorded up to 2066 mg/kg compared to the C4SL of 1300 mg/kg. In the disused section of track, approximately 29% of samples exceeded the C4SL, whereas less than 2% exceeded in the rest of the trackbed.

Portishead

10.4.27 Portishead Station was opened in 1867 and demolished in 1954 to make way for the Portishead B Power Station. A new railway station was built where the Waitrose petrol station now stands, but the railway station was closed in 1964 and demolished. The proposed location of the Portishead station is to the east and requires a realignment of Quay's Avenue with a new roundabout where it connects at Harbour Road.

10.4.28 The 1884 edition of the OS map shows the railway to the port at Portishead already present and the land between this and the town centre largely undeveloped and low lying. An inlet of the estuary approaches to the north. There is a gas works noted to the north and a nail works to the south as well as the various dock related activities to the north. Between 1931 and 1968 the area was substantially modified with infilling of the inlet and establishment of the road network including Harbour Road to the north. The new development area was used for railway sidings with cranes. By 1974, some of the current commercial buildings along Old Mill Road were established. By 1987, the sidings were gone and the rail connections to the docks were much reduced with further commercial development along Old Mill Road and Harbour Road. Between 1987 and 1999 the last rail connections to the docks were removed and much of the industrial activity in the area ceased. Redevelopment of the area was well established by 2003 and development continued through to 2005 when the current Waitrose building and car park were completed.

10.4.29 The area to the west of Quays Avenue bounded by Wyndham Way to the south, the railway to the north, and a drainage ditch to the west, was marked as a "depot" between 1970 and 1999 on the OS mapping. It is thought that this is the site of a fuel storage depot, which has since been cleared and remediated to make way for redevelopment.

10.4.30 To the east of Quays Avenue, the 1884 OS edition shows the railway as established with the surrounding area divided by field boundaries, which remained unchanged until 1961. The 1968 OS edition shows land raising in cells either side of the drainage ditch, one of which is labelled as a refuse tip. The 1974 OS edition labels these as slag heaps with the 1987 OS edition showing "Tips Disused". Aerial imagery from 2003 shows the current

road network being constructed with its completion by 2005 and construction of the residential housing to the north underway.

10.4.31 During a site visit in March 2014, the proposed station site within the railway boundary was observed to be largely overgrown with trees and bushes. The proposed car park area comprises a raised area of grassland along Quays Avenue and Harbour Road. There was no visual evidence of any contamination present. Evidence of a ground investigation was seen within the proposed car park area with three gas monitoring standpipes and a number of trial pits. The made ground at the exposed surface of the trial pits comprised a clay and sand matrix with gravel and cobbles of bricks, sandstone and slag. It is not known who commissioned this ground investigation.

10.4.32 Ground Investigation found Made Ground of approximately 1 m thickness. The results of the chemical analysis have been compared to C4SLs and S4ULs (unless otherwise stated) for a Public Open Space (not near residential) scenario. Slight exceedances are noted for lead and chloromethane (0.013 mg/kg). Leaching test results also recorded slight exceedances of Environmental Quality Standard ("EQS") values.

10.4.33 Ground gas monitoring showed carbon dioxide concentrations in BH1 and BH2 exceed the long-term exposure limits and short-term exposure limits. The low (mostly zero) gas flows indicate that whilst carbon dioxide exceeds these limits they are unlikely to present a material risk.

Pill Station and Avon Road Bridge

10.4.34 Pill Station was opened in 1867 and closed in 1964. The 1881 OS map shows the railway line in place and a station located within the village. By 1915 Monmouth Road has been built to the north of the railway with housing. Further residential development occurred between 1938 and 1955 continuing until the village reached its current extent sometime between 1970 and 1981. The original station is no longer in use.

10.4.35 The proposed car park to the west of the station is located on former railway sidings / goods yard. These appear on the 1915 OS edition consisting of a single track off the main line with a number of buildings.

10.4.36 The car park site comprises a generally flat area paved with macadam at the entrance and then aggregate. No significant contamination issues have been observed, which will be confirmed by site investigation. The former station area is not accessible from the road above but does not appear to have any significant issues with regards contamination.

10.4.37 Ground Investigation found Made Ground of approximately 2.2 m thickness. The results of the chemical analysis have been compared to C4SLs and S4ULs (unless otherwise stated) for a Public Open Space (not near residential) scenario. Slight exceedances are noted. Leaching test results also recorded slight exceedances of EQS values. Asbestos in the form of loose chrysotile fibres was detected in one sample (at Avon Road Bridge in Pill) at a concentration of 0.019% weight for weight ("w/w") from the foundation trial pit FDTP2. Asbestos was not detected in the other samples analysed.

10.4.38 Ground gas monitoring showed carbon dioxide concentrations and carbon monoxide exceed the LTELs and STELs. The low (mostly zero) gas flows

indicate that whilst carbon dioxide exceeds the these limits they are unlikely to present a material risk.

Potentially Contaminative Land Uses

10.4.39 The route of the DCO Scheme was an established railway corridor for a considerable period and as such there is potential for the underlying ground to be affected by contaminants associated with railway use such as hydrocarbons and asbestos. The existing ballast along the disused section between Portishead and Pill is no longer suitable and will have to be lifted and replaced with new stone. Some of the ballast is also contaminated and will require treatment prior to disposal or re-use elsewhere.

10.4.40 At Portishead the new station will be located on made ground, which may be contaminated due to historic land use. It is unlikely that any contamination would be so significant as to prevent development given the likely structures involved, namely, a station building, platform, car parking and pedestrian and cycle path to the town centre. However, given alterations are required to Quays Avenue, there is more potential to encounter contamination, given the proximity to the former fuel storage depot.

10.4.41 At Pill Station the potential car parking area may be affected by residual contamination associated with use of the site as sidings.

10.4.42 The renovation of the disused railway corridor will require the existing ballast to be lifted and new ballast to be laid, as the existing ballast is no longer physically suitable (railway ballast has to conform to a grading specification). The ballast will also be replaced on the freight line. Three options (one of which has four variants) have been considered for the temporary storage and removal of the ballast. These are described in the ES Chapter 4 Description of the Proposed Works (DCO Document Reference 6.7). Under all the options considered, all ballast will be removed and taken to one of Network Rail's recycling plants.

Coal Mining and Slope Stability

10.4.43 The proposed works at Ashton Gate Level Crossing and Barons Close Pedestrian Crossing are located within the defined coalfield and accordingly due consideration should be afforded to ground conditions and the potential for unstable land to be present. The Coal Authority has records of recorded mine entries in the vicinity and likely presence of historic unrecorded underground coal mining at shallow depth.

10.4.44 The DCO Scheme will not require the closure of the Ashton Gate Level Crossing. The design consists of extension of the left turn flare lane on Winterstoke Road, optimisation of the Ashton Vale Road signals, upgrade of signals to Microprocessor Optimised Vehicle Activation, and provision of a ramp to the north of the level crossing to connect pedestrians and cyclists between Ashton Vale Road and Ashton Road. With these modifications, the DCO Scheme is unlikely to need further assessment for coal mining risk.

10.4.45 Cliff instability is a known problem within the Avon Gorge, with individual stones and boulders moving downslope to occasional rock falls. On occasions failing stones have struck the freight trains travelling along this line. Network Rail periodically inspects the railway corridor through the gorge and investigates incidents of rock falls. They undertake "stone picking" exercises to reduce the risk of rock fall. This involves partial

removal of the vegetation on the cliff face, inspection and a rock combing exercise to remove all potentially dangerous material. Additional geotechnical stabilisation measures are considered where needed.

10.5 Measures Adopted as Part of the DCO Scheme

10.5.1 As described in Chapter 4 Description of the Proposed Works (DCO Document Reference 6.7), a number of measures have been included as part of the design of the DCO Scheme in order to minimise certain environmental effects. This includes:

- careful designing of the project to ensure key receptors are avoided where possible;
- construction adopting best practices techniques, which are introduced in the Code of Construction Practice ("CoCP") (DCO Document Reference 8.15) and presented in more detail in the Master CEMP (DCO Document Reference 8.14); and
- compliance with regulatory and legislative regimes as required by law.

10.5.2 The DCO includes a requirement for a written scheme to address the contamination of any land, including groundwater, within the Order limits, which will include an investigation and assessment report. The written scheme and assessment report will require approval by the planning authority after consultation with the EA and Local Authorities.

10.5.3 The ES Chapter 4 Description of the Proposed Works (DCO Document Reference 6.7) sets out the details of the measures that have been incorporated as part of the DCO Scheme and which are assessed within each of the topic chapters. Appendix 4.4 Summary of Works in the Avon Gorge Woodlands SAC (DCO Document Reference 6.25) details all the proposed works associated with geotechnical stability (rock falls) for the DCO Scheme. Geotechnical slope stabilisation works are required on eight rock faces on Network Rail land and a further seven rock faces on third party land. The type of work required involves partial vegetation clearance and the removal of loose stones and rocks, some rock bolting, and three new catch fences 2 m high and between approximately 30 m and 160 m long. All of the sites lie within the Avon Gorge Woodlands SAC and SSSI.

10.5.4 The following railway embankment and cutting slopes will require earthwork solutions for the DCO Scheme (see Figure 4.2 in Volume 3 of the ES).

- Pill Station Cutting Down 126 mi 9.5 ch to 126 mi 15.5 ch (miles and chains)
- Hardwick Road Cutting Down 126 mi 15.5 ch to 126 mi 26 ch
- Avon Road Embankment Down 126 mi 27 ch to 126 mi 33 ch
- Avon Road Embankment Up 126 mi 27 ch to 126 mi 33 ch
- Mount Pleasant Embankment Down 125 mi 67 ch to 125 mi 63.7 ch

10.5.5 Network Rail has prepared a MetroWest 1 Construction Strategy for the DCO Scheme, which is presented in DCO Document Reference 5.4. This will be issued to contractor(s), together with the CoCP (DCO Document Reference 8.15) and the Master CEMP (DCO Document Reference 8.14). The appointed contractor(s) will develop the implementation construction

strategy within the framework provided by these documents. The construction strategy will be developed in detail once the contractor(s) have been appointed.

10.6 Assessment of Effects

10.6.1 A risk assessment of the baseline conditions and the DCO Scheme are presented in Appendix 10.2 Land Contamination Summary Report (DCO Document Reference 6.25).

Construction Phase

Portishead to Pill

10.6.2 The construction of the new railway along the disused corridor mainly comprises replacement of the ballast, minor modifications to existing earthworks and drainage, and very localised foundations for specific structures. Whilst some of the ballast is moderately contaminated, the removal of the ballast will follow Network Rail standards and based on the concentrations of contaminants encountered the works are considered very unlikely to cause contamination of local groundwater or surface water. As such, construction will have no impact on the underlying geology or hydrogeology in terms of regional and local flows or groundwater quality. There will be no impact on the railway from underlying ground conditions and the railway construction will not be sensitive to any residual contamination beneath the existing railway corridor. The baseline condition is assessed as **low risk** (considered **unlikely**, consequence **medium**). For the DCO Scheme, it is considered there is no change to this risk and therefore a **neutral effect**. Risks to construction workers and adjacent site users will be addressed by the site health and safety plan, CoCP and the CEMP.

10.6.3 The ballast that will be removed will be temporarily stored either beside the tracks or at a construction compound prior to removal for treatment and reuse at an off-site facility. It is likely that non-waste framework directive exemptions for the temporary storage at the place of production (which does not require registration) will be required. Note that the place of production is considered to be the DCO Scheme as a whole, including temporary construction compounds. Whilst the ballast is not grossly contaminated (mostly metal and some organic contamination) the storage will require management, including pre and post ground analysis, basal and covering layers and control of runoff. Currently there is no storage or ballast and therefore there is no risk. Assuming the storage will be managed as described above, the probability of risk is considered **unlikely** and the consequence **mild**, indicating a **very low risk** and a **minor adverse effect** (an increase of 1 level of risk when compared to the no risk for baseline).

10.6.4 Construction of the station at Portishead is on land that has residual contamination arising from historic land uses. The nature of the proposed development, being a relatively small station building and platforms, is such that it is not expected that the underlying ground conditions will have a material impact on construction and use of the building. Constraints relating to any contamination will be addressed through the project design. For example, further ground investigation and risk assessment, including piling risk assessments will be required. The baseline condition is assessed as

low risk (considered **unlikely**, consequence **medium**). For the DCO Scheme, taking into account further investigation and design it is considered there is no change to this risk and therefore a **neutral effect**.

10.6.5 Ground Investigations at Portishead Station and car park have shown there to be elevated concentrations of carbon dioxide. This is considered an unlikely probability with severe consequence, and therefore a moderate/low risk. However, standard industry practice measures, such as further investigation and control of access to excavations and gas alarms during construction will aim to eliminate this risk completely. This is considered a **neutral effect.**

10.6.6 A Wessex Water sewer passes under the proposed site of Portishead station. Piling works will be managed in such a way as to avoid the known location and route of the sewer, which will be protected by a transfer slab. Baseline is assessed as no risk. Rupture of the sewer during construction is considered **unlikely** and the consequences **mild**, leading to a **very low risk**, and is considered a **minor adverse effect** (an increase of 1 level of risk when compared to the no risk for baseline).

10.6.7 There is a disused Ministry of Defence oil pipeline under the proposed site for car park B. As there is no purge certificate available for this pipeline, it will be treated as a live pipeline during construction with standard industry practice measures taken to avoid a pollution incident. The precise location and route of this pipeline will be confirmed through survey and trenching. The baseline risk is assessed as **unlikely** probability and **moderate** consequence, indicating a **low risk**. For the DCO Scheme, taking into account further investigation and design it is considered there is no change to this risk and therefore a **neutral effect**.

10.6.8 The DCO Scheme works in the vicinity of the Priory Farm Landfill consist of ballast replacement and new rails, and clearance/ reformation of ditches. It is considered that gas and leachate from this landfill, should they be present are unlikely to have a material effect on the DCO Scheme, although gas monitoring during construction should be undertaken, as a health and safety precaution. This is considered an **unlikely** probability with **severe** consequence, and therefore a **moderate/low risk**. However, standard industry practice measures, such as further investigation and control of access to excavations and gas alarms during construction will aim to eliminate this risk completely. This is considered a **neutral effect.**

10.6.9 The Elm Tree Farm Landfill is not considered to present a potential impact to the DCO Scheme due to the distance (c250 m) and intervening presence of housing. This is not considered to present a risk during construction.

10.6.10 The ground conditions at Avon Road Bridge site and embankment will be investigated as part of the design for the widened structure and changes to the embankment profile. The works consist of a large temporary cutting to install the retaining walls, excavation and benching of the existing embankments and piling for a king post wall. Ground investigation did note some contamination, most notably asbestos. However, good construction practice and compliance with the Control of Asbestos Regulations 2012 will mean that the risk during construction is the same as for baseline, i.e. a **neutral effect**.

10.6.11 Renovation of the station at Pill will have no impact on the underlying geology. The station platforms are already in existence and will be replaced. The cutting slope to the south of the station will be designed to form a steeper, stable slope. Construction of the station will need to take account of the ground conditions but it is not anticipated that these would pose any material constraints on construction. Further investigation of the station area is required and findings of the investigation will be used to inform the design. The baseline condition is assessed as **low risk** (considered **unlikely**, consequence **medium**). For the DCO Scheme, it is considered there is no change to this risk and therefore a **neutral effect**.

Portbury Freight Line (Operational Railway)

10.6.12 The works along the Portbury Freight Line are routine maintenance works undertaken across Network Rail's operational estate. The removal and replacement of ballast will entail limited groundworks and therefore will have no impact on the geology or hydrogeology. This is therefore considered to be no change to baseline and a **neutral effect**.

10.6.13 There is no predicted effect on the Ham Green SSSI. The existing rail corridor is wide enough to accommodate the planned services and no excavations of the existing cutting are proposed. Vegetation clearance may allow the cutting to be exposed however the site will be a more active railway and consequently the opportunities for academic study of the exposed sediments will be limited. It will be necessary to site a signal and location case to house telecommunications in the vicinity of Ham Green SSSI, but this should be located outside the SSSI and not directly impact on the designated site. This is therefore considered a **neutral effect**.

10.6.14 The proposed earthworks along the operating railway line will all be designed to stabilise the slopes and will be contained within the existing railway land. Consequently, these works will be beneficial in terms of slope stability. This is considered a **minor beneficial effect**.

10.6.15 Within the Avon Gorge, the cliff stabilisation assessment and mitigation measures required are relatively small scale and are not predicted to affect the SSSI designation. The risk of slope instability was assessed to vary between low and high and the risk level has been used to design the slope stabilisation works required to ensure an adequate level of safety for the passenger train service. Given the embedded mitigation, there is considered to be no changes to baseline conditions and therefore a **neutral effect**.

10.6.16 The proposed works are not making a material change to the existing land use and no likely significant effects have been predicted for the purposes of the EIA Regulations.

10.6.17 The works at Ashton Vale are considered unlikely that the works will be significantly affected by contamination although existing ground investigation data should be assessed ahead of the works. This is therefore considered a **neutral effect**.

Operation Phase

10.6.18 No impacts during operations phase are expected and this topic has been scoped out of further assessment, as explained in Section 10.1.

10.7 Mitigation and Residual Effects

10.7.1 No likely significant effects have been identified and no further mitigation measures over and above the measures to be included in a written scheme to address contamination within the Order limits are proposed. The residual effects remain as described in the preceding sections.

10.8 Cumulative Effects

10.8.1 The methodology for assessing cumulative effects with other projects is set out in Chapter 18 In-combination and Cumulative Effects (DCO Document Reference 6.21).

Other Schemes along the Portishead Branch Line

10.8.2 No cumulative effects with other projects along the Portishead Branch Line are considered likely.

Other Works for MetroWest Phase 1

10.8.3 Other elements of MetroWest Phase 1, namely Parson Street Junction (including works to South Liberty Lane freight depot), Parson Street Station, the Bedminster Down Relief Line and Bathampton Turnback comprise small scale works, confined within the existing railway land. These works are to be undertaken by Network Rail under their permitted development rights and do not form part of the DCO Application.

10.8.4 The management and control process used by Network Rail for delivering projects that enhance or renew the operational railway is called Governance for Railway Investment Projects (“GRIP”). The GRIP process provides assurance that a project can successfully progress to the next stage and requires the preparation of reports for each GRIP stage. Environmental studies are undertaken as part of the GRIP process to identify potential issues and capture the need for mitigation during design and construction. The environmental reports are carried forward from options and feasibility design (GRIP 3 and 4), into the detailed design phase (GRIP 5) and construction (GRIP 6). In this way, environmental issues and mitigation measures are identified at an early stage and addressed through the design and construction phases. Consequently, while permitted development works do not require statutory environmental impact assessment, the GRIP process provides an internal, non-statutory environmental impact assessment process.

10.8.5 Given the small-scale nature of these works and the distances between these projects and the Portishead Branch Line, it is considered that the probability of risk is considered unlikely and the consequence minor, indicating a very low risk and a neutral effect and that there are no significant cumulative effects during the construction and operation of these projects on ground conditions. Consequently, these works have been scoped out of further cumulative impact assessment for the DCO Scheme.

10.9 Limitations Encountered in Compiling the ES

10.9.1 The design of the DCO Scheme and the measures to be taken during the construction process have been detailed in Chapter 4 Description of the Proposed Works (DCO Document Reference 6.7), the CoCP (DCO Document Reference 8.15), the Master CEMP (DCO Document Reference 8.14) and the Network Rail Construction Strategy (DCO Document Reference 5.4). It will be necessary for the appointed Contractor(s) to provide their own CEMPs prior to the start of construction. However, sufficient information is now available in terms of risks associated with ground conditions to enable this assessment to conclude that the DCO Scheme is unlikely to cause harm to humans or the wider environment, and that there are no likely significant effects in terms of geology, hydrogeology, ground conditions and contaminated land as a result of the construction and operation of the DCO Scheme.

10.9.2 The DCO will also have a requirement for a written scheme to address the contamination of any land, including groundwater, within the Order limits, which will include an investigation and assessment report. The written scheme and assessment report will require approval by the planning authority after consultation with the EA and Local Authorities.

10.10 Summary

10.10.1 Table 10.7 sets out the potential construction and operational impacts and effects on the resources and receptors that have been identified, with an indication of the likely potential mitigation and residual impacts.

10.10.2 Any impacts that may arise from the underlying ground conditions will be dealt with at the construction phase. Such impacts may arise from contaminants within the underlying soils or from the chemical nature of the soils themselves. During the operational life of the DCO Scheme there will be some incidental contamination of the underlying track bed from leaks and spillages; for the reasons presented in this assessment, this is not predicted to be significant for the purposes of the EIA Regulations.

10.10.3 As explained in Section 10.1, the operational impacts on geology, hydrogeology, ground conditions, and contaminated land have been scoped out of this ES as no likely significant effects are predicted.

Table 10.7: Summary of the assessment of the DCO Scheme on Geology, Hydrogeology, Ground Conditions and Contaminated Land

Aspect and control measures embedded in the DCO Scheme	Receptors	Impact	Environmental Mitigation	Residual Effects
Construction activities				
Removal of ballast off site to one of Network Rail's recycling centres. Placement of clean ballast along the railway. Foundations and earthworks at Portishead Station, including protection of the Wessex Water sewer. Disused Ministry of Defence oil pipeline under the proposed car park B. Works near the Priory Farm Landfill and Elm Tree Landfill. Foundations and earthworks at Avon Road Bridge and embankments. Renovation of Pill Station and construction of Pill car park. Ham Green SSSI. Cliff stabilisation in the Avon Gorge. Design to remove exposure pathways and/or sources	Occupants Building Fabric Groundwater **Value: High**	Potential risks to site workers and visitors and groundwater. **Risk: Very low to Low** **Significance of Effect: Minor adverse to Minor beneficial**	None – ballast to be removed and treated. Mitigation built into design.	**Significance of Effect: Minor adverse to Minor beneficial** **Significance for EIA legislation: Not significant**

Table 10.7: Summary of the assessment of the DCO Scheme on Geology, Hydrogeology, Ground Conditions and Contaminated Land

Aspect and control measures embedded in the DCO Scheme	Receptors	Impact	Environmental Mitigation	Residual Effects
resulting in environmental clean up. Safe handling and final disposal for spoil as set out in the CEMP.				
Operational activities				
None.				
Cumulative Effects				
None.				

10.11 References

CIRIA. 2001. Contaminated Land Risk Assessment. A Guide to Good Practice (C552).

DEFRA Contaminated Land Statutory Guidance, April 2012

Environment Agency, 2004. *Model Procedures for the Management of Land Contamination*. Publication CLR11.

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North Somerset Council, 2015. Sites and Policies Plan Part 1 Development Management Policies.

Office of the Deputy Prime Minster, 2005. *Biodiversity and Geological Conservation – Statutory Obligations and their Impact within the Planning System*. Government Circular.

10.12 Abbreviations

BGS	British Geological Society
C4SL	Category 4 Screening Levels
CEMP	Construction Environmental Management Plan
CoCP	Code of Construction Practice
CSM	Conceptual Site Model
DCO	Development Consent Order
EIA	Environmental Impact Assessment
EQS	Environmental Quality Standard
ES	Environmental Statement
GRIP	Governance for Railway Investment Schemes
LTEL	Long term exposure limits
NPPF	National Planning Policy Framework
NPSNN	National Policy Statement for National Networks
NSIP	Nationally significant infrastructure project
OS	Ordnance Survey
PAH	Polycyclic aromatic hydrocarbons
RIGS	Regionally Important Geological and Geomorphological Sites
S4UL	Suitable for Use Level
SAC	Special Area of Conservation
SPZ	Source Protection Zones
SSSI	Site of Special Scientific Interest
STEL	Short term exposure limits
SWMP	Site Waste Management Plan