EWR Alliance

EWR Alliance

Title: The Network Rail (East West Rail Bicester to Bedford Improvements) Order Development Stages 2A1, 2A2, 2A3 and 2A4

Remediation Strategy.

Document Number: 133735-EWR-REP-EEN-000256

Date: 19th February 2020

East West Rail Phase 2

The Network Rail (East West Rail Bicester to Bedford Improvements) Order Development Stages 2A1, 2A2, 2A3 and 2A4

Remediation Strategy

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1. Introduction

1.1 Background

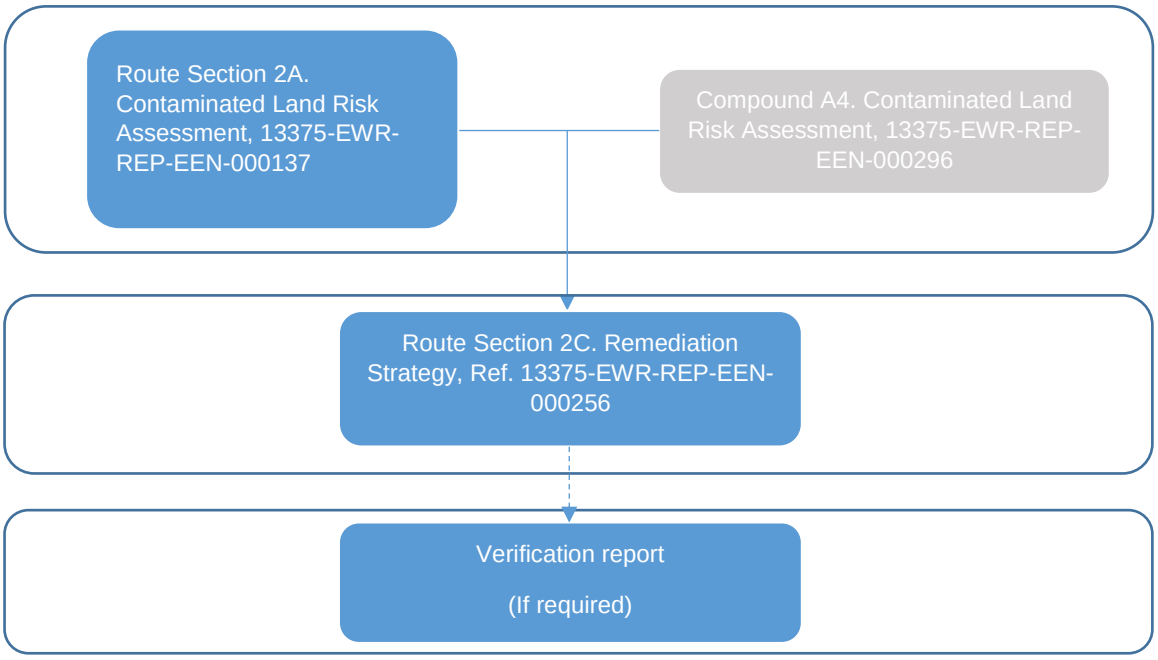
The following remediation strategy has been produced by the EWR Alliance (the Alliance) for Development Stages 2A1, 2A2, 2A3 and 2A4 including offline highways (within Route Section 2A) of the East West Rail 2 (EWR2) Project. It is provided to support the proposed construction works along the route and to discharge Condition 11 of the Network Rail (East West Rail Bicester to Bedford Improvement) Order. This report can also be used as evidence for the CEEQUAL assessment question 4.2 of the project.

Route Section 2A is located within Oxfordshire County Council, Cherwell District Council, Aylesbury Vale District Council and within Buckingham County Council jurisdiction.

In 2019, the Alliance prepared a Contaminated Land Risk Assessment (CLRA)[1] for Route Section 2A, which collated and assessed data collected during the Alliance GRIP 4 ground investigations (GIs) in 2017/18 and the WSP for GRIP 3 GI in 2016. The CLRA provides information on the contamination status of the soils and groundwater along Route Section 2A including a Generic Quantitative Risk Assessment (GQRA) and Conceptual Model (CM) for the proposed development. This report was produced to discharge Condition11.

In addition, ground investigations and associated Contaminated Land Risk Assessment reports have been carried out for proposed construction compound A4[2]. This report provides information only in relation to the proposed construction works and to support the CLRA[1] and this remediation strategy for Route Section 2A.

The flow diagram shows the relationship between the different reports and their respective purpose in discharging Condition 11.



1 The EWR2 Alliance (2019) EWR Bicester to Bedford Improvements, Route Section 2A. Contaminated Land Risk Assessment, Ref. 13375-EWR-REP-EEN-000137.

2 The EWR Alliance (2019) EWR Bicester to Bedford Improvements. Compound A4 Contaminated Land Risk Assessment. Ref. 13375-EWR-REP-EEN-000296.

1.2 Scope of Works

The purpose of this remediation strategy is to provide a summary of the existing data for Route Section 2A including outstanding risks and presents a remediation strategy for the proposed development.

This report comprises the following:

- Summary of the existing data and outcome of the CLRA and CM;
- Summary of the outstanding risks to on site and off site receptors;
- Presentation of a remediation strategy for re-development of the route including a summary of requirements to mitigate the outstanding risks to receptors; and
- Specification of validation / verification works to be undertaking during the construction works by the Alliance

1.3 Limitations

For the purposes of this remediation strategy it should be noted that the ground conditions encountered and discussed are based on the information obtained during the GRIP 3 and GRIP 4 ground investigation works in 2016 and 2017/2018. The exploratory holes sampled or tested represent a fraction of the ground being investigated and therefore, conditions may vary between sampling points. Furthermore, observations made at the time of investigations and during monitoring visits may be subject to variation due to atmospheric, seasonal or other effects.

This remediation strategy is based on the conclusions and recommendations of the CLRA only with respect to outline design of the proposed TWAO site boundary as shown on Drawings 133735 – EWR -EEN – 000256 – FIG1, 133735 – EWR -EEN – 000256 – FIG2 and 133735 – EWR -EEN – 000256 – FIG3 (Appendix A).

The conclusions of this report are based partly on the findings of the assessment of data taken from exploratory holes advanced on site as part of previous GIs and from information obtained from a variety of sources including documents provided by third party sources as detailed within this report, and which the Alliance believes is reliable. Nevertheless, the Alliance cannot and does not guarantee the authenticity or reliability of the information. No attempt has been made to verify independently any data collected by others. The Alliance accepts no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known other than within the terms of the contract.

A geotechnical assessment is outside of the scope of this report.

2. Background

2.1 Site Location and description

Development Stages 2A1, 2A2, 2A3 and 2A4 including offline highways sit within Route Section 2A, which is approximately 8.5 km in length running between Bicester in the west and Charndon in the east and has a general southwest-northeast orientation, along the existing OXD line. The route was taken out of operational service by the Alliance in September 2018. It had been operated as single-track line used for freight transport but not a regular passenger service until that point.

Route Section 2A passes through predominantly agricultural land with isolated residential housing and woodland. Urban development, including residential homes, industrial and light commercial properties, is present in the west of Route Section 2A associated with the town of Bicester. Several roadways intersect and bridge Route Section 2A at various points.

2.2 Proposed Development

The existing single track OXD Line within Route Section 2A will be double tracked to current design standards as part of the proposed works.

The existing earthworks and trackbed are to be re-engineered in order to achieve a new profile. This will include widening embankments, reengineering slopes, raising track levels in some areas and reducing track levels in other areas, and locally using retaining structures. In some areas, earthworks will have a wider profile than the existing degraded and over-steep earthworks.

New footbridges will be constructed to replace existing level crossing points. Three new highways overbridges will be constructed at approximate chainages 109000, 108400 and 10700 to replace existing level crossing points. Five existing highways overbridges / underbridges will also receive repairs and maintenance works.

Seven ecological compensation areas will be constructed as part of the works to mitigate habitat loss. Compensation Flood Storage Areas (CFSAs) sites for flood mitigation have also been proposed along Route Section 2A.

To facilitate the construction works, four temporary compound areas (Compound A1 to A4) will be constructed, centred at approximate Grid References 460304E, 223134N, 461948E, 223411N, 464863E, 224479N and 465685E, 225050N. The compound areas will be reinstated to their original use upon completion of the works and separate planning permission has been sought for these compound sites. On the compounds temporary modular portacabins and/or shipping container type units will be placed but these will have a ventilated void beneath.

Construction of new drainage channels and culverts, and refurbishment and reconstruction of existing culverts and track drainage are required along the length of Route Section 2A. Some minor realignment of a watercourse to the north of Route Section 2A at approximate chainage 106900 is also required. There are also areas of temporary highway widening and passing places.

No permanent buildings are to be constructed as part of the proposed works within Route Section 2A.

The route layout and exploratory hole locations are detailed on drawing Nos. 13375-EWR-REP-EEN-000137, 13375-EWR-REP-EEN-000137_1, 13375-EWR-REP-EEN-000137_2 and 13375-EWR-REP-EEN-000137_3.

2.3 Site History

Information on the site history is as detailed in the Alliance CLRA[1] and a summary is provided below. From 1885 Route Section 2A comprising the London and North Western railway and several stations (Launton and Marsh Gibbon and Poundon) have been constructed. The surrounding area within 500 m of Route Section 2A is predominantly agricultural with a disused Brick and Tile Works located approximately 150 m north, to the east of which is also an old clay pit. By 1899 a quarry is shown near Bicester located approximately 415 m north west of Route Section 2E. In 1922 old quarries are located approximately 110 m north of Route Section 2A at Marsh Gibbon.

From 1923 within Route Section 2A the Great Western Railway route from Banbury to Princes Risborough which enters Bicester from the south east and intersects with the London and North Western Railway has been constructed. This intersection is located at the western end of the Route Section 2A. A sewage works is shown approximately 380 m south of Route Section 2A at Launton. Further residential development has also taken place in Launton. By the 1950s Bicester has expanded, with more residential properties and businesses are indicated. The agricultural areas to the east of Route Section 2A including the areas around Launton are predominantly unchanged. A pit labelled as the Old Clay Pit (now known as Calvert Brickworks No. 3 pit) is present approximately 120 m east of Route Section 2A.

Between 1967 and 1980 a sewage works is shown to the south of Poundon Hill approximately 262 m north of Route Section 2E. Marsh Gibbon and Poundon Station located within Route Section 2A are no longer labelled and a small coal yard is shown adjacent to Poundon Station. By 1984 the coal yard adjacent to the railway line no longer appears. Within the surrounding area of Route Section 2A between 1983 and 1984 the Old Clay Pit 150 m north which adjacent to the disused Brick and Tile works is indicated to be infilled.

Presently Route Section 2A appears predominately unchanged. Within 500 m of Route Section 2A Bicester has expanded significantly with industrial and commercial properties being constructed to the north of the western extent of Route Section 2A.

2.4 Published Geology

2.4.1 Made Ground

Made Ground is anticipated along the length of Route Section 2A primarily associated with the original construction of the existing railway, as well as at specific locations where landfilling or other earthworks have occurred.

2.4.2 Superficial Geology

British Geological Survey (BGS) 1:50,000 mapping[3] of Route Section 2A indicates that superficial deposits are largely absent under most of Route Section 2A.

Superficial deposits comprising Alluvium are indicated to be present under discrete sections of Route Section 2A around Bicester (associated with the Langford Brook) and along Station Road in Launton associated with Summerston Ditch, Launton Brook and Cutters Brook.

3 British Geological Survey. [online]. GeoIndex. http://www.bgs.ac.uk/GeoIndex/ (accessed September 2017).

2.4.3 Bedrock Geology

BGS 1:50,000 mapping[3] of Route Section 2A indicates that the bedrock underlying Route Section 2A to the east of Chainage 108600 comprises the Oxford Clay Formation (consisting of mudstones from the Stewartby Member and Peterborough Member). Where the Oxford Clay is absent in the far west of Route Section 2A, bedrock comprises the Kellaways Sand Member between approximate Chainage 108600 and 109300, and the Kellaways Clay Member between approximate Chainage 109100 and 109300 which is underlain at depth by the Great Oolite Group (comprising the Cornbrash Formation, the Forest Marble Formation and the White Limestone Formation).

2.4.4 BGS Historical Boreholes

A number of historical borehole and trial pit logs held by the BGS archives[4] are located within 500 m of Route Section 2A and a selection are summarised below:

- Trial Pit SP62SW72 – located adjacent to the south of Route Section 2A to the west of Launton. Topsoil was encountered from ground level to 0.3 metres below ground level (m bgl) overlying Possible Weathered Kellaways Clay Member to 2.5 m bgl and Kellaways Sand Member to the base of the pit at 5.0 m bgl;
- Trial Pit SP62SW77 – located adjacent to the south of Route Section 2A to the north west of Launton. Topsoil and possible subsoil were encountered from ground level to 0.4 m bgl overlying possible reworked Kimmeridge Clay Member to 1.7 m bgl overlying Kimmeridge Sand Member to the base of the hole at 3.0 m bgl;
- Trial Pit SP52SE197 – located approximately 255 m south west of Route Section 2A in Bicester encountered topsoil overlying what are likely to be naturally reworked materials to 1.25 m bgl where the Kellaways Clay Member was encountered to the base of the pit at 3.5 m bgl; and
- Borehole SP62SW66 – located approximately 350 m to the south of Route Section 2A to the west of Launton. Made Ground was encountered from 0 to 0.5 m bgl overlying an organic clay, possibly representing Alluvium to approximately 1.2 m bgl overlying the Peterborough Member.

2.4.5 Mineral Sites

Information within the Envirocheck Report[5] identifies a common clay and shale pit at a location named Hareley's Farm 1.6 km to the northeast of Launton, approximately 290 m to the north of Route Section 2A. It is noted that this name may be incorrect as Hare Leys Farm is further to the east with this location actually being named Field Farm. There is a large pond in this location with the area to the northeast associated with the Brick and Tile Works seen on the earliest available historical map.

A second common clay and shale pit (Calvert Brickworks No. 3 pit now Grebe Lake and also known as Aylesbury Borough Refuse Tip) is present approximately 120 m to the east of Route Section 2A in Charndon. Reference to historical maps indicates that there were old quarries located approximately 110 m south of the Route Section at Marsh Gibbon and 415 m to the north west of the Route Section near Bicester.

4 British Geological Survey. [online]. Borehole Scans. http://www.bgs.ac.uk/data/boreholescans/home.html (accessed October 2017).

5 Landmark. (2017). Envirocheck Report, EWR Route (September of 2017). Supplied as GIS Data.

2.5 Hydrogeology and Hydrology

2.5.1 Hydrogeology

According to the Environment Agency the superficial Alluvium underlying Route Section 2A is classified as a Secondary A Aquifer.

The bedrock of the Kellaways Sand Member and Cornbrash Formation underlying Route Section 2A are also classified as Secondary A Aquifers, which are defined as:

"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".

The bedrock of the Oxford Clay – Weymouth Member, Oxford Clay – Stewartby Member, Oxford Clay – Peterborough Member and Kellaways Clay Member underlying Route Section 2A are classified as Unproductive Strata, which are defined as:

"rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow".

According to the Envirocheck Report[5] Route Section 2A is not situated within a groundwater Source Protection Zone (SPZ) and there are no SPZs located within 500m of Route Section 2A.

The Envirocheck Report[5] does not provide any indication of licensed groundwater abstractions within 500 m of Route Section 2A. Local council records of private groundwater abstraction did not identify any records along Route Section 2A.

A minor aquifer with high groundwater vulnerability is present approximately 400 m to the north of Route Section 2A, at the western portion around Bicester. This relates to the bedrock geology (Cornbrash Formation) in this area.

2.5.2 Hydrology

There are two Water Framework Directive (WFD) designated surface water bodies which intersect Route Section 2A at four points. Langford Brook crosses the west of Route Section 2A, to the east of Bicester and discharges to the River Ray located approximately 6.5 km to the south of Route Section 2A[6]. Launton Brook also crosses Route Section 2A to the east of Launton and to the north and northwest of Marsh Gibbon. The Launton brook and the Summerstown Ditch both discharge into Cutters Brook which discharges to the River Ray.

Three additional minor watercourses which are tributaries of Langford Brook intersect with Route Section 2A at various points and are identified as ordinary watercourses. Track drainage is also present along Route Section 2A. There is also an additional drain that starts just north of Lawn Farm, flowing northwards to the Padbury Brook just north of Twyford, in the eastern area of Route Section 2A.

Grebe Lake, a man-made lake in a disused clay pit is located approx. 120 m east of Route Section 2A with another man-made lake located further east, to the north of the former Calvert brickworks.

According to the Envirocheck Report[5] there are two active discharge consents to surface water within Route Section 2A, with a further 13 located within 500m. One of the discharge consents within Route Section 2A is located on Station Road to the east of Bicester and refers to the discharge of treated sewage effluent from a single residential property to a tributary of Launton Brook. The second discharge consent is located further to the east on Bicester Road and refers to the discharge of process waters by Southern Gas Networks from gas distribution and compressor stations into a tributary of a farm drain.

6 Environment Agency. [online] Catchment Data Search. http://environment.data.gov.uk/catchment-planning/ (accessed October 2017).

According to the Envirocheck Report[5] there are no licensed surface water abstractions recorded within 500m of Route Section 2A.

According to the Envirocheck Report[5] there has been one recorded pollution incident to air, land and water within 500 m of Route Section 2A. The incident was located approximately 270 m to the south of Route Section 2A in Launton and designated as a Category 3 - Minor Incident to air and land and a Category 2 significant incident to water. Details of the receiving watercourse, dates and details of the pollutants are not provided.

According to the Envirocheck Report[5] the western extent of Route Section 2A falls within an area of extreme flood risk. This is the flooding extent of the Langford Brook and extends approximately 2.7 km to the south west and approximately 1.4 km to the north east of the route.

There is a further area of flood risk located to the east associated with Launton Brook which intersects the southern extent of Route Section 2A approximately 1.5 km to the east of Bicester. This area extends approximately 2.2 km to the south west of the route.

2.6 Landfills

2.6.1 Recorded historical landfill sites

Environment Agency[7] data identifies two historic landfills located within 500 m of Route Section 2A. One record is for Aylesbury Borough Tip located approximately 120 m to the east of Route Section 2A, to the west of Calvert Pit No3 (also known as Buckingham Rural District Council Refuse Tip) and also known as Grebe Lake. The Aylesbury Tip was operated by Aylesbury Borough Council until December 1963 and received commercial waste.

Buckingham Rural District Council Refuse Tip is located approx. 200 m to the southeast of the eastern most extent of Route Section 2A (approximate chainage 101300) and received industrial and commercial waste from 31 December 1957 and was operated by Buckingham Borough Council.

2.6.2 Recorded Operating landfill sites

Environment Agency[7] data identifies no operational landfill sites located within 500 m of Route Section 2A.

2.7 Potential for Unexploded Ordnance

A third-party Preliminary Unexploded Ordnance (UXO) Risk Assessment[8] undertaken in accordance with CIRIA 681[9] “Unexploded Ordnance (UXO) – A guide for the Construction Industry” indicated that Route Section 2A has been rated as ‘low risk’ for UXO.

7 Environment Agency. What’s in your backyard [online]. http://maps.environment-agency.gov.uk/wiyby/wiybyController?ep=maptopics&lang=_e (accessed September 2017).

8 Bomb Search (2014) Preliminary Unexploded Ordnance (UXO) Risk Assessment: East West Rail Phase 2.

9 CIRIA (2009) Unexploded Ordnance (UXO) A guide for the Construction industry. London.

3. Ground Investigations

3.1 Scope of Works

Two geo-environmental GIs have been carried out along Route Section 2A including a GI undertaken in 2015 by WSP for GRIP 3 and a GI which was undertaken by the Alliance between 2017 and 2018 for GRIP 4.

In addition, ground investigations and associated Contaminated Land Risk Assessment reports have been carried out for proposed construction compound A4[2]. GI on the A4 Compound was undertaken due its previous historical use and therefore there was the potential source of contamination. Further GIs were not undertaken in Compounds A1 to A3 as these were agricultural and desk based assessment did not show historical use of the sites.

3.1.1 GRIP 3 Phase 2A GI

The GRIP 3 stage GI for Route Section 2A was undertaken by BAM Ritchies Ltd (BAM) on behalf of WSP Parsons Brinckerhoff between May and September 2015[10]. The scope of the investigation works comprised:

- 18 No. investigation locations spaced at approximately 500 m intervals along the route. Each investigation location consisted of three boreholes, drilled using windowless sampling techniques combined with dynamic probing;
- A further 15 No. two-hole locations were added to the scope for the purposes of investigating the ground conditions at the location of new structures or backfill to existing structures. These holes were drilled using a combination of cable percussion, window sampling techniques and standard penetration testing;
- A total of 16 No. samples of Made Ground and nine samples of natural ground were tested. Chemical analysis of the soils was scheduled by WSP for the GRIP 3 GI and carried out by Chemtest;
- No leachate, groundwater or surface water testing or groundwater depth monitoring was undertaken as part of the GRIP 3 investigation; and,
- No ground gas monitoring was carried out as part of the GRIP 3 investigation.

3.1.2 GRIP 4 Phase 2A GI

The GRIP 4 stage GI was undertaken by CC Ground Investigation on behalf of EWR Alliance between July 2017 and October 2018[11]. The scope of the investigation works comprised:

- 139 No. investigation locations, comprising trial pits, dynamic probing, window sampling and dynamic sampling with rotary follow on, located both within the railway corridor and adjacent to the railway on third party land in Route Section 2A;
- 21 No. soil samples comprising various material types, including Ballast, Made Ground and Subgrade/Engineered Fill and natural ground were tested. Leachate tests were also scheduled on soil samples. Chemical analysis was scheduled by the Alliance and carried out by i2 Analytical;
- Installation of combined ground gas and ground water monitoring wells;
- Four rounds of groundwater level monitoring and sampling were undertaken between August 2018 and October 2018;
- Collection and chemical testing of groundwater samples collected from 13 No. boreholes;
- A total of nine surface water samples were collected from three surface watercourse locations including the Langford Brook, the Summerstown Ditch and Launton and Cutters Brook and an unnamed drain/watercourse between August and October 2018; and

10 Bam Ritchies (2016). Final Factual Geotechnical Report on GI. 5624.3 – East West Rail GRIP 3 additional works.

11 EWR Alliance (2017). EWR Alliance GRIP4 Ground Investigation Specification.

- Four rounds of gas monitoring were undertaken between July 2018 and October 2018.

Exploratory hole locations are presented on Drawings Nos. 13375-EWR-REP-EEN-000137, 13375-EWR-REP-EEN-000137_1, 13375-EWR-REP-EEN-000137_2 and 13375-EWR-REP-EEN-000137_3.

The aim of the GIs was to characterise the ground and groundwater conditions along the route (including the soil type, composition, depth, thickness and groundwater flow direction) and to characterise the contamination status of the soils and groundwater and the ground gas regime along Route Section 2A. The design of the investigations was based on the development proposals at the time they were undertaken.

A summary of the findings of the GIs undertaken by WSP and the Alliance has been provided below. Further information can be found in the Alliance CLRA[1] for Route Section 2A.

3.2 Ground Conditions

The ground conditions along the route broadly reflect those anticipated from the published geology.

The route comprises rail track at grade, on embankments and in cuttings and the thickness of the underlying railway substructure reflects the previous development of the site as a railway.

Underlying the ballast, trackbed layers, engineered ground. Made Ground, subgrade / embankment fill and Topsoil (if present), the natural ground comprises Alluvium associated with watercourses around Station Road in Launton. Glacial Till was not previously identified on BGS maps however it was identified locally in areas of higher topography in the eastern section of the Route. No superficial deposits were identified within the remainder of the route.

The superficial deposits and railway substructure directly overlay the solid strata of the Oxford Clay Formation across much of Route Section 2A, with the Kellaways Formation (sand and clay Member) subcropping below the superficial Alluvium towards the western (Bicester) end of Route Section 2A from Marsh Gibbon. The Cornbrash, Forest Marble, White Limestone and Rutland Formations were encountered underlying the Kellaways Formation in the western end of Route Section 2A.

A summary of the encountered geology along the route is provided in Table 3.1 below:

Table 3.1 – Ground Conditions Summary

Geology	Description	Top of Stratum (m bgl)	Range of thickness (m bgl)
Topsoil	Topsoil is the top-most strata present, however it can be present in 'relic' form where it has been buried by artificial ground (beneath embankments). Soft/stiff/firm grey dark brown slightly sandy clay with frequent roots (<2mm).	0.00-1.70	0.05-1.00
Ballast	Ballast is encountered in areas which lie within the railway corridor, which were currently or previously part of the trackbed immediately beneath the rails and sleepers. Grey angular to sub-angular medium to coarse gravel of igneous material. Angular to sub-angular fine to coarse gravel of igneous material, clinker, slag. Approximately 50-70% undersized with fines of ash and degraded ballast.	0.00-0.50	0.02-0.60
Trackbed Layers (sand)	Trackbed describes material immediately below the ballast, forming part of the existing or former trackbed within the railway corridor. Yellow/light orangish/orangish/light brown gravelly slightly clayey sand. Gravel is angular to rounded fine to coarse of igneous material, chalk and siliceous material.	0.00-0.70	0.12-0.80
Engineered Ground	Light orangish brown gravelly slightly clayey fine to coarse sand. Gravel is angular to rounded fine to coarse of chert and clinker.	0.00-0.20	0.20-0.40

Geology	Description	Top of Stratum (m bgl)	Range of thickness (m bgl)
Made Ground	Made Ground is defined as anthropogenic materials which have not been classified as trackbed or subgrade fill for earthworks, although both of these are still Made Ground. Firm to stiff friable dark brown slightly sandy slightly gravelly clay with occasional roots (<2mm). Gravel is angular to sub-rounded fine to coarse of brick, ash, clinker, concrete, limestone and sandstone. Further comments in text below.	0.00-1.00	0.05-1.70
Subgrade / Embankment Fill	Subgrade Fill and Embankment Fill are used to describe material typically forming the bulk fill of railway embankments, below the trackbed layers, although this material is classed as Made Ground as it has been placed at this location by man. It is likely to include locally occurring geology in re-worked form. Soft light grey and bluish grey slightly gravelly slightly sandy clay with rare gypsum crystals (<5mm). Gravel is angular to rounded fine to coarse of siliceous material, limestone and red brick.	0.00-5.40	0.10-5.10
Glacial Deposits Cohesive	Soft to firm greenish brown mottled brown slightly gravelly silty clay with rare rootlets. Gravel is sub-angular to rounded fine chalk.	0.00-4.20	0.10-1.90
Alluvium	Firm grey mottled dark grey locally orangish brown slightly sandy clay. Occasional partially decomposed organic material (<5 mm).	0.15-6.00	0.10-1.60
Oxford Clay - Peterborough member	Very stiff thinly laminated dark grey silty clay locally tending to extremely weak mudstone with occasional shells (<20 mm).	0.10-19.80	0.15-12.50
Oxford Clay - Stewartby Member	Stiff to very stiff /Hard greyish to dark brown silty friable clay with shell fragments	0.20-5.00	0.10-3.30
Kellaways Clay Member	Stiff dark grey sandy clay with rare pockets (<10mm) of iron pyrite.	0.40-18.20	0.10 – 3.45
Kellaways Sand Member	Firm to stiff dark grey silty / clayey fine to medium sand with occasional shell fragments.	0.6-21.40	0.05-4.60
Cornbrash Limestone	Medium strong thinly bedded light grey fossiliferous Limestone. Discontinuities are closely spaced stepped rough with fine sand infill (<6 mm).	3.00-19.30	0.10-3.50
Forest Marble Formation	Weak to medium strong very thinly to thinly bedded light grey fine grained slightly shelly Limestone with medium interbeds of very stiff dark brownish grey clay. Discontinuities are sub-horizontal very closely to medium spaced undulating rough occasionally infilled (<3 mm) with clay.	6.00-20.00	0.43-3.20
White Limestone Formation	Weak to medium strong dark grey fossiliferous Limestone. Discontinuities are sub-horizontal undulating rough and infilled with dark grey silt	9.40-26.29	0.5-11.7
Rutland Formation	Weak dark grey Mudstone. Discontinuities are sub-horizontal undulating medium closely spaced rough.	29.60	0.90

Topsoil was located across the Route Section offline and occasionally underlying the embankment. Made Ground was encountered locally in fifteen locations, predominantly in offline locations. The deepest Made Ground at 2.70 m was recorded offline (CP2APOOB_1D) in the location of the proposed Poundon Occupation New Overbridge. The Made Ground in this location is described as firm becoming stiff thinly laminated sandy clay with leaf matter.

3.2.1 *Visual and Olfactory Evidence of Contamination*

The railway ballast included clinker, ash and slag with hydrocarbon staining noted locally on the ballast. The Made Ground included brick, ash, clinker and concrete.

Slight hydrocarbon odours in the soil were noted in the Made Ground, Trackbed layers and ballast. Within the natural strata hydrocarbon odours were identified within the Oxford Clay Formation (Peterborough Member and Stewartby Member) and Kellaways Clay Member.

Chemical odours were identified within both the Made Ground, Trackbed layers, Alluvium and Oxford Clay Formation between the depths of 0.08 m and 1.25 m bgl.

Hydrocarbon odours were identified in groundwater samples collected from the eastern Route Section 2A (Chainage 101120) to approximate Chainage 104000 (Station Road Marsh Gibbon) with no further visual or olfactory evidence of hydrocarbons in groundwater recorded until a hydrocarbon odour was encountered between Chainage 106320 and 107280 (in the general area of Launton Level Crossing) at depths between 0.75m to 3.00m and 0.95m and 1.80m in the Subgrade Fill. A sulphurous odour was also noted in some of the soil samples from Made Ground at Chainage 103011, and groundwater samples from the Oxford Clay – Stewartby Member at Chainage 101600 and 103940.

3.2.2 *Soil Vapour Headspace Results*

Soil samples taken during the GI were screened on site by the Alliance using a photo-ionisation detector (PID) to measure the concentration of total volatile organic compounds (VOCs). The results of the PID tests indicate that the majority of results were below or just above detection limits of the equipment used (<0.1 ppm), with the highest concentration (31.7 ppm) recorded in WS101_C, associated with a hydrocarbon odour in the Oxford Clay Formation at 1.0 m bgl.

3.2.3 *Asbestos Containing Material*

Asbestos screening in the laboratory was undertaken on 51 No. samples, all of which were located <1.0 m bgl collected from topsoil, Made Ground, ballast, trackbed layers, subgrade fill and Alluvium. Chemical analysis was carried out in accordance with MCERTS and UKAS accredited procedures. No asbestos fibres or Asbestos Containing Material (ACM) was identified within any of the samples tested.

Asbestos has been identified at surface at Compound A4. The contaminated Land Risk Assessment report Reference 133735-EWR-REP-EEN-000261 has not identified asbestos within the soil in the samples collected as part of the ground investigation works. Therefore, it is assumed that there is a low risk of asbestos being identified within the soil and excavation works will be managed in accordance with the asbestos management plan which is written by an experienced and suitably qualified asbestos specialist. The Asbestos at surface within the A4 Compound will be hand-picked by an experienced and suitably qualified asbestos specialist prior to the construction works taking place on site.

3.3 Groundwater Strikes

Groundwater strikes during the GIs were recorded within the Ballast, Subgrade Fill, Trackbed Layers, Made Ground, Alluvium, Glacial Deposits, Oxford Clay, Kellaways Clay Member, Kellaways Sand Member, Cornbrash Limestone and Forest Marble Limestone and the White Limestone Formation.

3.4 Groundwater Monitoring

Groundwater levels were recorded during the groundwater monitoring rounds undertaken between August and October 2018 as part of the GRIP 4 GI. Groundwater levels are summarised in Table 3.2 below.

Table 3.2 – Summary of Groundwater Level Monitoring

Location	Response Zone		Groundwater Level Range	
	Geology	Depth (m bgl)	(m bgl)	m (AOD)
CP2AMFOB_2U	Oxford Clay - Peterborough Member, Kellaways Clay Member, Cornbrash Limestone, Forest Marble Formation	2.0 – 30.0	1.48 – 1.81	67.95 – 67.62
CP2APOOB_1D	Oxford Clay – Peterborough Member, Kellaways Sand Member	1.4 – 19.6	4.92 – 5.4	80.81 – 80.33
WS2A100_U	Glacial Deposits Cohesive, Oxford Clay - Peterborough Member	1.0 – 5.6	3.84 – 4.5	87.66 – 87.00
WS2A103_U	Subgrade Fill, Weathered Oxford Clay - Peterborough Member	1.0 – 4.7	1.8 – 2.3	85.81 – 85.31
WS2A106_D	Oxford Clay - Peterborough Member	1.0 – 6.0	1.0	83.40
WS2A121_U	Alluvium, Kellaways Sand Member	1.0 – 3.5	2.0	63.71
WS2A123_D	Kellaways Clay Member	1.25 – 6.25	1.96 – 2.28	63.72 – 63.40
WS2A124_U	Kellaways Clay Member	1.0 – 4.0	1.91 – 3.31	63.78 – 62.38
WS2A14D	Weathered Oxford Clay - Peterborough Member	1.0 – 4.7	2.57	75.38
WS2AFCGF15U	Oxford Clay – Peterborough, Member Kellaways Sand Member	2.0 – 5.0	1.87	66.91
WS2ALOB_1D	Alluvium, Oxford Clay Peterborough Member, Kellaways Clay Member, Kellaways Sand Member	1.0 – 4.0	0.99 – 1.3	66.22 – 65.91

Groundwater levels ranged from 87.66 m AOD (WS2A100_U, August 2018) to 62.38 m AOD (WS2A124_U, September 2018).

The only groundwater level taken in the western most part of Route Section 2A is the artesian borehole encountered at CP2AJLFB_2U, chainage 109300 (south of the track line and immediately south west of Jarvis Lane, Bicester). Groundwater at this location rose to 2.85 m above ground level. There are no other groundwater dip levels data for the western part of Route Section 2A (the nearest dips are taken from borehole CP2AMFOB_2U at chainage 108400), however, it can be inferred that groundwater flow is most likely in an easterly direction at location CP2AJLFB_2U towards Langford Brook. A second artesian borehole was encountered a third of the way along Route Section 2A at CPA2ALOB_1D (chainage 107000), immediately east of the junction between the track line and Station Road in Launton. The groundwater at this location initially rose to 0.30 m above ground level but had risen to 5.0 m above ground level approximately two weeks after borehole installation. Groundwater dip data in this area shows that groundwater is likely to flow in a westerly/south westerly direction. The artesian groundwater was encountered within the White Limestone Formation, this Principal Aquifer is encountered at depth below Route Section 2A and is confined by the Forest Marble Formation.

3.5 Ground Gas Monitoring

Four rounds of ground gas monitoring were undertaken along the route between July and October 2018 as part of the GRIP 4 GI. A summary of maximum concentrations is provided in Table 3.3.

Table 3.3 – Summary of Ground Gas Monitoring

Location	Response Zone		Date	Minimum Oxygen (% v/v)	Maximum Carbon Dioxide (% v/v)	Maximum Methane (% v/v)	Maximum Carbon Monoxide (ppm)	Maximum Hydrogen Sulphide (ppm)	Maximum flow rate (l/hr)	Atmospheric Pressure (mb)	Rising/ Falling Atmospheric Pressure*
	Geology	Depth (m bgl)									
CP2ALLCDE	Alluvium and Oxford Clay - Peterborough Member	2.5-10.5	24/09/2018	2.6	14.5	<0.1	<1.0	<1.0	0.2	1032	Rising
			22/10/2018	19.4	0.3	<0.1	<1.0	<1.0	0.2	1032	Rising
CP2AMFOB_2U	Oxford Clay - Peterborough Member, Kellaways Clay Member, Cornbrash Limestone, Forest Marble Formation	2.0-30.0	01/08/2018	19.3	1.4	19.3	5.0	<1.0	<0.1	1016	Rising
			03/09/2018	21.0	0.6	<0.1	<1.0	<1.0	0.2	1015	Falling
			24/09/2018	19.3	0.6	<0.1	<1.0	<1.0	0.3	1032	Rising
CP2APOOB_1D	Oxford Clay - Peterborough Member, Kellaways Sand Member	1.4-19.6	01/08/2018	9.1	5.8	<0.1	1.0	<1.0	0.4	1016	Rising
			03/09/2018	16.5	4.0	<0.1	1.0	<1.0	<0.1	1015	Falling
			25/09/2018	18.1	3.5	<0.1	<1.0	<1.0	0.5	1031	Steady
WS2A100_U	Glacial Deposits Cohesive, Oxford Clay - Peterborough Member	1.0-5.6	01/08/2018	20.3	1.4	0.4	1.5	<1.0	<0.1	1016	Rising
			04/09/2018	20.4	1.9	<0.1	<1.0	<1.0	0.3	1013	Steady
			27/09/2018	20.0	0.5	<0.1	<1.0	<1.0	<0.1	1018	Falling
			22/10/2018	18.3	2.5	<0.1	<1.0	<1.0	Not measured	1028	Rising
WS2A103_U	Subgrade Fill, Oxford Clay -	1.0-4.7	31/07/2018	19.0	1.5	<0.1	<1.0	1.0	0.2	1007	Falling
			04/09/2018	21.1	0.8	<0.1	<1.0	<1.0	0.3	Not measured	Steady

Location	Response Zone		Date	Minimum Oxygen (% v/v)	Maximum Carbon Dioxide (% v/v)	Maximum Methane (% v/v)	Maximum Carbon Monoxide (ppm)	Maximum Hydrogen Sulphide (ppm)	Maximum flow rate (l/hr)	Atmospheric Pressure (mb)	Rising/ Falling Atmospheric Pressure*
	Geology	Depth (m bgl)									
	Peterborough Member		27/09/2018	19.4	0.6	<0.1	<1.0	<1.0	<0.1	1018	Falling
			22/10/2018	18.5	1.7	<0.1	<1.0	<1.0	<0.1	1028	Rising
WS2A106_D	Oxford Clay - Peterborough Member	1.0-6.0	06/09/2018	20.4	0.7	<0.1	<1.0	<1.0	0.2	1009	Falling
			27/09/2018	20.3	0.3	<0.1	<1.0	<1.0	<0.1	1019	Falling
WS2A121_U	Alluvium, Kellaways Sand Member	1.0-3.5	03/09/2018	20.7	1.0	<0.1	<1.0	<1.0	<0.1	1015	Falling
			24/09/2018	18.6	2.1	<0.1	<1.0	<1.0	0.3	1032	Rising
WS2A123_D	Kellaways Clay Member	1.25-6.25	01/08/2018	15.4	5.8	<0.1	1.0	<1.0	0.1	1016	Rising
			03/09/2018	17.2	4.7	<0.1	<1.0	<1.0	0.1	1015	Falling
			24/09/2018	17.0	4.3	<0.1	<1.0	<1.0	0.4	1034	Rising
WS2A124_U	Kellaways Clay Member	1.0-4.0	01/08/2018	19.6	3.6	<0.1	1.0	<1.0	<0.1	1016	Rising
			03/09/2018	19.9	2.7	<0.1	1.0	<1.0	0.1	1015	Falling
			24/09/2018	18.4	2.7	<0.1	<1.0	<1.0	0.4	1044	Rising
WS2A12U	Oxford Clay - Peterborough Member	4.0-5.0	27/09/2018	19.5	0.9	<0.1	<1.0	<1.0	<0.1	1017	Falling
WS2A14D	Oxford Clay - Peterborough Member	1.0-4.7	06/09/2018	20.3	0.5	<0.1	<1.0	1.0	-0.1	1010	Falling
			26/09/2018	19.6	0.3	<0.1	<1.0	<1.0	0.6	1037	Falling
			22/10/2018	19.9	0.1	<0.1	<1.0	<1.0	<0.1	1030	Rising
WS2A16U	Oxford Clay - Peterborough Member	3.0-4.0	06/09/2018	19.9	0.6	<0.1	<1.0	2.0	-0.2	1010	Falling
			27/09/2018	10.5	7.2	<0.1	2.0	<1.0	0.3	1021	Falling
WS2AFCGF15U	Oxford Clay - Peterborough Member,	2.0-5.0	06/09/2018	20.3	0.9	<0.1	<1.0	1.0	-0.1	1015	Falling
			24/09/2018	20.1	1.3	<0.1	<1.0	<1.0	0.5	1032	Rising

Location	Response Zone		Date	Minimum Oxygen (% v/v)	Maximum Carbon Dioxide (% v/v)	Maximum Methane (% v/v)	Maximum Carbon Monoxide (ppm)	Maximum Hydrogen Sulphide (ppm)	Maximum flow rate (l/hr)	Atmospheric Pressure (mb)	Rising/ Falling Atmospheric Pressure*
	Geology	Depth (m bgl)									
	Kellaways Sand Member										
WS2ALOB_1D	Alluvium, Oxford Clay - Peterborough Member, Kellaways Clay Member, Kellaways Sand Member	1.0-4.0	01/08/2018	19.8	0.3	<0.1	1.0	<1.0	0.3	1016	Rising
			03/09/2018	21.0	0.3	<0.1	1.0	<1.0	0.3	1015	Falling
			24/09/2018	20.5	0.2	<0.1	<1.0	<1.0	0.3	1032	Rising

*Atmospheric pressure falling / rising trends have been calculated based on the trend two days before and after the monitoring visit

3.5.1 *Oxygen*

The minimum oxygen concentration recorded was 2.6 % v/v in monitoring well CP2ALLCDE, installed within the Alluvium and Oxford Clay - Peterborough Member, during the September 2018 gas monitoring round.

3.5.2 *Carbon Dioxide*

Elevated concentrations of carbon dioxide greater than 5 % v/v were identified were identified within four monitoring wells CP2ALLCDE (approx. 80 m west of Compound A2), CP2APOOB_1D (approx. 244 m north west of Compound A2), WS2A123_D (approx. 242 m north west of Compound A2) and WS2A16U (approx. 357 m north east of Compound A2) installed within the Alluvium, Oxford Clay , Kellaways Sand and the Kellaways Clay. A maximum carbon dioxide concentration of 14.5 % v/v was recorded within CP2ALLCDE.

3.5.3 *Methane*

Recorded methane concentrations were generally less than 1 % v/v, apart from CP2AMFOB_2U installed within the Oxford Clay, Kellaways Clay, Cornbrash Limestone, Forest Marble Formation, where methane was recorded at 19.3 % v/v in the August 2018 monitoring round. During two subsequent gas monitoring rounds undertaken in September 2018 concentrations of methane were recorded at <0.1% v/v. CP2AMFOB_2U is located approximately 130 m west of Compound A1.

3.5.4 *Carbon Monoxide*

Concentrations of carbon monoxide were recorded below the instrument's limit of detection in the majority of monitoring locations. The maximum recorded concentration of carbon monoxide was 5 ppm in CP2AMFOB_2U installed within the Oxford Clay, Kellaways Clay Member, Cornbrash Limestone, Forest Marble Formation.

3.5.5 *Hydrogen Sulphide*

Concentrations of hydrogen sulphide were recorded below the instrument's limit of detection in the majority of monitoring locations. The maximum recorded concentration of hydrogen sulphide was 2 ppm.

3.5.6 *Flow*

Steady state flow rates within all of the installations ranged between <0.2 l/hr and 0.5 l/hr, with slightly negative flow rates recorded occasionally. The highest negative flow rate was in WS2A16U installed within the Oxford Clay where a maximum steady state flow of -0.2 l/hr recorded. This negative flow was associated with falling atmospheric pressures. The highest positive flow rate of 0.6 l/hr was recorded in WS2A14D, installed within the Oxford Clay Peterborough Member and was recorded over a period of falling atmospheric pressure.

3.5.7 *Atmospheric Pressure*

Atmospheric pressures were found to be between 1009 mb and 1037 mb during the monitoring rounds, with pressures found to be falling on four visits (3 September 2018, 6 September 2018, 26 September 2018 and 27 September 2018).

3.6 Compound A4 Contaminated Land Risk Assessment

A4 will be used as a temporary construction compound which will be reverted to fields following completion of the works. To facilitate the construction works, a separate planning consent No. 19/01001/APP.

Ground Investigation and Contaminated Land Risk Assessment[2] Ref. 133735-EWR-REP-EEN-000296 was undertaken at Compound A4 on the between 12th June and 20th August 2019 due to the presence of a former track shown on historical maps and therefore to assess the potential source of contamination with human health and the environment. A ground investigation was therefore undertaken to support the planning application and proposed temporary construction works.

The site is located approximately 1.25 km to the south-east of Poundon and approximately 1.8 km from Charndon to the south-east. The approximate Ordnance Survey (OS) Grid Reference for the site is SP 65687 25027 and the nearest postcode for the site is OX27 9BA.

The GI comprised 18 machine dug trial pits excavated to a maximum depth of 0.55 m bgl, 3 hand dug pits to a maximum depth of 1.2 m bgl and 4 machine excavated infiltration pits to a maximum depth of 1.8 m bgl. Two topsoil and two subsoil samples were also collected prior to the GI by RSK in January 2019 from hand augers undertaken at the site as part of agricultural soil surveys. All soil samples were submitted to an MCERTS and UKAS accredited laboratory for analysis.

The GI encountered Made Ground of soft greyish brown slightly sandy slightly gravelly silty Clay. Sand is fine to coarse. Gravel is sub-angular to rounded fine to coarse brick, ceramic and sandstone. Topsoil was identified to a maximum depth of 0.32 m bgl described at brown gravelly sandy clay with low root content. Gravel is fine subangular flint. Glacial Till was encountered in all trial pits to a maximum depth. The depth of this strata was not proven.

The results of the soils screening have identified no exceedances of the human health GAC for a commercial end use and public open space (parks) use in the soil samples analysed indicating that there are unlikely to be unacceptable risks to on and off-site human and property receptors from soils underlying the site.

Asbestos screening in the laboratory was undertaken on 38No. samples in total collected from the Topsoil, Made Ground and Glacial Deposits. No asbestos fibres or asbestos containing materials were identified in the samples analysed. Asbestos was visually identified at the surface during both the archaeological survey and by WSP subsequently in a site walkover and the ground investigation works. The asbestos at surface within the A4 Compound will be hand-picked by an experienced and suitably qualified asbestos specialist prior to the construction works taking place on site. Construction works will be managed in accordance with the asbestos management plan which will be prepared by the Alliance experienced and suitably qualified asbestos consultant.

Given that the site is underlain by Unproductive Strata, is not located within 500 m of a SPZ and no groundwater abstractions are located within 500 m of the site, the site is considered to be in a low sensitivity area with respect to groundwater. Therefore, it is considered unlikely that contaminants will represent an unacceptable risk to controlled waters beneath and adjacent to the site.

No significant thicknesses of Made Ground were encountered on the site. The proposed development is for a temporary construction compound with cabins raised off the ground with an air flow beneath and therefore the risk of ground gas is considered to be low.

4. Risk Assessment Summary

4.1 Introduction

This section provides a summary of the Human Health, Ground Gas and Controlled Waters Risk Assessments undertaken at the site based on the results of the GIs undertaken for GRIP 3 in 2015 and GRIP 4 in 2017/2018. Further information on these risk assessments can be found in the 2019 CLRA1.

4.1.1 Risk Assessments

Under the National Planning Policy Framework (NPPF) 2018[12], the approach to risk assessment of land potentially affected by contamination follows the risk based tiered framework published by Defra and the Environment Agency. Primary guidance for assessing and managing risks posed by land contamination is presented in CLR11 and Land Contamination: Risk Management (LCRM) published by the Environment Agency on 5 June 2019. CLR11 and LCRM provides a technical framework (and signposts other key guidance) for identifying and remediating contamination through the application of a risk management process. The question of whether risk is unacceptable in any particular case involves not only scientific and technical assessments, but also appropriate criteria by which to judge the risk and conclude exactly what risk would be unacceptable.

The basic approach to the risk assessments given in CLR11 and LCRM is application of the following hierarchy:

- Tier 1 – risk screening by the establishment of potential contaminant linkages, i.e. the conceptual model with preliminary qualitative risk assessment;
- Tier 2 – generic quantitative risk assessment (GQRA) using generic assessment criteria (GAC) that represent 'minimal' or 'tolerable' risk; and / or
- Tier 3 – detailed quantitative risk assessment (DQRA) using site specific assessment criteria (SSAC) that represent 'unacceptable' risk where generic assessment criteria are unavailable or they are not applicable to the Conceptual Model.

Following the ground investigations, a ground gas risk assessment was undertaken in accordance with methodology contained within BS 8485:2015+A1 2019[13] code of practice for design of protective measures for methane and carbon dioxide ground gases for buildings, to assess the likely impact on humans, property and services from the presence of ground gas along the route.

This section summarises the findings of Tier 2 Human Health, Ground Gas and Controlled Waters Risk Assessment.

4.2 Summary of Results

4.2.1 Human Health GQRA

GACs for a public open space (parks) and a commercial end use were adopted to assess potential risks to human health, as the proposed end-use (railway) will include both outdoor human health receptors including potential for dust inhalation (users crossing the railway) and indoor human health receptors (station users). The full soil screening and laboratory results are presented in the CLRA[1] and are summarised in the following sections.

A total of 37 No. soil samples were tested as part of the GRIP 3 and GRIP 4 GIs. No exceedances of the commercial land use or public open space (parks) GAC were identified in the soil samples tested in Route Section 2A.

12 Department for Communities and Local Government, 2018. National Planning Policy Framework

13 BS 8485:2015+A1 2019 - Code of Practise for the design of protective measures for methane and carbon dioxide ground gases for new buildings.

Organic contaminants including Polycyclic Aromatic Hydrocarbons (PAHs), Total Petroleum Hydrocarbons (TPHs), Volatile Organic Compounds (VOCs) and Semi-Volatile Organic Compounds (SVOCs) were predominantly reported below the laboratory's limit of detection in all groundwater testing results. Results were screened against Atkins Water Screening Values (WSV), no exceedances of the WSVs were identified. In addition, no enclosed structures are proposed to be constructed within Route Section 2A. Therefore, groundwater is considered unlikely to present significant risks to human health receptors via the vapour inhalation pathway.

4.2.2 *Controlled Waters GQRA*

The soil-derived leachate and groundwater data was compared against water quality standards (WQS), to assess the risk of potential contaminants at site to identified controlled waters receptors. The WQS were based on both Drinking Water Standards (DWS)[14] to assess the potential risk posed to the underlying groundwater receptors and freshwater Environmental Quality Standards (EQS)[15] to assess risks to the surface water receptors.

The Environment Agency Water Framework Directive bioavailability tool (M-BAT)[16] was also used to derive Tier 2 site specific WQS values for copper, lead, manganese, nickel and zinc based on the EQS 2015 Tier 1 long term bioavailability freshwater concentrations.

The full results of the soil-derived leachate, groundwater and surface water screening are provided in CLRA1 and are summarised in the following sections.

4.2.3 *Soil Derived Leachate Screening*

A total of 9 No. samples were tested for their leachability of contaminants. These samples were taken from 8 No. locations.

Elevated exceedances of Sulphate, Selenium, Iron, Lead, Copper, Nickel and Zinc against WQS were identified from the Trackbed Layers, Subgrade Fill and Alluvium from various locations within Route Section 2A. Detailed assessment of the exceedances can be found in Route Section 2A CLRA[1].

4.2.4 *Groundwater Screening*

A total of 31 No. groundwater samples were collected from 13 No. monitoring boreholes across Route Section 2A between August 2018 and October 2018.

Elevated concentrations of Copper, Sulphate, Manganese, Nickel and Zinc were recorded in the majority of samples when assessed against the EQS assessment criteria. Elevated concentrations of Sulphate, Ammonium as NH4, Iron and Manganese are also recorded above the DWS assessment criteria. Cadmium, Selenium, Chromium and lead were recorded above WQS in the minority of samples. There were four recorded TPH concentrations and one phenol EQS exceedance recorded across Route Section 2A. Detailed assessment of the exceedances can be found in Route Section 2A CLRA[1].

4.2.5 *Surface Water*

A total of nine surface water samples were collected from three surface watercourse locations including the Langford Brook, the Summerstown Ditch and Launton and Cutters Brook and an unnamed drain/watercourse located within Route Section 2A between August and October 2018. Several exceedances of Manganese, Iron, Copper, Nickel, and Zinc were recorded against EQS. Detailed assessment of the exceedances can be found in Route Section 2A CLRA[1].

14 Statutory Instruments (2016) The Water Supply (Water Quality Regulations) No. 614.

15 DEFRA (2015) Water Framework Directive

16 Environment Agency (2013) Water Framework Directive bioavailability tool (M-BAT).

4.2.6 *Controlled Waters Assessment Summary*

Leachate testing of soils identified limited exceedances of metals and inorganics in the five locations sampled along the route. Exceedances of metals, inorganics and TPH were also recorded in the groundwater samples tested. However, it is considered likely given the widespread geographical distribution of the exceedances that these elevated concentrations of metals and inorganics are due to influences from the underlying geology and representative of background concentrations in the wider area.

Exceedances of TPH were identified above the MDL in the groundwater at two monitoring locations across Route Section 2A (WS2A100_U and CP2APOOB_1D) on one monitoring round per location. The recorded concentrations are considered to be marginal and were not identified during later monitoring rounds. The geology at WS2A100_U comprises Made Ground of sandy silt and stiff friable clay overlying glacial cohesive deposits of stiff to very stiff clay. While the geology at CP2APOOB_1D comprises Made Ground of silty clay and very stiff clay overlying the stiff to very stiff clay of the Oxford Clay Peterborough Member. The nature of the geology at both locations is stiff lower permeability unproductive strata, therefore it is extremely unlikely that a suitable viable pathway exists from either of these locations to Secondary A or Principal Aquifers or to the nearest surface water receptor. Additionally, WS2A100_U is located over 500 m away from a surface receptor. It is considered unlikely that the concentrations identified in soil leachate and groundwater would represent a significant risk to identified groundwater receptors.

Surface water testing identified limited exceedances of metals within the Summerstown Ditch, Launton and Cutters Brook, the unnamed drain/watercourse to the Summerstown Ditch, Launton and Cutters Brook and within Langford Brook. However, it is considered likely that these elevated concentrations of metals are due to influences from the underlying geology and representative of background concentrations in the wider area. The calculated bioavailability of the copper, manganese and nickel exceedances did not exceed the EQS. Additionally, the lack of superficial deposits in the area and the underlying low permeability strata shows that the surface water courses will unlikely be in hydraulic continuity with the underlying Secondary A or Principal Aquifers. The lack of hydraulic continuity and the stiff to very stiff lower permeability clays that underlie the site will make the viability of any migratory pathway from the soil leachate to the surface watercourses highly unlikely. Therefore, it is considered unlikely that the exceedances identified in soil leachate and groundwater would represent a significant risk to the identified surface water receptors.

4.2.7 *Ground Gas Risk Assessment*

Four rounds of ground gas monitoring were undertaken along the route between July and October 2018. The full results of the ground gas assessment provided in the CLRA1 and are summarised in the following sections.

The calculated gas screening value (GSV) and characteristic (CS) for each monitoring location is presented in Table 4.1.

Table 4.1 – Ground Gas Risk Assessment

Location	Strata	Max. Peak Recorded conc. (% v/v)		Max. Positive Steady State Flow Rate (l/hr)	Gas GSV (l/hr)	CS
		Carbon Dioxide	Methane			
CP2ALLCDE	Alluvium and Oxford Clay - Peterborough Member	14.5	0.1	0.2	<0.07	CS2 (due to CO2 above 5% threshold)
CP2AMFOB_2U	Oxford Clay - Peterborough Member, Kellaways Clay Member, Cornbrash Limestone, Forest Marble Formation	1.4	19.3	0.3	<0.7	CS2
CP2APOOB_1D	Oxford Clay - Peterborough Member, Kellaways Sand Member	5.8	0.1	0.5	<0.7	CS2
WS2A100_U	Glacial Deposits Cohesive, Oxford Clay -Peterborough Member	2.5	0.4	0.3	<0.07	CS1
WS2A103_U	Subgrade Fill, Oxford Clay - Peterborough Member	1.7	0.1	0.3	<0.07	CS1
WS2A106_D	Oxford Clay - Peterborough Member	0.7	0.1	0.2	<0.07	CS1
WS2A121_U	Alluvium, Kellaways Sand Member	2.1	0.1	0.3	<0.07	CS1
WS2A123_D	Kellaways Clay Member	5.8	0.1	0.4	<0.7	CS2
WS2A124_U	Kellaways Clay Member	3.6	0.1	0.4	<0.07	CS1
WS2A12U	Oxford Clay - Peterborough Member	0.9	0.1	0.1	<0.07	CS1
WS2A14D	Oxford Clay - Peterborough Member	0.5	0.1	0.6	<0.07	CS1
WS2A16U	Oxford Clay - Peterborough Member	7.2	0.1	0.3	<0.7	CS2
WS2AFCGF15U	Oxford Clay - Peterborough Member, Kellaways Sand Member	1.3	0.1	0.5	<0.07	CS1

Location	Strata	Max. Peak Recorded conc. (% v/v)		Max. Positive Steady State Flow Rate (l/hr)	Gas GSV (l/hr)	CS
		Carbon Dioxide	Methane			
WS2ALOB_1D	Alluvium, Oxford Clay - Peterborough Member, Kellaways Clay Member, Kellaways Sand Member	0.3	0.1	0.3	<0.07	CS1

*Maximum gas concentrations combined with maximum steady state flow recorded on any site visit.

#Note: where gas concentrations have been recorded as <0.1% v/v, a value of 0.1 has been used in calculation of the Qhg and where the maximum steady state flow rate is negative, the value has been converted to a positive flow rate.

The potential sources of ground gas along Route Section 2A are considered to be the landfills around Calvert approximately 120 m to 700 m to the south east of the redline boundary, the anthropogenic materials (Made Ground / Fill material) which are present with variable thicknesses (as listed in Table 3.1) from ground level up to 5.40 m bgl and Alluvium which was recorded between the depths of 0.15 m and 6.0 m bgl (with a thickness of 0.10 – 1.60 m).

The response zones of the monitoring wells were flooded during the gas monitoring rounds, with the exception of WS2A16U which was dry on all monitoring occasions. It is noted that gas data collected from flooded response zones may not be representative of the site gas regime (e.g. methane could be dissociating from groundwater into the artificially created void of the well). In addition, it is noted that gas monitoring installations did not target the Made Ground. However, installations were located within the Alluvium and within the vicinity of the landfills.

Recorded methane concentrations were generally less than 1 % v/v, apart from CP2AMFOB_2U installed within the Oxford Clay, Kellaways Clay, Cornbrash Limestone, Forest Marble Formation, where methane was recorded at 19.3 % v/v in the August 2018 monitoring round. Subsequent monitoring rounds recorded concentrations <0.1 % v/v. There are no obvious sources of methane (including no landfills) in the vicinity of this location either historical or current and it is therefore considered that the result is either the result of operator error when the monitoring was undertaken or potentially due to shale units within the Clay in the vicinity of this borehole.

Elevated concentrations of carbon dioxide greater than 5 % v/v were identified within four monitoring wells CP2ALLCDE (80 m west of Compound A2), CP2APOOB_1D (244 m north west of Compound A2), WS2A123_D (242 m north west of Compound A2) and WS2A16U (357 m north east of Compound A2) installed within the Alluvium, Oxford Clay, Kellaways Sand and the Kellaways Clay. A maximum carbon dioxide concentration of 14.5 % v/v was recorded within CP2ALLCDE. These elevated concentrations are considered to be naturally derived. In addition, none of these locations are located near (>500 m) to the historical landfills around Calvert or screened within Made Ground strata.

Two historic landfills are located within 500 m of Route Section 2A. There are no operational landfill sites located within 500 m of Route Section 2A. Based on the distance from these landfills to Route Section 2A, it is considered that the risk of landfill gas to humans and property is low.

No new permanent enclosed structures are proposed to be constructed within Route Section 2A. The temporary site accommodation within Compounds A1 and A4 will be modular portacabins and/or shipping container type units raised with a ventilated void beneath and these structures have therefore been excluded as ‘built environment’ receptors. Based on the absence of permanent enclosed structures within Route Section 2A, the risks from ground gasses are considered to be low and no further assessment is required.

4.2.8 Property

No volatile contaminants in soil or groundwater have been identified above the assessment criteria. However, aggressive ground conditions and the potential implications to buried structures will need to be considered separately as part of the detailed design.

4.3 Updated Conceptual Model

Following the assessment of the site-specific data obtained during the ground investigation, the preliminary conceptual model (PCM) included within the CLRA1 has been updated. The potential pollutant linkages (PPLs) contained within the PCM have been re-evaluated and re-assessed to determine relevant pollutant linkages (RPLs).

The updated CM is provided in Table 4.2 and demonstrates the modified risks posed to the identified receptors both on and off site. The remaining RPLs shown in Table 4.2 are considered to require either further assessment or implementation of mitigation measures during construction works as part of this remediation strategy.

Table 4.2 – RPL for Route Section 2A

Source	Receptor	Pathway	Probability	Consequence	Risk Classification	Comment
On-site Made Ground, Ballast, Trackbed Layers, Subgrade Fill and Embankment Fill Shallow groundwater *(Metals, inorganics and TPH)*	Human (on-site) Members of the public using public rights of way to cross the railway, level crossings, stations, bridges, agricultural land and public footpath/cycle tracks along the railway corridor	Inhalation of asbestos fibres	Unlikely	Severe	Moderate/Low risk	No asbestos fibres or Asbestos Containing Material were identified within the soil samples tested. Soil will be placed under compacted hardcover or vegetation so likelihood of dust generation following construction is low. However, due to Made Ground being present at the site, there is still the potential for asbestos to be present. This risk will be assessed by a suitably experienced and qualified asbestos specialist and construction works to be undertaken in accordance with an asbestos management plan. Asbestos identified at the surface of Compound A4 will be handpicked by an asbestos specialist and works will be undertaken in accordance with the asbestos management plan.
	Human (off-site) Residents living adjacent to Route Section 2A in Bicester, Launton and Charndon. Workers in adjacent commercial / industrial properties in Bicester. Members of the public accessing the surrounding area adjacent to Route	Inhalation of asbestos fibres which may have migrated off-site	Unlikely	Severe	Moderate/Low risk	No asbestos fibres or Asbestos Containing Material were identified within the soil samples tested. Soil will be placed under compacted hardcover or vegetation so likelihood of dust generation following construction is low. However, due to Made Ground being present at the site there is still the potential for asbestos to be present. Assessment by a suitably qualified asbestos specialist is required prior to the re-use of materials to confirm the suitability

Source	Receptor	Pathway	Probability	Consequence	Risk Classification	Comment
	Section 2A including station and road users Farmers working on nearby agricultural land					of material for re-use on-site. The construction works will be undertaken in accordance with an asbestos management plan.
	Controlled Waters (on- and off-site) Secondary A Aquifers Principal Aquifer	Leaching and migration of contaminants (free and dissolved phase) from soils in the unsaturated zone into groundwater in underlying aquifers Migration of contaminants via preferential pathways such as via piles or track drainage to deeper groundwater	Low likelihood	Mild	Low risk	It is highly unlikely the exceedances in the soil leachate would present a risk to the Secondary A or Principal aquifers. However, foundation / piling risk assessments may be required to be produced for the proposed works. The risk to groundwater will be further assessed as part of the Piling Risk Assessment which will consider the potential for the creation of preferential pathways and identify suitable mitigation measures if required.

5. Remediation

5.1 Project Works

The Route Section 2A project works will generally comprise of the following:

- De-vegetation, topsoil stripping and removal of sub-soil for compound set-up with material bunded on-site for later re-re-instatement;
- De-vegetation, topsoil stripping and removal of sub-soil for construction of temporary work sites including temporary haul routes, Compensation Flood and Environmental Mitigation sites with material bunded on-site for later re-instatement;
- Construction of 4 Compounds including installation of drainage, compound/road surface and welfare buildings on strip or pad foundations with establishment of relevant storage, processing, road and car parking areas within and around compounds;
- Removal of existing infrastructure (including rail, sleepers, cable routes, level crossings, road and track surfacing fences and other redundant features and transportation of removed infrastructure to nearest compound for stripping and processing for appropriate disposal, re-use or recycling;
- Excavation of track ballast, track bed, and embankment materials, to enable re-profiling, re-grading and track improvement works. This will include widening embankments, reengineering slopes, raising track levels in some areas and reducing track levels in other areas, and locally using retaining structures. In some areas, earthworks will have a wider profile than the existing degraded and over-steep earthworks.
- Construction of four new footbridges to replace existing level crossing points;
- Construction of three new highways overbridges to replace existing level crossing points. Five existing highways overbridges / underbridges will also receive repairs and maintenance works;
- Construction of six ecological compensation areas to mitigate habitat loss;
- Construction of new drainage channels and culverts, and refurbishment and reconstruction of existing culverts and track drainage are required along the length of Route Section 2A. There are also areas of temporary highway widening and passing places;
- No permanent buildings are to be constructed as part of the proposed works within Route Section 2A; and
- Minor realignment of a watercourse to the north of Route Section 2A at approximate chainage 106900.

5.2 Remediation Strategy Overview

The remediation strategy for works at the site will follow the steps detailed below:

- Piling risk assessment in accordance with Environment Agency guidance and implementation of piling techniques deemed appropriate[17] to identify and manage potential risks from creating pathways to groundwater.
- Implementation of Soils Management Plan (SMP), Materials Management Plan (MMP) and site waste management plan (SWMP) to provide a detailed assessment of the suitability of soils for re-use and the appropriate destination for waste (if required), including details on:
    - Stockpiling and testing of topsoil and clean and naturally occurring superficial deposits (if required) to confirm suitability for re-use on site;
    - Screening, crushing, sorting, and stockpiling of excavated Ballast and Trackbed with subsequent testing to confirm suitability for re-use as granular fill and as sub-base for new railway;
    - Screening, sorting, and stockpiling of excavated Made Ground and Subgrade Fill, with subsequent testing to confirm suitability for re-use within the scheme, and
    - Stockpiling and testing of material suspected to contain contamination to confirm suitability for re-use within the scheme or disposal facility.
- Management of asbestos containing materials and asbestos impacted soils by an experienced and suitably qualified asbestos specialist in accordance with the Asbestos Management Plan and Materials Management Plan.

All works will be undertaken in accordance with the Code of Construction Practice (CoCP) and Construction Environment Management Plan (CEMP) for the proposed development.

5.2.1 Contingency Plan

Where any additional unexpected contaminated materials and/or previously unidentified materials are encountered during the construction works (including presence of potential ACM) within the Made Ground and trackbed), and construction works; works will temporarily cease to enable inspection (and testing if necessary) by a suitably qualified asbestos specialist or if related to non-ACM contamination, by a suitably qualified geo-environmental engineer.

If significant contamination is identified, the area shall then be made secure and the appropriate parties (Local Authority, the Environment Agency and / or HSE) will be contacted and a strategy for dealing with the contamination agreed.

Significant contamination will include but not be limited to:

- Significant volume of visual or olfactory evidence of contamination (hydrocarbons, tar, solvents, waste etc.);
- Evidence of ACMs which would require management / remediation beyond the measures of the asbestos method statement;
- Highly coloured material or soil;
- Significant volume of ash or clinker;
- Suspected UXO; and
- Evidence of biological contamination.

Should additional significant contamination be found, the following procedure will be followed.

- Details of the location, type and final destination of all previously unidentified materials encountered during the works will be recorded by the Alliance on an appropriate tracking forms and plans will be included in the MMP verification report;

17 Environment Agency. Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention National Groundwater. 2001.

- Details of all the additional testing will be included within the MMP verification report issued following completion of the works to remove materials considered to pose an unacceptable risk to human health or controlled waters. Details of the MMP verification report and the information that will be needed is discussed in Section 6 below; and
- Details of the location, type and final destination of all previously unidentified materials encountered during the works shall also be recorded within the MMP verification report.

If a potential UXO is found, the area will be evacuated immediately, and the police called to assess the situation.

6. Post Remediation Constraints and Development Requirements

6.1 Piling Risk Assessment

The results from the GRIP 3 and 4 GIs have identified that the risk to groundwater at the site is considered to be low. However, piling works are proposed as part of the scheme therefore the risk to groundwater will be further assessed as part of the Piling Risk Assessment which will consider the potential for the creation of preferential pathways and identify suitable mitigation measures if required.

The piling risk assessment will be prepared in accordance with Environment Agency guidance prior to construction works being undertaken.

The Alliance will implement the piling techniques recommended in the piling risk assessment, to manage the identified potential risks associated with creating pathways to groundwater.

6.2 Excavated Materials, Re-use and Importation Specification

6.2.1 Overview

All works will be undertaken in accordance with the CoCP and CEMP to reduce potential impacts from dust, soil erosion, run-off and contamination.

SMP, MMP and SWMP will be written and adhered too as part of the construction works for the scheme. Further details on these documents have been provided below.

6.2.2 Materials Management Plan

The CL:AIRE Definition of Waste Code of Practice (DoWCoP) will be used as part of the proposed development to maximise the re-use of materials and reduce waste. A Materials Management Plan (MMP) will be prepared and will include on-site testing requirements and assessment of materials, a list of site specific re-use criteria (Appendix B & C) and verification plan requirements. This, and other applicable documentation (as detailed in the DoWCoP), will be reviewed by a Qualified Person (listed on the CL:AIRE Qualified Person Register) and the declaration submitted to CL:AIRE, prior to the excavation of materials on the Project.

6.2.3 Site Won Excavated Materials

Material excavated during construction works can be re-used on-site in accordance with DoWCoP if, among other criteria, it can be demonstrated that it does not pose a potential risk to human health or the environment.

The Alliance proposes to re-use natural soil, Made Ground / recycled aggregates (including ballast and trackbed) as part of the Scheme rather than disposing the material off site. Made Ground / aggregate could be re-used as generic fill under the proposed railway structure and embankments, which are the locations of the majority of the fill as part of the proposed design.

All arisings will be stockpiled and assessed for suitability on geotechnical and environmental grounds for inclusion in the works. Where materials are deemed unsuitable for reuse on site, they will be stockpiled and options to reuse on third party sites or off site disposal will be explored.

6.2.4 Imported Virgin / Recycled Materials

Virgin or recycled material will be imported onto site for use as part of the scheme. The material will be sourced as locally as possible. Virgin material will hold appropriate certification from the quarry and recycled material will follow the WRAP quality protocol for recycled aggregate. Recycled materials will be tested in accordance with Table 6.1.

6.2.5 *Imported Soil Materials*

Soil material maybe imported onto site for use as part of the scheme but will only ne clean and naturally occurring. The material will be sourced as locally as possible. The source of material will be;

- checked prior to acceptance, and
- undergo a visual check for signs of potential contamination;
- .

If the material is considered to be unsuitable i.e. if it contains visual signs of contamination it will not be used as part of the scheme and we be sent back to its place of origin.

6.2.6 *Chemical Testing*

Material that is either excavated and re-used on site (site-won) or imported from off-site will be tested for chemical suitability purposes by a UKAS accredited laboratory. The detected concentrations will be compared to site specific derived re-use criteria as shown in Appendix B and C which will be provided within the MMP to confirm suitability for re-use of material on-site or otherwise.

The material will be tested as a minimum in accordance with the following soil testing suites:

- pH;
- Metals including:
  - Arsenic, Boron, Cadmium, Chromium (total), Chromium (VI), Copper, Lead, Mercury, Nickel, Selenium, Vanadium, Zinc, Iron, Manganese;
- Inorganics including:
  - Total Sulphate as SO4;
  - Free Cyanide;
  - Ammonium as NH4;
- Hydrocarbons including:
  - Benzene, Toluene, Ethylbenzene and Xylene (BTEX);
  - TPH Carbon Working Group (CWG) aliphatic / aromatic split;
- Speciated 16 PAHs;
- Total Phenol; and
- Asbestos.

Site won material and all imported material will be sampled and tested for unexpected contamination. The minimum testing frequencies, to be considered by the Alliance, are defined in the MMP and are summarised in Table 6.1 below:

Table 6.1 – Material Testing Requirements

Material Source	Sampling	Testing schedule
Imported virgin quarried material	None – source approval	N/A
Site won road surfacing including sub base	1 per 50 m^3	-Coal tar -Total TPH -Total PAH
Site won crushed hardcore, stone, brick	1 per 500 m^3	-Metals -Inorganics -Hydrocarbons
Imported recycled aggregate and soil	1 per 500 m^3	

Site won ballast (from track bed)	1 per 1,000 m^3	-Speciated 16 PAHs -Total Phenol -Asbestos
Site won sand (from track bed)	1 per 1,000 m^3	
Site won brownfield soils (Made Ground, engineered ground, subgrade / embankment fill)	1 per 500 m^3	
Site won greenfield soils, clean and naturally occurring including topsoil and subsoil	1 per 5,000 m^3	-Major nutrients -Phosphorous -Potassium -Magnesium -pH

6.2.7 *Site Won Recycled Aggregates*

It is envisaged that site won materials in the form of crushed brick and concrete will be utilised for inclusion in civil engineering works where possible. The materials will be screened and crushed to specification for use as general fill under the railway structure/embankments.

The resulting crushed materials shall comply with the WRAP Quality Protocol[18] for the production of aggregate to be used on site and therefore will not be classified as a waste and will not require exemption from an environmental permit. All materials visibly impacted by contamination or odour i.e. materials displaying indications of impact from oil, fuels or solvents shall be removed to a sealed stockpile area tested and removed from site to appropriately licensed facilities.

6.2.8 *Materials Tracking*

Material tracking system will be developed to trace and record the movement and placement of excavated materials within the Scheme. Audits of the MMP and tracking system will be undertaken during the Project as part of the Integrated Management System (IMS) Audit Plan. This will include audits of tracking data.

Materials management will be incorporated into the site inspections, the requirement for which are outlined in the CoCP and CEMP.

6.2.9 *Site Waste Management Plan*

Material that is surplus to requirements and where there is no clear strategy for reuse on-site may be considered waste. All wastes produced on site will be disposed of in accordance with the Waste Hierarchy and Duty of Care as specified in the current waste management legislation and guidance[19]. If materials are to be removed off-site for disposal at landfill, they will be appropriately classified using the guidance in WM3 and appropriate Waste Acceptance Criteria (WAC) testing undertaken and provided to the chosen landfill operator.

Where material is removed from site, full records (i.e. Duty of Care documentation) will be produced and the MMP and SWMP updated as necessary. Details of waste generation and how the material has been managed will be provided within the SWMP. Full details will also be recorded in the MMP Verification Report required by the CL:AIRE Definition of Waste Code of Practice (DoWCoP).

6.2.10 *Soil Management Plan*

Soils within areas of agricultural land along Route Section 2A which are designated to be used temporarily and will be converted back to agriculture following the construction works will be managed, stored and tested in accordance with a Soil Management Plan (SMP) which includes measures for stripping, stockpiling, management and reinstatement of the topsoil and subsoil[20] in accordance with the DEFRA Construction Code of Practice for the Sustainable Use of Soils on Construction Sites.

18 EA: WRAP Quality Protocol (2013) Aggregates from inert waste

19 DEFRA (2016) Waste Duty of Care Code of Practice

20 DEFRA (2009) Construction Code of Practice for the Sustainable Use of Soils on Construction Sites

(SMP subsection A1 133735-EWR-REP-EEN-000206, SMP subsection A2 133735-EWR-REP-EEN-000207, SMP subsection A3 133735-EWR-REP-EEN-000208 and SMP subsection A4 133735-EWR-REP-EEN-000209).

6.2.11 Ground Construction Workers

Due to the presence of Made Ground underlying the route, a potential short-term contamination exposure and ground gas risk could exist to construction and ground workers involved in the development. Asbestos fibres or ACM has not been identified in the soil samples tested and therefore the risk to asbestos is considered to be low. Due to the potential for Made Ground to be found at the site, the risk from asbestos will need to be further assessed by an experienced and suitably qualified asbestos specialist in the form of an asbestos management plan in accordance with the Control of Asbestos Regulations (2012).

The presence of Made Ground, ground gas and asbestos in soil at the site will also be included in the CoCP, the MMP, the Construction Phase Health and Safety Plan and other risk assessments, method statements, tool box talks, mitigation strategy etc., so that all site personnel are made aware of the potential risk.

Asbestos has been identified on the ground surface at Compound A4. The asbestos will be hand-picked by a suitably experienced and qualified asbestos specialist prior to construction works. The works will be undertaken in accordance with the Asbestos Management Plan which will be produced by an experienced and suitably qualified asbestos specialist. A remediation strategy in relation to this asbestos clearance works is not considered to be required.

6.3 Verification Report

Based on the Route Section 2A remaining relevant pollution linkages that relate to asbestos and material management, it is not considered that a formal verification report associated with this remediation strategy is required. Therefore, it is considered that Condition 11 of the TWAO Network Rail (East West Rail Bicester to Bedford Improvements) Order for Development Stages 2A1, 2A2, 2A3 and 2A4 including offline highways (Route Section 2A) located within Oxfordshire County Council, Cherwell District Council and Aylesbury Vale District Council jurisdiction can be discharged in receipt of this remediation strategy.

A verification report will be produced in accordance with the requirements of the CL:AIRE Code of Practice. The verification report will provide a complete record of the material management activities undertaken on the project and the data collected. It will include detailed descriptions of the works undertaken and include the associated as built drawings, photographs and other appropriate documentation.

The verification report shall include:

- Background information – project and site details;
- Final site conditions i.e. an account of the state of the site following completion of the works;
- Supporting information – plans, as–built drawings, progress photographs and reports, analytical results, H&S, quality assurance, environmental monitoring, method statements, copies of consignment notes; and
- Volume and quality of imported, exported and / or re-used material including locations of verification samples including depths and volumes etc.

Appendix A - Drawings

EWR Alliance

LEGEND

EWR TWAO Planning Boundary

Client

EWR Alliance

Project Title

Remediation Route Section 2A

Drawing Title

Section 2A TWAO Boundary

Scale	Designed	Drawn	Checked	Authorised
N/A	KM	KM	SB	SB
Original Size	**Date**	**Date**	**Date**	**Date**
A4	Aug 2019	Aug 2019	Aug 2019	Aug 2019

Drawing Number

133735-EWR-REP-EEN-000256-FIG1

Revision

01

EWR Alliance

LEGEND

EWR TWAO Planning Boundary

Client

EWR Alliance

Project Title

Remediation Route Section 2A

Drawing Title

Section 2A TWAO Boundary

Scale	Designed	Drawn	Checked	Authorised
N/A	KM	KM	SB	SB
Original Size	**Date**	**Date**	**Date**	**Date**
A4	Aug 2019	Aug 2019	Aug 2019	Aug 2019

Drawing Number

133735-EWR-REP-EEN-000256-FIG2

Revision

01

EWR Alliance

LEGEND

EWR TWAO Planning Boundary

Client

EWR Alliance

Project Title

Remediation Route Section 2A

Drawing Title

Section 2A TWAO Boundary

Scale	Designed	Drawn	Checked	Authorised
N/A	KM	KM	SB	SB
Original Size	**Date**	**Date**	**Date**	**Date**
A4	Aug 2019	Aug 2019	Aug 2019	Aug 2019

Drawing Number

133735-EWR-REP-EEN-000256-FIG3

Revision

01

Appendix B – Human Health Re-Use Criteria

Contaminant of Concern	Units	Human Health Re-use Criteria
Inorganics		
Free Cyanide	mg/kg	34
Metals		
Arsenic (aqua regia extractable)	mg/kg	168
Cadmium (aqua regia extractable)	mg/kg	882
Chromium (hexavalent)	mg/kg	251
Chromium (aqua regia extractable)	mg/kg	83500
Copper (aqua regia extractable)	mg/kg	45200
Lead (aqua regia extractable)	mg/kg	1340
Mercury (aqua regia extractable)	mg/kg	1110
Nickel (aqua regia extractable)	mg/kg	804
Selenium (aqua regia extractable)	mg/kg	2550
Vanadium (aqua regia extractable)	mg/kg	1550
Zinc (aqua regia extractable)	mg/kg	201000
BTEX		
Benzene	mg/kg	139
Toluene	mg/kg	69900
Ethylbenzene	mg/kg	21400
o-xylene	mg/kg	9560
Petroleum Hydrocarbons		
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	109000
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	163000
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	9720
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	17700
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	23800
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	864000
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	864000
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	139
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	69900
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	5140
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	8260
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	10600
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	7870
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	7870

Polycyclic Aromatic Hydrocarbons		
Phenol	mg/kg	685
Naphthalene	mg/kg	623
Benzo(a)pyrene	mg/kg	21.4
Asbestos		
Asbestos		<0.001%

**Benzo(a)pyrene surrogate used

Appendix C – Controlled Water Re-Use Criteria

Parameter	Soil Re-use Criteria (mg/kg)	Leachate Re-use Criteria (mg/l)
Inorganics		
Total Sulphate as SO4	230,117	11,543
Ammonium as NH4	128	18
Metals		
Arsenic	305	0.23
Boron	1,536	46.17
Cadmium	59.5	0.25
Chromium (hexavalent)	8.10	0.23
Chromium (total)	1,137	0.22
Copper	13,012	44.09
Lead	614	0.23
Mercury	0.99	0.00046
Nickel	4,184	0.92
Selenium	8.53	0.89
Vanadium	501	3.55
Zinc	21,508	3.00
Iron	7,481	9.23
Manganese	223	4.43
Monoaromatics		
Benzene	0.05	0.05
Toluene	0.57	0.18
Ethylbenzene	0.12	0.05
p & m-xylene	0.88	0.14
o-xylene	1.01	0.14
Petroleum Hydrocarbons		
TPH-CWG - Aliphatic >EC5 - EC6	8.07	0.46
TPH-CWG - Aliphatic >EC6 - EC8	31.5	0.46
TPH-CWG - Aromatic >EC5 - EC7	2.82	0.46
TPH-CWG - Aromatic >EC7 - EC8	4.08	0.46
TPH-CWG - Aromatic >EC8 - EC10	13.9	0.46
TPH-CWG - Aromatic >EC10 - EC12	20.7	0.46
TPH-CWG - Aromatic >EC12 - EC16	39.1	0.46

Naphthalene	13.4	0.67