6.11.7 8No. PLT were undertaken in CONG. Two of the $I_{s(50)}$ values were recorded as 0.0MPa which may be due to the poorly cemented core or drilling/handling induced fracturing. Using an $I_{s(50)}$ to UCS conversion factor of UCS = 24 x $I_{s(50)}$, UCS values determined for the remaining tests vary between 2.4MPa and 7.2MPa. It is considered highly likely that these results underestimate the strength of the CONG due to drilling disturbance caused by the contrasting strength of the matrix and clasts.

6.11.8 Due to its scarce distribution and generally low thickness, there are not many in-situ or laboratory tests available for the CONG; therefore, similar properties of the surrounding MST or WSST/SST can be cautiously adopted for this material.

6.11.9 However, it must be considered that the CONG formed of quartzite gravel may be an issue for the piling works and may require early piling contractor involvement during the detailed design stage. The piling contractor should be consulted to ensure that adequate information is available for the correct piling method to be chosen.

6.12 Geotechnical Parameters Summary

6.12.1 A summary of the indicative geotechnical characteristic parameters derived for the geological units are summarised in Table 6.12.1 below.

Table 6.12.1: Indicative Geotechnical Characteristic Parameters Summary

Geotechnical Parameter	Made Ground (MG/Eng)	Made Ground (MG FOB)	Alluvium Granular (ALL-G)	Glacial Sands and Gravels (GSG)	Glacial Till (GT)	Weathered Sandstone (WSST)	Sandstone (SST)	Siltstone (SLST)	Mudstone (MST)
PI (%)	14	13	I/D	N/A	15	N/A	N/A	N/A	N/A
γ_{bulk} (kN/m^3)	20.5	20.5	18	21	21	20	22	22	22
SPT-N	12	7	12	15 + 1.4z[1]	5 + 2.25z[1]	50	> 100	> 100	> 50
C_u (kPa)	60	40	N/A	N/A	25 + 11.25z[1]	N/A	N/A	N/A	N/A
$\varphi'_{cv,k}$ (°)	28	26	28	35	28	36	N/A	N/A	N/A
$\varphi'_{pk,k}$ (°)	-	-	30	39	-	43	N/A	N/A	N/A
c' (kPa)	0	0	N/A	N/A	0	0	N/A	N/A	N/A
E' (MPa)	15	10	12	30 + 2.8z[1]	6.25 + 2.81z[1]	100	400	400	225
E_u (MPa)	-	-	N/A	N/A	8.92 + 4.0z[1]	N/A	N/A	N/A	N/A
UCS (MPa)	N/A	N/A	N/A	N/A	N/A	N/A	5	4	3
m_v (m^2/MN)	I/D	I/D	N/A	N/A	DD	N/A	N/A	N/A	N/A
c_v (m^2/yr)	I/D	I/D	N/A	N/A	DD	N/A	N/A	N/A	N/A
k (m/sec)	10^{-4} - 10^{-7}	10^{-4} to 10^{-7}	10^{-4} - 10^{-6}	10^{-7} – 10^{-6}	10^{-8} – 10^{-9}	10^{-7} – 10^{-5}	10^{-4} – 10^{-5}	10^{-5} – 10^{-7}	10^{-9} – 10^{-10}
OCR	N/A	N/A	N/A	4	4	N/A	N/A	N/A	N/A
CBR (%)	3 – 5	1-2	3 - 10	15	3.5 – 5.5	20	I/D	I/D	I/D

Note: 1) Where z is depth below ground level
DD – To be determined at Detailed Design Stage.
N/A – Not applicable for this soil/rock type.
ID – Insufficient data to provide derived parameter.

6.13 Concrete Aggressivity

6.13.1 The concrete aggressivity testing, undertaken in accordance with BRE special Digest 1:2005 Concrete in Aggressive Ground, targeted the superficial deposits underlying the Scheme. The results for each stratum have been analysed to produce derived values for pH, water soluble sulphate as SO4 (mg/l) and total potential sulphate as SO4. In total 45No. samples for testing were taken.

6.13.2 The derived value for each stratum was then used to derive corresponding Design Sulphate (DS) and Aggressive Chemical Environment for Concrete (ACEC), according to limit set by BRE SD1.

6.13.3 These are shown in the Table 6.13.1 below.

Table 6.13.1: Concrete Aggressivity Class Summary

Geological Unit	Design Sulfate Class	ACEC Class	Number of Tests
Made Ground/Eng Fill	DS-2	AC-2	14
Made Ground FOB	DS-1	AC-1	5
GT	DS-1	AC-1	10
GSG	DS-1	AC-1	16

6.14 Soakaway Testing

6.14.1 Four soakaway testing trial pits were performed during the 2019 Ground Investigation as part of the attenuation ponds design. TP09, TP14 and TP18 were constructed to their specified depths of 2.50m bgl; whilst TP01 was terminated at 1.40m bgl due to local risk of ground instability. Prior to testing, groundwater was observed in all four trial pits, at depths ranging between 1.4m bgl and 2.5m bgl.

6.14.2 Details of the soakaway tests are included in the Ground Investigation Report (HE514465-BAM-EGT-ZZ-RP-WM-0001) and summarised in Table 6.14.1 below.

Table 6.14.1: Summary of Soakaway Tests

Exploratory Hole	Stratum	Soil Infiltration Rate (m/s)
TP01	MG FOB	$4.0\ e^{-5}$
TP09	GSG over GT	$1.0\ e^{-6}$
TP14	GSG over GT	$9.7\ e^{-7}$
TP18	GSG over GT	$6.6\ e^{-7}$

6.15 Permeability Testing

6.15.1 Falling Head tests were undertaken in boreholes BH15, BH16, BH22 and BH23 to determine the permeability of the targeted soil. Details of the falling head tests are included in the Ground Investigation Report (HE514465-BAM-EGT-ZZ-RP-WM-0001) and summarised in Table 6.15.1 below.

Table 6.15.1: Summary of Falling Head Tests

Borehole ID	Response Zone (m bgl)		Target Stratum	Permeability, k (m/s)
	Top	Base		
BH15	3.5	4.5	Cohesive GT	9.07 e^{-8}
BH16	2.2	3.8	GSG	4.72 e^{-6}
BH22	1.5	2.5	GSG	8.10 e^{-6}
BH23	3.0	4.0	GSG	1.40 e^{-7}

6.16 Compaction Testing

6.16.1 A total of 13No. compaction tests with a 4.5kg rammer have been undertaken on samples expected to be within cuttings. Compaction tests were completed on GSG and GSG and GT samples mixed together. A summary of the Maximum Dry Densities (MDD) and Optimum Moisture Contents (OCM) are presented in Table 6.16.1.

Table 6.16.1: Compaction Testing Summary

Geological Unit	MDD Range (Mg/m^3)	MDD Average (Mg/m^3)	OMC Range (%)	OMC Average (%)	Number of Tests
GSG	1.96 – 2.19	2.09	5.3 – 9.0	7.8	9
GSG and GT	2.01 – 2.1	2.07	7.4 – 9.1	8.0	4

6.16.2 12No. Moisture Condition Value (MCV) testing was undertaken on samples of GSG. A summary of the MCV results are presented in Table 6.16.2.

Table 6.16.2: MCV Testing Summary

Geological Unit	MCV Range (%)	MCV Average (%)	Number of Tests
GSG	0.1 – 12.6	4.6	12

6.17 Groundwater Level

6.17.1 Groundwater was encountered in many trial pits and boreholes. Out of a total of 33 boreholes drilled during the 2019 Ground Investigation, 16 recorded groundwater strikes between 1.5m bgl and 24.3m bgl. Water levels typically rose following the initial strike. Isolated strikes at greater depth were recorded near Featherstone Junction Overbridge and near Brookfield Farm Accommodation Overbridge. The groundwater strikes and the levels after their standing period and highest recorded levels are presented in Table 6.17.1. Exploratory holes not included in Table 6.17.1 did not encounter groundwater.

Table 6.17.1: Summary of Groundwater Levels

Borehole	Groundwater Strike (m bgl)	Depth after Standing Period (m bgl)	Highest monitored groundwater level/ strike (m bgl)	Geological Formation
BH01	9	4.1	4.1	GT
BH02	4.6	4.1	4.1	MG
BH03	-	-	0.6	MG
BH04	-	-	5.0	GSG
BH06	4	3.6	3.0	GSG
BH07	-	-	5.0	GSG
BH08	9.7	4.8	4.8	CWST
BH08A	-	-	2.0	GT
BH09	24.3	10.1	8.2	GSG
BH10	10.5	6.9	4.9	CWST
BH11	11.8	4	4.0	CWST
BH12	1.5	1.3	0.3	GSG
BH13	4.2	3.1	3.1	GSG
BH16	-	-	6.8	GSG
BH17	7.8	4	4.0	GSG
BH18	8.7	4.1	1.5	GSG
BH19	3	0.6	0.6	GT
BH20	14.5	14	10.7	GSG
BH21	2.5	2	1.0	ALL-G
BH22	2	1.5	1.5	GT
BH22A	-	-	+0.0	ALL-G
BH24	-	-	3.0	GT
BH25	-	-	7.0	GSG
BH26	-	-	4.7	MG
BH27	-	-	12.4	GSG
TP01	1.4	1	1.0	MG
TP05	3	2.9	2.9	GSG
TP09	2	1.8	1.8	GT
TP10	2	-	2.0	GSG
TP11	2.4	-	2.4	GSG
TP12	4.3	-	4.3	GT
TP14	1.3	-	1.3	GSG
TP17	3	1.7	1.7	GSG
TP18	2.5	-	2.5	GT
TP19	4.5	-	4.5	GSG

*Note: * The groundwater strike in BH19 originates in the GSG at 11.0m bgl and rises to 0.6m bgl, which is the approximate level of the nearby Brookfield Ponds. This is close to artesian water conditions and is considered a potential risk for construction. Further details of this are discussed in Section 7 of this report.*

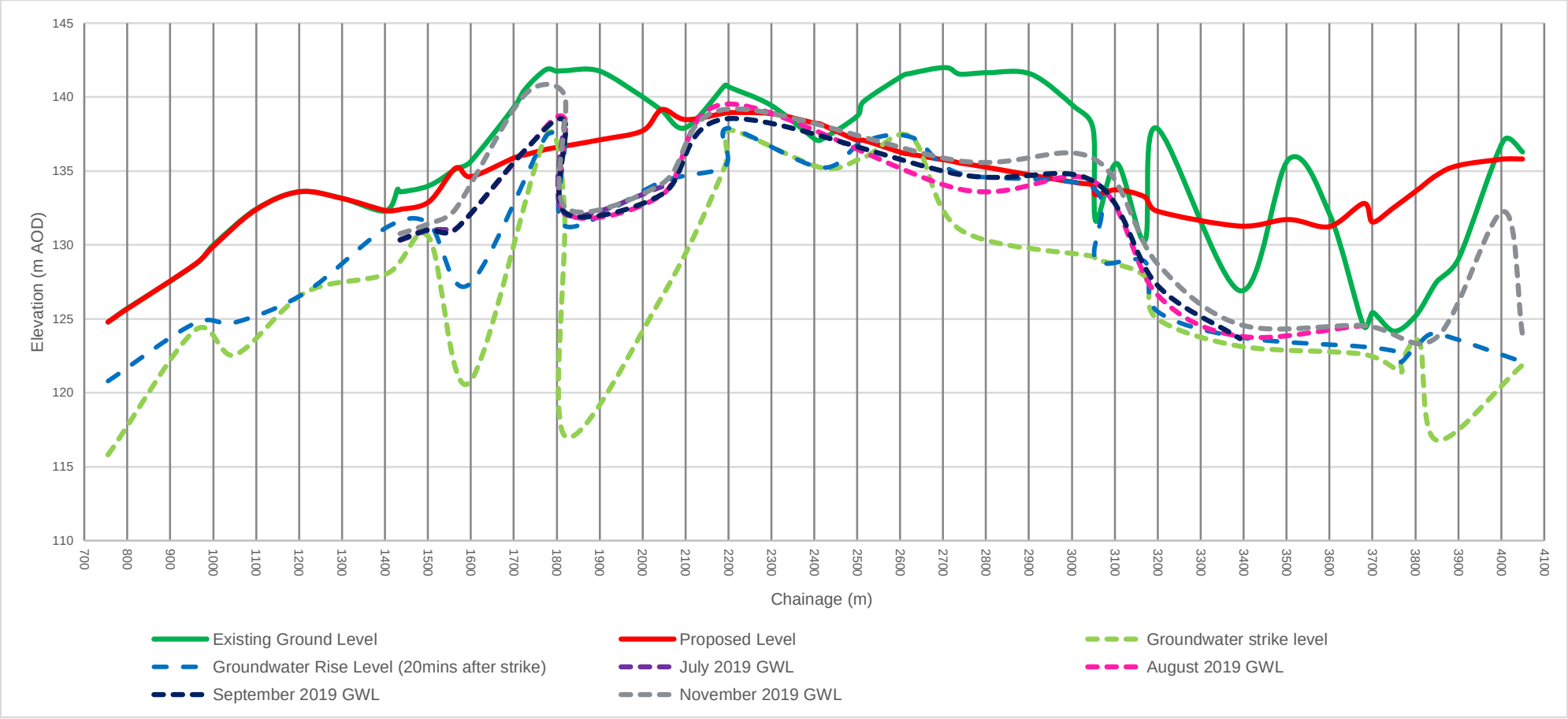
6.17.2 Up to ten rounds of groundwater monitoring were undertaken between the 11th July 2019 and 25th November 2019 as part of the 2019 Ground Investigation. The results of the groundwater monitoring are summarised in Table 6.17.2 and a plot showing the ground water levels fluctuation with time, including boreholes and trial pits the water strikes and response after 20 minutes, is shown in Figure 6.17-1.

Table 6.17.2: Summary of Groundwater Level Monitoring

Hole	Response Zone (m AOD)		Geological Formation	Water Level Readings (m AOD)										
	Top	Bottom		First Round	Second Round	Third Round	Fourth Round	Fifth Round	Sixth Round	Seventh Round	Eighth Round	Ninth Round	Tenth Round	Eleventh Round
				11/07/2019	21/07/19 – 23/07/19	31/07/19 – 01/08/19	06/08/19 – 07/08/19	20/08/19 – 21/08/19	29/08/19 – 30/08/19	05/09/19 – 06/09/19	05/11/19 – 08/11/19	12/11/19 – 14/11/19	18/11/19 – 20/11/19	25/11/2019
BH03	139.78	136.28	MG	-	Dry	136.73	136.36	136.3	136.38	136.32	136.62	140.16	140.12	-
BH04	132.29	123.29	GSG/WSST/SST/SLST	-	129.49	130.31	130.37	130.34	130.37	130.31	130.57	130.69	130.75	-
BH05	128.33	122.44	WSST	-	-	-	-	-	-	-	130.85	130.92	131.06	-
BH06	131.51	113.53	GSG/WSST	-	130.76	130.99	131.04	126.11	131.04	131.2	131.29	131.38	131.45	-
BH07	126.47	121.97	WSST	-	130.77	131.02	131.03	131.07	131.07	131.01	132.32	132.39	132.44	-
BH08A	121.17	113.97	SST/CONG	138.62	138.52	138.53	138.52	138.57	138.38	138.52	139.07	140.11	139.16	-
BH09	121.36	114.36	WSST	132.08	132.11	132.11	132.15	132.14	132.19	133.15	132.45	132.51	132.53	-
BH10	129.75	123.25	WSST/SST	131.12	130.95	130.98	131.02	128.06	131.08	129.05	131.59	131.74	131.86	-
BH11	128.28	124.28	WSST/SLST	133.69	133.68	133.95	133.4	133.36	133.41	133.38	133.64	-	133.85	134.15
BH12	137.79	134.79	GSG/GT	-	-	-	138.6	139.52	138.53	138.39	139.17	-	139.17	139.19
BH16	133.46	130.46	GSG	-	-	-	-	133.78	134.76	134.69	135.47	135.54	135.69	-
BH18	136.82	125.82	GSG/GT/MST	-	134.34	134.32	134.29	134.32	134.32	134.27	135.58	135.86	136.27	-
BH20	138.64	124.54	GSG	-	126.74	127.34	126.58	126.67	127.31	127.08	128.36	128.42	128.8	-
BH21	123.65	120.65	ALL-C/GSG	-	-	-	-	123.82	123.66	123.67	124.5	124.62	124.3	124.49
*BH22A	100.54	95.54	SST/WSST/WST	-	-	-	-	124.54*	124.54*	124.54*	124.54*	124.54*	124.54*	-
BH24	122.17	117.17	GSG	-	121.62	121.61	121.54	121.57	121.55	121.61	122.39	122.56	122.66	-
BH25	119.79	113.89	GSG	-	-	-	-	-	-	-	123.61	123.73	123.77	-
BH26	134.04	132.04	MG	-	-	-	-	-	-	-	132.28	132.21	132.03	-
BH27	127.3	118.3	WSST	-	-	-	-	-	-	-	-	123.77	123.82	123.89

*Note: * BH22A recorded a low flow of artesian water which is considered a potential risk during construction. Details of this are discussed in Section 7 of this report.*

Figure 6.17-1: Groundwater Level Fluctuation with Time



6.18 Groundwater / Chemistry

Human Health Risk Assessment

6.18.1 The following sections present an evaluation of the risks to human health (e.g. future site users following the proposed future use of the site) associated with any potential contamination present within the soils and soil leachate present across the Scheme.

6.18.2 In accordance with Environment Agency Land Contamination: Risk Management, 2019 guidance a Tier 2 *generic quantitative risk assessment was undertaken on the soil and leachate sample datasets that resulted from the 2019 Ground Investigation to identify whether any of the samples had recorded concentrations of the various metals, inorganic and organic determinants that were elevated in comparison with the corresponding Generic Assessment Criteria (GAC) for the proposed highway development of the site.

6.18.3 Generic Assessment Criteria (GAC) are defined in the Land Contamination: Risk Assessment guidance as: "screening criteria which are derived using a standard set of generic assumptions. They are designed to be broadly applicable to a wide range of site conditions and exposure scenarios. They must be appropriate and suitable for your site".

6.18.4 These generic assumptions are generally conservative based upon a defined range of conditions, the appropriateness of such values to site conditions, therefore, needs to be fully understood and evaluated.

6.18.5 A commercial/industrial end use categorisation is considered to be the most appropriate for a highway development.

6.18.6 The hierarchy of soil GAC sources for a commercial/industrial end use (HH Soil. Commercial/Industrial. Sandy Loam. TOC >=0.58 to <1.45%) utilised in the analysis is as follows:

- LQM/CIEH Suitable 4 Use Levels (2015). Commercial. Inorganic;
- LQM/CIEH Suitable 4 Use Levels (2015). Commercial. 1% SOM;
- EIC/AGS/CL:AIRE GAC. Commercial/Industrial, Sandy Loam, 1% SOM;
- AECOM GAC, modified EIC. Commercial/Industrial, Sandy Loam, 1% SOM;
- Defra (2014) SP1010: Development of Category 4 Screening Levels for Assessment of Land Contamination - Policy Companion Document, December 2014. Commercial. 1% SOM;
- Defra (2014) SP1010: Development of Category 4 Screening Levels for Assessment of Land Contamination - Policy Companion Document, December 2014. Commercial. 6% SOM; and
- US Environmental Protection Agency, Regional Screening Levels, May 2019. Industrial (no vapours).

* In the Land Contamination: Risk Management (EA, 2019) guidance the Preliminary Risk Assessment is defined as a Tier 1 assessment.

6.18.7 These GAC constitute the Tier 2 quantitative risk assessment criteria and are based upon the series of standard default assumptions as to ground conditions, the duration and frequency of exposure of the end-use receptor group as defined in the EA/DEFRA science reports. They are based on a sandy loam soil type, with a Soil Organic Matter content of 0.58 – 1.45%.

Tier 2 Screening (Soil)

6.18.8 The results of the Tier 2 screening assessment for the soil samples obtained during the 2019 Ground Investigation are presented in Appendix C and the certificates of chemical analysis are presented in the Ground Investigation Report (HE514465-BAM-EGT-ZZ-RP-WM-0001).

6.18.9 The soil tests carried out include:

- Forty-seven (47) Soil Suite A tests: Arsenic, Boron Cadmium, Copper, Chromium (hexavalent), Chromium (total), Iron, Lead, Mercury, Nickel, Selenium, Zinc, Cyanide (total), Cyanide (free), Asbestos, pH value, Ammoniacal nitrogen, Phenols, Soil Organic Matter;
  - Five (5) Topsoil, twenty-three (23) Made Ground, nineteen (19) Natural deposits
- Thirty-nine (39) tests for asbestos screening and identification tests;
- Twenty-five (25) Total Petroleum Hydrocarbon (speciated)– CWG Aliphatic/Aromatic Split (with CWG banding (C5-40) tests;
  - Three (3) Topsoil, fifteen (15) Made Ground, seven (7) Natural deposits
- Thirty-three (33) Polycyclic Aromatic Hydrocarbons (USEPA 16) speciated tests;
  - Four (4) Topsoil, nineteen (19) Made Ground, ten (10) Natural deposits
- Thirteen (13) Volatile Organic Chemicals (VOCs) tests;
  - One (1) Topsoil, nineteen (9) Made Ground, three (3) Natural deposits
- Twenty (20) Semi- Volatile Organic Chemicals (SVOCs) tests;
  - Two (2) Topsoil, thirteen (13) Made Ground, five (5) Natural deposits
- Forty-seven (47) tests for Phenols – speciated; and
  - Five (5) Topsoil, twenty-three (23) Made Ground, nineteen (19) Natural deposits

6.18.10 All identified exceedances above the GAC for soils occurred in Made Ground. The details of these exceedances are summarised in Table 6.18.1.

Table 6.18.1: Summary of Exceedances in Made Ground

Determinand	No. of Exceedances / No. Analysed	Units	GAC	Minimum Concentration	Maximum Concentration
Asbestos					
Chrysotile	1 / 39	-	-	<0.001	<0.001
PAH					
Benzo(a)pyrene	1 / 19	mg/kg	35	<0.00005	80
Dibenz(a,h)anthracene	1 / 19	mg/kg	3.5	<0.00005	8.9
Benzo(b)fluoranthene	1 / 19	mg/kg	44	<0.00005	86

6.18.11 Table 6.18.2 outlines at which locations and depths these exceedances in Made Ground at the Site were identified.

Table 6.18.2: Location and Depths of Identified Exceedances in Made Ground

Determinand	Location	Depth (m bgl)	Ground Characteristics
PAH			
Benzo(a)pyrene Dibenz(a,h)anthracene Benzo(b)fluoranthene	BH29	3	MADE GROUND: Soft becoming firm reddish brown gravelly slightly sandy clay with medium cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of quartz, sandstone, siltstone, brick, coal, tarmac and slag. Cobbles are angular of bricks and quartz. (hydrocarbon odour).

6.18.12 Table 6.18.2 shows one exceedance of Benzo(a)pyrene, Dibenz(a,h)anthracene and Benzo(b)fluoranthene recorded in a sample taken from a depth of 3.0m bgl (133.26m AOD) in borehole BH29. As the exceedances are marginal and in one location only this indicates a negligible risk to human health from PAH.

6.18.13 Asbestos identified as Chrysotile was detected in TP04 at a depth of 3.0m bgl (135.94m AOD). Quantification analysis was undertaken on this sample which recorded a concentration of <0.001% wt./wt. asbestos.

Controlled Water Risk Assessment

6.18.14 Soil leachate and groundwater monitoring datasets have been evaluated against the following hierarchy of criteria in order to assess potential risks with respect to Environmental Quality Standards (EQS):

- The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015 - AA-EQS Inland; MAC-EQS Inland and Freshwater Standards;
- The Water Environment (River Basin Management Planning etc.) (Miscellaneous Amendments) (Scotland) Regulations 2015. Scottish SI 2015 No. 211. AA-EQS Inland and MAC-EQS Inland;
- SEPA - Supporting Guidance (WAT-SG-53) Environmental Quality Standards for Discharges to Surface Waters. v6. Dec 2015. Fresh EQS – AA and Fresh EQS – MAC;

- The Water Framework Directive (Classification, Priority Substances and Shellfish Waters) Regulations (Northern Ireland) 2015. AA-EQS Inland; MAC-EQS Inland and Freshwater Standards;
- European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2015. S.I. No. 386 of 2015. Ireland - AA-EQS Inland and MAC-EQS Inland; and
- PNEC derived for EU REACH registration dossiers – Freshwater.

6.18.15 Soil leachate and groundwater monitoring datasets have been evaluated against the following hierarchy of criteria for the drinking water abstraction or groundwater receptors in order to assess potential risks with respect to the Drinking Water Standards (DWS):

- Water, England & Wales - Water Supply (Water Quality) Regulations, 2016 No. 614;
- Guidelines for Drinking-water Quality (4th Edition). World Health Organisation. 2011;
- WHO, Petroleum Products in Drinking-Water. Background document for development of WHO Guidelines for Drinking-water Quality WHO/SDE/WSH/05.08/123, 2008;
- Drinking Water Guidelines Calculated using WHO Methodology;
- US Environmental Protection Agency, Regional Screening Levels, May 2016. Tap water; and
- Draft health protective concentration from California Environmental Protection Agency (1999) Ethanol in Gasoline.

6.18.16 An Initial Tier 2 Generic Quantitative Risk Assessment was undertaken to compare the soil leachate and groundwater monitoring datasets to the criteria detailed above depending on the identified receptor. The aim of the Tier 2 screening is to identify whether any of the samples had recorded elevated concentrations of metals, inorganic or organic determinands compared to the screening criteria.

6.18.17 It should be noted that for a risk to be present, a viable pollutant linkage should be identified between the source and receptor. The results of the Tier 2 Screen for controlled waters are presented in Appendix C to this GIR.

Critical Receptors

6.18.18 The small superficial deposits of alluvium located to the north of the Scheme along the M6 is designated as a Secondary 'A' aquifer. The Devensian Till which underlies the majority of the Scheme running along the M6 and a small area to the east of the Scheme along the M54 is designated as a Secondary (Undifferentiated) aquifer.

6.18.19 The majority of the bedrock (Clent and Enville Formation, Alveley Member, Etruria Formation) is designated as Secondary A. Small sections of the Chester Formation to the north and west of the Scheme are designated as a Principal Aquifer.

6.18.20 The main surface water critical receptor is Latherford Brook which crosses through the north area of the Scheme near the M6 J11. There are also several small fishing ponds in the Lower Pool and Brookfield Farm area.

6.18.21 The majority of the alignment of the Scheme does not lie within a SPZ. However, the area from the M54 Junction 2 eastwards for approximately 1.2km, heading northwards through the Featherstone area and towards Latherford are within a SPZ 3 (Total Catchment).

6.18.22 The Envirocheck Report (2017) indicates that there are no groundwater abstractions within the Scheme boundary whilst there are six groundwater abstractions within 1.0km of the Scheme boundary. The details of these groundwater abstractions are detailed in Table 6.18.3. A private water supply noted as AW9 on Environmental Statement Figure 13.1 [TR010054/APP/6.2]. AW9 is located at Latherford Farm to the north of the Order limits.

Table 6.18.3: Groundwater abstractions identified within 1km of the Scheme

Water Abstraction Details	Compass Direction	Estimated Distance from Site (m)	NGR
Operator: Allow Limited Location: Hilton Park – Borehole Abstraction type: Private non-industrial amenity (lake and pond throughflow)	E	950	395790 304390
Operator: R & M Simkin Location: Essington Fruit Farm - Borehole Abstraction type: General agriculture (spray irrigation – direct)	SE	850	395420 303820
Operator: Tarmac Limited Location: Windmill Quarry, off Cannock Road – Gravel pit Abstraction type: Extractive – Mineral washing	SE	599	394320 303910
Operator: Tarmac Limited Location: Windmill Quarry, off Cannock Road – Gravel pit Abstraction type: Extractive – Mineral washing	SE	677	394300 303800
Operator: Tarmac Building Products Limited Location: Hilton Industrial Estate - Borehole Abstraction type: Other industrial/commercial/public services – process water	W	404	394010 304050
Operator: Hollybush Nurseries Ltd Location: Hollybush Garden Centre & Nursery - Borehole Abstraction type: General agriculture (spray irrigation – direct)	NE	366	396450 306490

Leachate Analysis Results (Tier 2 Screening)

6.18.23 The results of the Tier 2 screening assessment for the leachate samples obtained during the ground investigation are presented in Appendix C and the certificates of chemical analysis are presented in the Ground Investigation Report (HE514465-BAM-EGT-ZZ-RP-WM-0001).

6.18.24 The leachate tests carried out included:

- Forty-three (43) Leachate Suite B tests: Arsenic, Boron Cadmium, Copper, Chromium (hexavalent), Chromium (total), Iron, Lead, Mercury, Nickel, Selenium, Zinc, Cyanide (total), Cyanide (free), Asbestos, pH value, Ammoniacal nitrogen, Phenols, Soil Organic Matter;
  - Four (4) Topsoil, twenty (20) Made Ground, nineteen (19) Natural deposits
- Twenty (20) Total Petroleum Hydrocarbon (speciated)– CWG Aliphatic/Aromatic Split (with CWG banding (C5-40) test;
  - Three (3) Topsoil, ten (10) Made Ground, seven (7) Natural deposits

- Thirty-five (35) Polycyclic Aromatic Hydrocarbons (USEPA 16) speciated tests;
  - Four (4) Topsoil, eighteen (18) Made Ground, thirteen (13) Natural deposits
- Fourteen (14) Volatile Organic Chemicals (VOCs) tests;
  - One (1) Topsoil, ten (10) Made Ground, three (3) Natural deposits
- Twenty-one (21) Semi- Volatile Organic Chemicals (SVOCs) tests;
  - Two (2) Topsoil, thirteen (13) Made Ground, six (6) Natural deposits
- Forty-four (44) tests for Phenols – speciated; and
  - Four (4) Topsoil, twenty (20) Made Ground, Nineteen (19) Natural deposits
- Four (4) tests for Pesticides/ herbicides.
  - One (1) Topsoil, three (3) Natural deposits

6.18.25 The exceedances recorded in the soil leachate samples in each strata are summarised in Table 6.18.4 to Table 6.18.6.

Table 6.18.4: Summary of Exceedances in Soil Leachate in Topsoil

Determinand	No. of Exceedances / No. Analysed	Units	DWS	EQS	Concentration		> DWS	> EQS
					Minimum	Maximum		
pH	-	-	-	-	6.7	8.1	-	-
Dissolved Organic Carbon	-	mg/L	-	-	4.22	16	-	-
VOC								
Hexachlorobutadiene	1 / 2	µg/L	0.1	0.6	<0.05	0.19	Yes	No
Metals								
Copper	4 / 4	µg/L	2,000	1	1.8	22	No	Yes
Iron	2 / 4	µg/L	200	1,000	13	7,000	Yes	Yes
Lead	2 / 4	µg/L	10	1.2	<1	8.6	No	Yes
Nickel	1 / 4	µg/L	20	4	<0.3	6.1	No	Yes
Zinc	1 / 4	µg/L	6,000	10.9	4.2	29	No	Yes

Table 6.18.5: Summary of Exceedances in Soil Leachate in Made Ground

Determinand	No. of Exceedances / No. Analysed	Units	DWS	EQS	Concentration		> DWS	> EQS
					Minimum	Maximum		
pH	-	-	-	-	6.7	11	-	-
Dissolved Organic Carbon	-	mg/L	-	-	<0.1	25.4	-	-
TPH								
>EC10-EC12 Aromatics	1 / 10	µg/L	90	-	<10	600	Yes	-
>EC12-EC16 Aromatics	1 / 10	µg/L	90	-	<10	1,700	Yes	-
>EC16-EC21 Aromatics	1 / 10	µg/L	90	-	<10	1,600	Yes	-
>EC21-EC35 Aromatics	1 / 10	µg/L	90	-	<10	210	Yes	-