ALIGN Working on behalf of HS2

Construction of Chiltern Tunnel Site Specific Groundwater Monitoring

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1 Introduction

- 1.1.1 This document has been prepared in order to provide details of the proposed groundwater monitoring required prior to, during and following construction of the Chiltern tunnel, including the cross passages. The report supports the Water Environment Assessments¹² prepared for the tunnel and cross passages construction consent applications and these documents should be read in conjunction with this report.
- 1.1.2 All monitoring locations referred to in this report are shown on the map in Figure 1 and Appendix A with borehole logs provided in Appendix B.

2 Baseline groundwater monitoring by HS2

2.1.1 Locations used for baseline monitoring prior to the start of construction works were agreed between the EA and HS2 in consultation with Affinity Water. Boreholes identified for this purpose are referred to as Priority Monitoring Boreholes. The baseline monitoring prior to start of construction works has been undertaken by HS2, and latterly Align, at a series of Priority Monitoring Boreholes. There are 26 Priority locations along the line of the tunnel with a summary of the available data provided in Table 1 and their positions are shown in Appendix A:

Location	Ground Level	Easting Northing		Response Zone Top	Response Zone Base	Data available from	
	m AOD	m	m		m bgl	mbgl	Date
ML031-CR003	84	501962	191764	Chalk	25.00	45.00	Oct 2016
ML035-CR003	72	499036	193721	Chalk	14.00	34.00	Nov 2016
ML035-CR004	72	498914	193850	River Terrace deposits	0.50	6.00	Nov 2016
				Chalk	18.00	28.00	Nov 2016
ML035-RC013	86	498602	194084	Chalk	15.00	60.00	Jan 2017
ML035-RO001	77	498654	194212	Chalk	5.00	50.00	Jan 2017
ML035-RO002a	71	499179	193641	Chalk	6.00	16.00	Feb 2017

Table 1: Baseline monitoring borehole location and depths.

¹ Align, 2021, Chiltern Tunnel Construction Water Environment Assessment, Document no: 1MC05-ALJ-EV-REP-CS02_CL04-000142

² Align, 2021, Chiltern Tunnel Cross Passages Construction Water Environment Assessment, Document No. TBC

Location	Easting Northing		Response Zone Top	Response Zone Base	Data available from		
	m AOD	m	m		m bgl	mbgl	Date
ML035-RO003a	71	499197	193634	River Terrace deposits	3.00	6.00	Jan 2017
ML036-RC006	113	498095	194328	Chalk	55.50	68.00	Nov 2016
ML037-RC001	103	497551	194607	Chalk	30.00	46.00	Oct 2016
ML037-RC014	118	497018	195002	Chalk	38.00	65.00	Mar 2017
ML039-RC002	159	496039	195935	Chalk Chalk	54.00 83.50	72.50 93.50	Oct 2016 Oct 2016
ML039-RC015	102	495355	196595	Chalk	31.50	41.50	Oct 2016
ML039-RO002	103	495888	196905	Chalk	28.00	67.00	Jan 2017
ML040-RC002	105	495314	196630	Chalk	27.00	67.00	Jan 2018
ML040-RO007	105	494962	197481	Chalk	10.00	50.00	Dec 2016
ML041-RC012	104	494061	197997	Chalk	5.00	25.00	Aug 2016
ML041-RO001	97	494478	197792	Chalk	6.50	30.00	Jan 2017
ML042-CR001a	101	493836	198222	Alluvium Chalk	1.00 20.50	5.00 30.50	Oct 2016 Oct 2016
ML042-CR003	101	493822	198374	Chalk	15.00	35.00	Nov 2016
ML042-RC002	101	493938	198118	Chalk	20.00	30.00	Aug 2016
ML042-RC014	112	493449	198740	Chalk	22.00	23.00	Dec 2016
ML042-RC021	117	493329	198800	Chalk	50.00	65.00	Jan 2017
ML042-RO004	101	493865	198351	River Terrace deposits	1.00	3.00	Nov 2016
ML043-RC009	136	492896	199301	Chalk	32.00	42.00	Dec 2016
ML044-RC007	165	492280	200018	White Chalk	45.00	75.00	Jan 2017
ML046-RC026	182	491201	201185	White Chalk	24.00	60.00	Jan 2017

2.1.2 Monitoring data has been provided by HS2 in a series of baseline reports which include data up to March 2020. Align took over the monitoring in September 2020 and this Priority Borehole monitoring data is now shared by Align with HS2, Affinity Water and the Environment Agency on a monthly basis. The next update planned for February 2021.

3 Monitoring during construction

^{3.1.1} Construction monitoring along the line of the tunnel will be undertaken by Align and will commence in April 2021, prior to the start of tunnelling activities which are programmed

for May 2021. Monitoring is linked to active tunnel construction and so is closely linked to the locations of the tunnel boring machines (TBMs) and as such will vary both in time and space along the line of the tunnel, tracking the progress of tunnel excavation. Monitoring will only be undertaken in the areas where the tunnel will be at or below the water table.

Groundwater monitoring

Tunnel

- 3.1.2 The boreholes to be monitored, their locations and depth of response zones are listed in Table 2, whilst the frequency and type of monitoring is listed in Tables 3 to 9, with the locations shown on the map in Figure 1 with more detailed figures presented in Appendix A.
- 3.1.3 A number of Priority boreholes have been selected for tunnel monitoring (Table 2), although it is important to point out that monitoring of the Priority boreholes (both water level and water quality) as required by the APA will continue on a monthly basis irrespective of the progress of tunnel construction.
- 3.1.4 The monitoring frequency and determinands are those currently anticipated to be required, but these may be amended to accommodate any changes to programme. In addition, the monitoring frequency would increase after an event such as a spill or if data suggested threshold exceedances occurred or mitigation was required. Any changes to monitoring frequency or determinands will be agreed between Align, HS2, Affinity Water and the Environment Agency. Where practical all monitoring boreholes will be retained for the duration of the monitoring but if boreholes are lost or damaged beyond use then Align, HS2, Affinity Water and the Environment Agency will discuss the need for a replacement borehole and its location. No boreholes will be decommissioned without prior agreement.
- 3.1.5 Proximity to the TBM will be the principal driver for monitoring frequency with the dates stated in the following tables based upon the current programme and therefore subject to change. Programme will be reviewed every 3 months to check on the proposed monitoring vs actual TBM progress at which time any necessary amendments to monitoring timings would be implemented.

Figure 1: Monitoring borehole locations



Location	Ground Level	Easting	Northing	Geology	Stand pipe dia.	Response Zone Top	Response Zone Base	Approximate Tunnel invert level
	m AOD	m	m		mm	m bgl	mbgl	mAOD
ML031-CR013	75.80	502246	191442	CHALK	50	15	35	55
ML032-RC001	87.16	501761	191929	CHALK	50	23.50	64	50
ML032-RC004	94.27	501609	191986	CHALK	50	28	64	50
ML032-RC014	98.58	501569	192113	CHALK	50	37.80	57.80	50
ML032-RC006	99.44	501451	192155	CHALK	50	33.50	54	50
ML032-RC009	99.99	501328	192333	CHALK	50	49.50	64	45
ML033-RC423	99.5	500424	192953	CHALK	50	47.50	64.50	40
ML034-CR001	102.38	500115	193167	CHALK	50	55	75	40
ML034-RC007	100.79	499891	193226	CHALK	50	52	63	40
ML034-RO407	101.57	500046	193191	CHALK	50	42	62.40	40
ML034-RO408	101.12	500035	193139	CHALK	50	42	67	40
ML034-RD400 deep	101.23	500037	193135	CHALK	50	76.55	86.55	40
ML034-RD401 shallow	100.29	500015	193106	CHALK	50	43.96	49.96	40
ML034-RD401 deep	100.29	500015	193106	CHALK	50	74.11	85.11	40
ML035-RC016	72.86	499288	193572	CHALK	50	21	31.50	40

Table 2: Monitoring borehole locations and depths.

Location	Ground Level	Easting	Northing	Geology	Stand pipe dia.	Response Zone Top	Response Zone Base	Approximate Tunnel invert level
	m AOD	m	m		mm	m bgl	mbgl	mAOD
ML035-RO002a	70.95	499179	193641	CHALK	50	6	16	45
ML035-RO003a	70.69	499197	193634	River terrace deposits (RTD)	50	3	6	45
ML035-CR003	71.34	499036	193721	CHALK	50	13.50	34.50	45
ML035-CR004 (CHK)	72.15	498914	193850	CHALK	50	18	28	45
ML035-CR004 (RTD)	72.15	498914	193850	River terrace deposits (RTD)	50	0.5	6	45
ML035-RC012	79.45	498739	193951	CHALK	50	19	40.25	45
ML035-RO001	76	498654	194212	CHALK	50	4.50	50	45
ML035-RC013	85.82	498602	194084	CHALK	50	14.50	61.50	45
ML036-RC004	108.68	498268	194250	CHALK	50	43	63	50
ML037-RC001	103.63	497551	194607	CHALK	50	30	40	60
ML037-RC003	100.4	497375	194688	CHALK	50	28	39	60
ML037-RC019	94.15	497336	194775	CHALK	50	17.5	37.5	60
ML037-RO439	99.36	497209	194852	CHALK	50	46.69	56.69	65

Location	Ground Level	Easting	Northing	Geology	Stand pipe dia.	Response Zone Top	Response Zone Base	Approximate Tunnel invert level
	m AOD	m	m		mm	m bgl	mbgl	mAOD
ML037-RC014	118.24	497018	195002	CHALK	50	37.5	65	65
ML037-CR433	95.35	497266	194785	CHALK	50	25.40	43.40	65
ML037-RC012	97.32	497195	194794	CHALK	50	23	37	65
ML037-RC009	99.59	497265	194830	CHALK	50	22	43	65
ML037-RO440	99.84	497224	194872	CHALK	50	48.36	58.36	65
ML038-RC004	120.86	496560	195405	CHALK	50	43	53.50	70
ML039-RC010	136.07	495476	196452	CHALK	50	71.07	61.07	60
ML039-RC015	101.44	495355	196595	CHALK	50	31	41	60
ML040-RC004c	101.36	495314	196630	CHALK	50	27	47	60
ML040-RC434	105.26	495309	196686	CHALK	50	37.5	55.5	60
ML039-RO002	103.09	495888	196905	CHALK	50	27	70	60
ML040-RO409	111.07	495795	196856	CHALK	50	15.99	30.99	60
ML040-RO406	100.31	495353	196685	CHALK	50	53.24	63.24	60
ML040-RO001	99.83	495359	196674	CHALK	50	54.70	64.70	60
ML040-RC435	101.78	495370	196612	CHALK	50	23	46	60
ML040-RO007	104.83	494962	197481	CHALK	50	10	50	65
ML040-RC012	131.21	494940	197247	CHALK	50	54.50	75.50	65
ML041-RO001	103.04	494478	197792	CHALK	50	5	30.20	65
ML041-RC007	116.93	494281	197734	CHALK	50	5	60	70
ML041-RC010	107.69	494226	197892	CHALK	50	27	39	70

Location	Ground Level	Easting	Northing	Geology	Stand pipe dia.	Response Zone Top	Response Zone Base	Approximate Tunnel invert level
	m AOD	m	m		mm	m bgl	mbgl	mAOD
ML041-RC012	106.37	494061	197997	CHALK	50	5	25	70
ML042-RC002	101.11	493938	198118	CHALK	50	20	30	70
ML042-CR001a (shallow)	100.64	493836	198222	Alluvium	50	1	5	70
ML042-CR001a (deep)	100.64	493836	198222	CHALK	50	20	31	70
ML042-RO004	100.81	493865	198351	River terrace deposits (RTD)	50	1	3	70
ML042-CR003	100.22	493822	198374	CHALK	50	14.90	35.10	70
ML042-RC010	104.65	493635	198499	CHALK	50	23	33	75
ML042-RC013	106.28	493522	198543	CHALK	50	17	37	75
ML042-RC014	111.37	493449	198740	CHALK	50	22.5	33	80
ML042-CR439	112.81	493397	198760	CHALK	50	26	44	80
ML042-RC021	116.72	493329	198800	CHALK	50	50	65	80
ML043-CR438	119.16	493336	198829	CHALK	50	31	41	80
ML043-RO404	121.78	493302	198857	CHALK	50	51.7	61.7	80
ML042-RC020	117.26	493393	198809	CHALK	50	23	55	80
ML042-RC001	117.82	493399	198815	CHALK	50	21.5	42	80

Location	Ground Level	Easting	Northing	Geology	Stand pipe dia.	Response Zone Top	Response Zone Base	Approximate Tunnel invert level
	m AOD	m	m		mm	m bgl	mbgl	mAOD
ML043-RO405	120.19	493356	198838	CHALK	50	50.4	60.4	80
ML043-RO403 Deep	120.39	493320	198838	CHALK	50	50	60	80
ML043-RC004	131.41	493221	198983	CHALK	50	30	40	85
ML043-RC007	130.68	493129	199048	CHALK	50	32.50	43	85

Note: Priority boreholes in bold

- 3.1.6 As the key concerns along the tunnel are the potential to increase turbidity the monitoring is focussed on field measurements of turbidity using portable equipment. In addition, monitoring of pH, electrical conductivity, temperature, redox and dissolved oxygen would be undertaken at the monitoring boreholes using hand held equipment. The pH and conductivity data would provide an indication of any grout contamination. If significant changes (compared to baseline) in these parameters are identified, then further monitoring and laboratory analysis for major ions would be undertaken to determine if contaminant migration is taking place and if any mitigation is required. Samples would also be collected and analysed for the presence of TBM greases (Table 3). Groundwater level monitoring would also be undertaken at the same time as water quality monitoring to determine what, if any, changes to the hydraulic gradients in the vicinity of the tunnel occur during construction.
- 3.1.7 Monitoring would begin on a monthly basis starting approximately 3 months in advance of TBM arrival, with the first position to be monitored from March 2021 (Table 4). Monitoring frequency would then increase to daily (Mon-Fri) when the TBM is within circa 150m of a monitoring borehole, to determine if there are significant effects as a result of tunnel construction, with the anticipated timings of this set out in Table 5. If no significant effects are encountered then monitoring will decrease to weekly once the TBM has moved beyond 300m from the monitoring borehole. These distances are based upon proximity of the TBM. 150m is assumed to be approximately 7 days until TBM arrival (assuming a 20m/day rate of progress), with 300m being 2 weeks until TBM arrival.
- 3.1.8 Monitoring frequency would increase to daily (Mon-Fri) as the second TBM approaches in close proximity to the monitoring location (circa 150m) and would continue until the TBM had moved more than 300m from the monitoring borehole, with indicative dates set out in Table 6.
- 3.1.9 After this period the monitoring would reduce to weekly for one month and then reduce further to monthly at only the Priority boreholes (Table 7). If significant changes in water quality are detected then discussions would be held with the Environment Agency, Affinity Water and HS2 before any change in monitoring frequency is implemented.
- 3.1.10 Groundwater level monitoring would be undertaken by manual dipping using a portable dip meter. Twenty-one of the boreholes would be installed with data loggers set to monitor water levels at hourly intervals and which would be downloaded on a monthly basis. If there are activities of significant concern the recording frequency for the loggers and download frequency can be increased.

- 3.1.11 Trigger levels have been provided in column 11 of Tables 4 to 7 for the parameters being monitored. These levels have been set based on professional judgement and are designed to provide an indication when additional action may be required by Align. In the event of a trigger level being exceeded the Align shaft environment manager would contact the EA, HS2 and Affinity Water to notify them, to make them aware of the exceedance and to discuss if additional monitoring is required. The notification procedure is discussed further in section 7.
- 3.1.12 The groundwater quality samples would be collected following purging. The method of purging and sampling may vary between boreholes but will likely include the following:
 - Purging using a small electric or compressed air pump or check valve system with monitoring of well head parameters pH, electrical conductivity, temperature, turbidity, redox and dissolved oxygen to determine when static borehole water has been purged. Purging will be deemed complete when well head parameters have stabilised. Purged water would be discharged to ground unless there is evidence of contamination.
 - Samples would be collected using the pump, check valve system or bailer following purging and depending upon the analysis to be performed. Pumping systems would not be used for sampling where analysis for volatile compounds is required. Low flow purging/sampling using bladder pumps will also be considered along with no purge sampling using sample bags such as hydrasleeves³ in some circumstances. Where a pressure transducer is present in a borehole to be sampled care will be taken to ensure that the logger is always set to the same elevation in the borehole after sampling has been completed as it was prior to sampling.
 - Analysis would be completed for pH, electrical conductivity, temperature, turbidity, redox and dissolved oxygen on site using portable equipment. For any other analyses (Table 3) water samples would be collected in bottles provided by the laboratory and stored in chilled cool boxes prior to dispatch to the laboratory.
- 3.1.13 As part of the preparation of this monitoring plan an audit has been commenced to confirm those boreholes that are available for monitoring. Due to land access constraints only a small number of boreholes have been visited to date, with the remainder to be checked as soon as access is allowed. Once the audit is complete the available boreholes will be assessed and any replacements will be made.

³ https://waterra.com/hydrasleeve-for-groundwater-sampling

Table 3: Analytical suites

Group Suit Physical (field) (a Physical (lab) (b	electrical conductivity pH	Detection 1 0.1 1 1 0.1 0.1 1 0.1 1 1 0.1 1 1 1 0.1 1 1 1	µS/cm pH unit NTU MV Mg/I ⁰C µS/cm pH unit NTU mg/I	Drinking Water Standard# 2500 6.5 <ph<9.5 4 / 1* n/a n/a n/a 2500 6.5<ph<9.5 4 / 1*</ph<9.5 </ph<9.5 	Quality Standard n/a 6 <ph<9 n/a n/a 60-75% n/a n/a 6<ph,9 n/a</ph,9 </ph<9
	pH turbidity redox potential dissolved oxygen temperature electrical conductivity pH turbidity total dissolved solids chemical oxygen demand total suspended solids	1 0.1 1 0.1 0.1 0.1 1 0.1 1 10 10	pH unit NTU MV Mg/I ≌C μS/cm pH unit NTU	Standard# 2500 6.5 <ph<9.5 4 / 1* n/a n/a n/a 2500 6.5<ph<9.5 4 / 1*</ph<9.5 </ph<9.5 	Standard n/a 6 <ph<9 n/a 60-75% n/a n/a 6<ph,9< th=""></ph,9<></ph<9
	pH turbidity redox potential dissolved oxygen temperature electrical conductivity pH turbidity total dissolved solids chemical oxygen demand total suspended solids	0.1 1 0.1 0.1 1 0.1 1 10 10	pH unit NTU MV Mg/I ≌C μS/cm pH unit NTU	2500 6.5 <ph<9.5 4 / 1* n/a n/a 2500 6.5<ph<9.5 4 / 1*</ph<9.5 </ph<9.5 	n/a 6 <ph<9 n/a n/a 60-75% n/a n/a 6<ph,9< th=""></ph,9<></ph<9
	pH turbidity redox potential dissolved oxygen temperature electrical conductivity pH turbidity total dissolved solids chemical oxygen demand total suspended solids	0.1 1 0.1 0.1 1 0.1 1 10 10	pH unit NTU MV Mg/I ≌C μS/cm pH unit NTU	6.5 <ph<9.5 4 / 1* n/a n/a 2500 6.5<ph<9.5 4 / 1*</ph<9.5 </ph<9.5 	6 <ph<9 n/a n/a 60-75% n/a n/a 6<ph,9< td=""></ph,9<></ph<9
	turbidity redox potential dissolved oxygen temperature electrical conductivity pH turbidity total dissolved solids chemical oxygen demand total suspended solids	1 0.1 0.1 1 0.1 1 10 10	NTU mV Mg/l ⁰C μS/cm pH unit NTU	4 / 1* n/a n/a 2500 6.5 <ph<9.5 4 / 1*</ph<9.5 	n/a n/a 60-75% n/a n/a 6 <ph,9< td=""></ph,9<>
	redox potential dissolved oxygen temperature electrical conductivity pH turbidity total dissolved solids chemical oxygen demand total suspended solids	1 0.1 0.1 1 0.1 1 10 10	mV Mg/l ΩC μS/cm pH unit NTU	n/a n/a 2500 6.5 <ph<9.5 4 / 1*</ph<9.5 	n/a 60-75% n/a n/a 6 <ph,9< td=""></ph,9<>
Physical (lab) (b	dissolved oxygen temperature electrical conductivity pH turbidity total dissolved solids chemical oxygen demand total suspended solids	0.1 1 0.1 1 10 10	≌C μS/cm pH unit NTU	n/a 2500 6.5 <ph<9.5 4 / 1*</ph<9.5 	n/a n/a 6 <ph,9< td=""></ph,9<>
Physical (lab) (b	electrical conductivity pH turbidity total dissolved solids chemical oxygen demand total suspended solids	1 0.1 1 10 10	μS/cm pH unit NTU	2500 6.5 <ph<9.5 4 / 1*</ph<9.5 	n/a 6 <ph,9< td=""></ph,9<>
Physical (lab) (b	pH turbidity total dissolved solids chemical oxygen demand total suspended solids	0.1 1 10 10	pH unit NTU	6.5 <ph<9.5 4 / 1*</ph<9.5 	6 <ph,9< td=""></ph,9<>
Physical (lab) (b	turbidity total dissolved solids chemical oxygen demand total suspended solids	1 10 10	NTU	4/1*	
Physical (lab) (b	total dissolved solids chemical oxygen demand total suspended solids	10 10			n/a
	chemical oxygen demand total suspended solids	10	mg/l		
	total suspended solids			n/a	n/a
			mg/l	n/a	n/a
	Calcium	5	mg/l	n/a	n/a
		1	mg/l	n/a	n/a
	magnesium	1	mg/l	n/a	n/a
	sodium	1	mg/l	200	n/a
Major ions (c	potassium	1	mg/l	n/a	n/a
	chloride	1	mg/l	250	250
	sulphate	1	mg/l	250	400
	bicarbonate/carbonate	1	mg/l	n/a	n/a
	fluoride	1	mg/l	1.5	n/a
	iron	0.11	mg/l	0.2	1
Minor ions/	manganese	0.01	mg/l	0.05	0.1 (bio)
organics (d	dissolved organic	5	mg/l	n/a	n/a
organics	carbon (DOC)				
	total organic carbon	5	mg/l	n/a~	n/a
	(TOC)				
	total nitrogen	1	mg/l	n/a	n/a
	nitrate (NO₃)	0.1	mg/l	50	n/a
Nitrogen species	nitrite (NO ₂)	0.1	mg/l	0.5 / 0.1*	0.01-0.03
and nutrients (e	ammoniacal nitrogen	0.1	mg/l	0.5 (NH ₄)	0.3-0.6 (TN)
and nutrients	(N)				
	total phosphorous	0.1	mg/l	n/a	Various
	ortho phosphate	0.1	mg/l	n/a	n/a
	aluminium	10	µg/l	200	n/a
	arsenic	1	µg/l	10	50
	barium	1	µg/l	n/a	n/a
	cadmium	0.1	µg/l	5	0.08-0.25
	chromium	5	µg/l	50	n/a
T	chromium III		µg/l	n/a	4.7
Trace metals (f)	chromium VI	3	µg/l	n/a	3.4
	copper	1	µg/l	2000	1 (bio)
	mercury	0.05	μg/l	1	0.07
	nickel	1	μg/l	20	4 (bio)
	lead	1	µg/l	10	1.2
	zinc	5	μg/l	n/a	11 (bio)

Group	Suite	Parameters	Limit of Detection	Units	Drinking Water Standard#	Environmental Quality Standard
Hydrocarbons	(g)	Gasoline Range Organics/Extractable Petroleum Hydrocarbons Organics as a screening for light (C_4-C_{10}) and heavy $(C_{10}-C_{40})$ hydrocarbons	100	µg/l	n/a	n/a
Microbiological	(h)	Faecal coliforms; total coliforms; e coli; clostridium; enterococci.	1	no./100ml	0	n/a
Greases	(i)	Specific analytical suite to detect bespoke greases used in the TBM (see Groundwater Assessment for Construction Tasks – Tunnel and Cross Passages, Document no: 1MC05-ALJ-EV-NOT- CS02_CL04-400048). Likely to be long chained hydrocarbons as per suite (g)	10	µg/l	n/a	n/a

Notes: #The Water Supply (Water Quality) Regulations 2016, UK Statutory Instruments 2016, No. 614, Schedule 1. * prescribed at consumers taps/limit at treatment works, ~no abnormal change. Bio - bioavailable

Table 4: Monitoring frequency and determinands for site-specific pre-construction baseline monitoring.

Location	Well Screen (mbgl)	Purpose	Start Date	End Date	Water Level	Water Quality sample suites (as per Table 3)	Monitoring Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
ML031-CR013	15 - 35	M25	March 2021	June 2021	Manual dip	Suite (a)	Monthly	20		
ML032-RC001	23.5 - 64.02	West Hyde SPZ 1	June 2021	September 2021	Logger	Suite (a)	Monthly	35		
ML032-RC004	28 - 64.01	West Hyde SPZ 1	June 2021	September 2021	Manual dip	Suite (a)	Monthly	45		
ML032-RC014	37.8 - 57.8	West Hyde SPZ 1	June 2021	September 2021	Manual dip	Suite (a)	Monthly	45	Purging	
ML032-RC006	33.5 - 54	West Hyde SPZ 1	July 2021	October 2021	Manual dip	Suite (a)	Monthly	50	with direct	
ML032-RC009	49.5 - 64.03	West Hyde SPZ 1	July 2021	October 2021	Manual dip	Suite (a)	Monthly	55	analysis of purged	n/a - baseline
ML033-RC423	47.5 - 64.5	CSP shaft	July 2020	February 2022	Logger	Suite (a)	Monthly	55	water	
ML034-CR001	55 - 75	CSP shaft	July 2020	February 2022	Manual dip	Suite (a)	Monthly	60	quality	
ML034-RC007	52 - 63	CSP shaft	July 2020	February 2022	Manual dip	Suite (a)	Monthly	55	using a	
ML034-RO407	42 - 62.4	CSP shaft	August 2020	February 2022	Logger	Suite (a)	Monthly	55	portable	
ML034-RO408	42 - 67	CSP shaft	July 2020	February 2022	Logger	Suite (a)	Monthly	55	turbidity	
ML034-RD400 deep	76.55 - 86.55	CSP shaft	July 2020	February 2022	Manual dip	Suite (a)	Monthly	80	meter	
ML034-RD401 shallow	43.96 - 49.96	CSP shaft	July 2020	February 2022	Manual dip	Suite (a)	Monthly	45		
ML034-RD401 deep	74.11 - 85.11	CSP shaft	July 2020	February 2022	Logger	Suite (a)	Monthly	75		

Location	Well Screen (mbgl)	Purpose	Start Date	End Date	Water Level	Water Quality sample suites (as per Table 3)	Monitoring Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
ML035-RC016	21 - 31.5	River Misbourne Crossing #1	December 2021	March 2022	Manual dip	Suite (a)	Monthly	25		
ML035- RO002a	6 - 16	River Misbourne Crossing #1	December 2021	March 2022	Manual dip	Suite (a)	Monthly	10		
ML035- RO003a	3 - 6	River Misbourne Crossing #1	January 2022	April 2022	Manual dip	Suite (a)	Monthly	4		
ML035- CR003	13.5 - 34.5	River Misbourne Crossing #1	January 2021	May 2022	Logger	Logger Suite (a) and (d)	Monthly	25	Purging with	
ML035- CR004 (CHK)	18 - 28	River Misbourne Crossing #1	February 2022	May 2022	Manual dip	Suite (a) and (d)	Monthly	25	direct analysis	
ML035- CR004 (RTD)	0.5 - 6	River Misbourne crossing #1	January 2021	May 2022	Logger	Logger Suite (a) and (d)	Monthly	3	of purged water	n/a - baseline
ML035-RC012	19 - 40.25	CSG PWS	February 2022	May 2022	Logger	Suite (a)	Monthly	35	quality	
ML035- RO001	4.5 - 50	CSG PWS	February 2022	May 2022	Manual dip	Suite (a)	Monthly	30	using a portable	
ML035- RC013	14.5 - 61.5	CSG PWS	January 2021	May 2022	Manual dip	Suite (a)	Monthly	40	turbidity meter	
ML036-RC004	43 - 63	CSG PWS	March 2022	June 2022	Manual dip	Suite (a)	Monthly	55]	
ML037- RC001	30 - 40	CSG shaft	October 2020	August 2022	Logger	Suite (a)	Monthly	35		
ML037-RC003	28 - 39	CSG shaft	October 2020	August 2022	Manual dip	Suite (a)	Monthly	30		
ML037-RC019	17.5 - 37.5	CSG shaft	October 2020	August 2022	Logger	Suite (a)	Monthly	30		
ML037-RO439	46.69 - 56.69	CSG shaft	October 2020	August 2022	Manual dip	Suite (a)	Monthly	50	Purging with	n/a - baseline

Location	Well Screen (mbgl)	Purpose	Start Date	End Date	Water Level	Water Quality sample suites (as per Table 3)	Monitoring Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
ML037- RC014	37.5 - 65	CSG shaft	October 2020	August 2022	Manual dip	Suite (a)	Monthly	50	direct analysis	
ML037-CR433	25.4 - 43.4	CSG shaft	October 2020	August 2022	Logger	Suite (a)	Monthly	30	of purged	
ML037-RC012	23 - 37	CSG shaft	October 2020	August 2022	Logger	Suite (a)	Monthly	30	water	
ML037-RC009	22 - 43	CSG shaft	October 2020	August 2022	Manual dip	Suite (a)	Monthly	30	quality	
ML037-RO440	48.36 - 58.36	CSG shaft	October 2020	August 2022	Manual dip	Suite (a)	Monthly	50	using a portable	
ML038-RC004	43 - 53.5	Tunnel alignment	June 2022	September 2022	Manual dip	Suite (a)	Monthly	45	turbidity meter	
ML039-RC010	71.07 - 61.07	Amersham shaft	December 2020	January 2023	Manual dip	Suite (a)	Monthly	65		
ML039- RC015	31 - 41	Amersham shaft	January 2021	January 2023	Logger	Suite (a)	Monthly	35		
ML040- RC004c	27 - 47	Amersham shaft	January 2021	January 2023	Manual dip	Suite (a)	Monthly	40		
ML040-RC434	37.5 - 55.5	Amersham shaft	December 2020	January 2023	Logger	Suite (a)	Monthly	45		
ML039- RO002	27 - 70	Amersham shaft	January 2021	January 2023	Logger	Suite (a)	Monthly	45		
ML040-RO409	15.89 - 30.89	Amersham shaft	December 2020	January 2023	Manual dip	Suite (a)	Monthly	25		
ML040-RO406	53.24 – 63.24	Amersham shaft	January 2021	January 2023	Manual dip	Suite (a)	Monthly	55	Purging with	n/a -
ML040-RO001	54.70 - 64.70	Amersham shaft	December 2020	January 2023	Manual dip	Suite (a)	Monthly	55	direct analysis	baseline

Location	Well Screen (mbgl)	Purpose	Start Date	End Date	Water Level	Water Quality sample suites (as per Table 3)	Monitoring Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
ML040- RO007	10 - 50	River Misbourne crossing #2	November 2022	February 2023	Manual dip	Suite (a)	Monthly	40	of purged water	
ML040-RC012	54.50 - 75.50	River Misbourne crossing #2	November 2022	February 2023	Manual dip	Suite (a)	Monthly	65	quality using a	
ML041- RO001	5 - 30.20	River Misbourne crossing #2	January 2021	March 2023	Manual dip	Suite (a)	Monthly	25	portable turbidity	
ML041-RC007	5 - 60	River Misbourne crossing #2	January 2023	April 2023	Manual dip	Suite (a)	Monthly	45	meter	
ML041-RC010	27 - 39	River Misbourne crossing #2	January 2023	April 2023	Manual dip	Suite (a)	Monthly	30		
ML041- RC012	5 - 25	River Misbourne crossing #2	January 2021	April 2023	Manual dip	Suite (a)	Monthly	20		
ML042- RC002	20 - 30	River Misbourne crossing #2	January 2021	April 2023	Logger	Logger Suite (a)	Monthly	25		
ML042- CR001a (shallow)	0.8 – 6	Shardeloes Lake	May 2023	May 2023	Manual dip	Suite (a) and (d)	Monthly	3		
ML042- CR001a (deep)	20 - 31	River Misbourne crossing #2	January 2021	May 2023	Logger	Logger Suite (a) and (d)	Monthly	25		
ML042- RO004	1 - 3	River Misbourne crossing #2	January 2021	May 2023	Logger	Logger Suite (a)	Monthly	2		
ML042- CR003	14.90 - 35.10	River Misbourne crossing #2	January 2021	May 2023	Logger	Logger Suite (a) and (d)	Monthly	30		

Location	Well Screen (mbgl)	Purpose	Start Date	End Date	Water Level	Water Quality sample suites (as per Table 3)	Monitoring Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
ML042-RC010	23 - 33	River Misbourne crossing #2	February 2023	May 2023	Manual dip	Suite (a)	Monthly	25		
ML042-RC013	17 - 37	River Misbourne crossing #2	February 2023	May 2023	Manual dip	Suite (a)	Monthly	30		
ML042- RC014	22.5 - 33	Little Missenden shaft	January 2021	June 2023	Manual dip	Suite (a)	Monthly	25		
ML042-CR439	26 - 44	Little Missenden shaft	March 2023	June 2023	Manual dip	Suite (a)	Monthly	30	Purging	
ML042- RC021	50 - 65	Little Missenden shaft	January 2021	June 2023	Logger	Suite (a)	Monthly	55	with direct	
ML043-CR438	31 - 41	Little Missenden shaft	March 2023	June 2023	Logger	Suite (a)	Monthly	35	analysis of purged	n/a - baseline
ML043-RO404	51.70 – 61.70	Little Missenden shaft	March 2023	June 2023	Manual dip	Suite (a)	Monthly	55	water quality	baseline
ML042-RC020	23 - 55	Little Missenden shaft	March 2023	June 2023	Logger	Suite (a)	Monthly	35	using a portable turbidity	
ML042-RC001	21.5 - 42	Little Missenden shaft	March 2023	June 2023	Manual dip	Suite (a)	Monthly	35	meter	
ML043-RO405	50.40 – 60.40	Little Missenden shaft	March 2023	June 2023	Manual dip	Suite (a)	Monthly	55		
ML043-RO403	50 - 60	Little Missenden shaft	March 2023	June 2023	Manual dip	Suite (a)	Monthly	55		
ML043-RC004	30 - 40	Dry valley from tunnel route to	March 2023	June 2023	Manual dip	Suite (a)	Monthly	35		

Location	Well Screen (mbgl)	Purpose	Start Date	End Date	Water Level	Water Quality sample suites (as per Table 3)	Monitoring Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
		Misbourne valley								
ML043-RC007	32.5 - 43	Dry valley from tunnel route to Misbourne valley	April 2023	July 2023	Manual dip	Suite (a)	Monthly	35	Purging with direct analysis of purged water quality using a portable turbidity meter	n/a - baseline

Notes: Priority monitoring boreholes in bold.

Hydrocarbon analysis to be conducted to establish baseline.

Monitoring positions at CSP, CSG and Amersham shafts (as indicated in Column 3) are already being monitoring as part of shaft construction (refer to CSP shaft SSMP (1MC05-ALJ-EV-REP-CS02_CL04-000059) and Amersham shaft SSMP (1MC05-ALJ-EV-REP-CS02_CL04-000067) for further details.

The inclusion of suite (d) was derived from the listed requirement for monitoring of Iron and Manganese from four Priority boreholes near the river crossings. This is solely because of their status as priority holes and is not driven by a technical requirement associated with the tunnel crossing of the Misbourne.

Table 5: Monitoring frequency and determinands during TBM operation

Location	Well Screen mbgl	Purpose	Start Date	End Date	Water Level	Water Quality sample suites (as per Table 3)	Monitoring Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
ML031-CR013	15 - 35	M25	June 2021	July 2021	Manual dip	Suite (a) and Suite (i)*	Monthly	20		
ML032-RC001	23.5 - 64.02	West Hyde SPZ 1	September 2021	October 2021	Logger	Suite (a) and Suite (i)*	Daily	35		
ML032-RC004	28 - 64.01	West Hyde SPZ 1	September 2021	October 2021	Manual dip	Suite (a) and Suite (i)*	Daily	45		
ML032-RC014	37.8 - 57.8	West Hyde SPZ 1	September 2021	October 2021	Manual dip	Suite (a) and Suite (i)*	Daily	45	Purging with direct	
ML032-RC006	33.5 - 54	West Hyde SPZ 1	October 2021	November 2021	Manual dip	Suite (a) and Suite (i)*	Daily	50	analysis of purged	
ML032-RC009	49.5 - 64.03	West Hyde SPZ 1	October 2021	November 2021	Manual dip	Suite (a) and Suite (i)*	Daily	55	water quality	500 NTU pH <5 or > 9
ML033-RC423	47.5 - 64.5	CSP shaft	February 2022	March 2022	Logger	Suite (a) and Suite (i)*	Monthly	55	using a portable	EC >1000
ML034-CR001	55 - 75	CSP shaft	February 2022	March 2022	Manual dip	Suite (a) and Suite (i)*	Daily	60	turbidity meter	
ML034-RC007	52 - 63	CSP shaft	February 2022	March 2022	Manual dip	Suite (a) and Suite (i)*	Monthly	55		
ML034-RO407	42 - 62.4	CSP shaft	February 2022	March 2022	Logger	Suite (a) and Suite (i)*	Daily	55		
ML034-RO408	42 - 67	CSP shaft	February 2022	March 2022	Logger	Suite (a) and Suite (i)*	Daily	55		
ML034-RD400 deep	76.55 - 86.55	CSP shaft	February 2022	March 2022	Manual dip	Suite (a) and Suite (i)*	Quarterly	80		
ML034-RD401 shallow	43.96 - 49.96	CSP shaft	February 2022	March 2022	Manual dip	Suite (a) and Suite (i)*	Monthly	45	Purging with direct	500 NTU

Location	Well Screen mbgl	Purpose	Start Date	End Date	Water Level	Water Quality sample suites (as per Table 3)	Monitoring Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
ML034-RD401 deep	74.11 - 85.11	CSP shaft	February 2022	March 2022	Logger	Suite (a) and Suite (i)*	Monthly	75	analysis of purged	pH <5 or > 9 EC >1000
ML035-RC016	21 - 31.5	River Misbourne Crossing #1	March 2022	April 2022	Manual dip	Suite (a) and Suite (i)*	Daily	25	water quality using a	
ML035- RO002a	6 - 16	River Misbourne Crossing #1	March 2022	April 2022	Manual dip	Suite (a) and Suite (i)*	Daily	10	portable turbidity meter	
ML035- RO003a	3 - 6	River Misbourne Crossing #1	March 2022	April 2022	Manual dip	Suite (a) and Suite (i)*	Daily	4		
ML035-CR003	13.5 - 34.5	River Misbourne Crossing #1	April 2022	May 2022	Logger	Logger Suite (a), (d)∞ and (ï)*	Daily	25		
ML035-CR004 (CHK)	18 - 28	River Misbourne Crossing #1	May 2022	May 2022	Manual dip	Suite (a), (d)∞ and (i)*	Daily	25		
ML035-CR004 (RTD)	0.5 - 6	River Misbourne crossing #1	May 2022	May 2022	Logger	Logger Suite (a), (d)∞ and (i)*	Daily	3		
ML035-RC012	19 - 40.25	CSG PWS	May 2022	May 2022	Logger	Suite (a) and Suite (i)*	Daily	35		
ML035-RO001	4.5 - 50	CSG PWS	May 2022	May 2022	Manual dip	Suite (a) and Suite (i)*	Daily	30		
ML035-RC013	14.5 - 61.5	CSG PWS	May 2022	May 2022	Manual dip	Suite (a) and Suite (i)*	Daily	40	-	
ML036-RC004	43 - 63	CSG PWS	Jun 2022	Jun 2022	Manual dip	Suite (a) and Suite (i)*	Daily	55		
ML037-RC001	30 - 40	CSG shaft	July 2022	September 2022	Logger	Suite (a) and Suite (i)*	Monthly	35	Purging with direct	500 NTU

Location	Well Screen mbgl	Purpose	Start Date	End Date	Water Level	Water Quality sample suites (as per Table 3)	Monitoring Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
ML037-RC003	28 - 39	CSG shaft	August 2022	September 2022	Manual dip	Suite (a) and Suite (i)*	Weekly	30	analysis of purged	pH <5 or > 9 EC >1000
ML037-RC019	17.5 - 37.5	CSG shaft	August 2022	September 2022	Logger	Suite (a) and Suite (i)*	Monthly	30	water quality	
ML037-RO439	46.69 - 56.69	CSG shaft	August 2022	September 2022	Manual dip	Suite (a) and Suite (i)*	Daily	50	using a portable	
ML037-RC014	37.5 - 65	CSG shaft	August 2022	September 2022	Manual dip	Suite (a) and Suite (i)*	Monthly	50	turbidity meter	
ML037-CR433	25.4 - 43.4	CSG shaft	August 2022	September 2022	Logger	Suite (a) and Suite (i)*	Daily	30		
ML037-RC012	23 - 37	CSG shaft	August 2022	September 2022	Logger	Suite (a) and Suite (i)*	Daily	30		
ML037-RC009	22 - 43	CSG shaft	August 2022	September 2022	Manual dip	Suite (a) and Suite (i)*	Daily	30		
ML037-RO440	48.36 - 58.36	CSG shaft	August 2022	September 2022	Manual dip	Suite (a) and Suite (i)*	Monthly	50		
ML038-RC004	43 - 53.5	Tunnel alignment	September 2022	October 2022	Manual dip	Suite (a) and Suite (i)*	Daily	45		
ML039-RC010	71.07 - 61.07	Amersham shaft	January 2023	February 2023	Manual dip	Suite (a) and Suite (i)*	Monthly	65		
ML039-RC015	31 - 41	Amersham shaft	January 2023	February 2023	Logger	Suite (a) and Suite (i)*	Monthly	35]	
ML040- RC004c	27 - 47	Amersham shaft	January 2023	February 2023	Manual dip	Suite (a) and Suite (i)*	Daily	40	1	
ML040-RC434	37.5 - 55.5	Amersham shaft	January 2023	February 2023	Logger	Suite (a) and Suite (i)*	Daily	45	Purging with direct	500 NTU

Location	Well Screen mbgl	Purpose	Start Date	End Date	Water Level	Water Quality sample suites (as per Table 3)	Monitoring Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
ML039-RO002	27 - 70	Amersham shaft	January 2023	February 2023	Logger	Suite (a) and Suite (i)*	Weekly	45	analysis of purged	pH <5 or > 9 EC >1000
ML040-RO409	15.89 - 30.89	Amersham shaft	January 2023	February 2023	Manual dip	Suite (a) and Suite (i)*	Weekly	25	water quality	
ML040-RO406	53.24 - 63.24	Amersham shaft	January 2023	February 2023	Manual dip	Suite (a) and Suite (i)*	Daily	55	using a portable	
ML040-RO001	54.7 - 64.7	Amersham shaft	January 2023	February 2023	Manual dip	Suite (a) and Suite (i)*	Daily	55	turbidity meter	
ML040-RO007	10 - 50	River Misbourne crossing #2	February 2023	March 2023	Manual dip	Suite (a) and Suite (i)*	Daily	40		
ML040-RC012	54.5 - 75.5	River Misbourne crossing #2	February 2023	March 2023	Manual dip	Suite (a) and Suite (i)*	Daily	65		
ML041-RO001	5 - 30.2	River Misbourne crossing #2	March 2023	April 2023	Manual dip	Suite (a) and Suite (i)*	Daily	25		
ML041-RC007	5 - 60	River Misbourne crossing #2	April 2023	April 2023	Manual dip	Suite (a) and Suite (i)*	Daily	45		
ML041-RC010	27 - 39	River Misbourne crossing #2	April 2023	April 2023	Manual dip	Suite (a) and Suite (i)*	Daily	30		
ML041-RC012	5 - 25	River Misbourne crossing #2	April 2023	May 2023	Manual dip	Suite (a) and Suite (i)*	Daily	20		

Location	Well Screen mbgl	Purpose	Start Date	End Date	Water Level	Water Quality sample suites (as per Table 3)	Monitoring Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
ML042-RC002	20 - 30	River Misbourne crossing #2	April 2023	May 2023	Logger	Logger Suite (a) and Suite (i)*	Daily	25		
ML042- CR001a (shallow)	0.8 – 6	Shardeloes Lake	May 2023	May 2023	Manual dip	Suite (a), (d)∞ and (i)*	Daily	3		
ML042- CR001a (deep)	20 - 31	River Misbourne crossing #2	May 2023	May 2023	Logger	Logger Suite (a), (d)∞ and (i)*	Daily	25	Purging with direct	
ML042-RO004	1 - 3	River Misbourne crossing #2	May 2023	May 2023	Logger	Logger Suite (a) and Suite (i)*	Daily	2	analysis of purged water	500 NTU
ML042-CR003	14.90 - 35.10	River Misbourne crossing #2	May 2023	May 2023	Logger	Logger Suite (a), (d)∞ and (i)*	Daily	30	quality using a portable	pH <5 or > 9 EC >1000
ML042-RC010	23 - 33	River Misbourne crossing #2	May 2023	June 2023	Manual dip	Suite (a) and Suite (i)*	Daily	25	turbidity meter	
ML042-RC013	17 - 37	River Misbourne crossing #2	May 2023	June 2023	Manual dip	Suite (a) and Suite (i)*	Daily	30		
ML042-RC014	22.5 - 33	Little Missenden shaft	June 2023	July 2023	Manual dip	Suite (a) and Suite (i)*	Monthly	25		

Location	Well Screen mbgl	Purpose	Start Date	End Date	Water Level	Water Quality sample suites (as per Table 3)	Monitoring Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
ML042-CR439	26 - 44	Little Missenden shaft	June 2023	July 2023	Manual dip	Suite (a) and Suite (i)*	Weekly	30		
ML042-RC021	50 - 65	Little Missenden shaft	June 2023	July 2023	Logger	Suite (a) and Suite (i)*	Daily	55		
ML043-CR438	31 - 41	Little Missenden shaft	June 2023	July 2023	Logger	Suite (a) and Suite (i)*	Daily	35		
ML043-RO404	51.70 - 61.70	Little Missenden shaft	June 2023	July 2023	Manual dip	Suite (a) and Suite (i)*	Weekly	55		
ML042-RC020	23 - 55	Little Missenden shaft	June 2023	July 2023	Logger	Suite (a) and Suite (i)*	Weekly	35		
ML042-RC001	21.5 - 42	Little Missenden shaft	June 2023	July 2023	Manual dip	Suite (a) and Suite (i)*	Weekly	35		
ML043-RO405	50.40 - 60.40	Little Missenden shaft	June 2023	July 2023	Manual dip	Suite (a) and Suite (i)*	Weekly	55		
ML043-RO403	50 - 60	Little Missenden shaft	June 2023	July 2023	Manual dip	Suite (a) and Suite (i)*	Weekly	55	Purging with direct analysis of	500 NTU pH <5 or > 9
ML043-RC004	30 - 40	Dry valley from tunnel route to	June 2023	July 2023	Manual dip	Suite (a) and Suite (i)*	Daily	35	purged water	EC >1000

Location	Well Screen mbgl	Purpose	Start Date	End Date	Water Level	Water Quality sample suites (as per Table 3)	Monitoring Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
		Misbourne valley							quality using a	
ML043-RC007	32.5 - 43	Dry valley from tunnel route to Misbourne valley	June 2023	July 2023	Manual dip	Suite (a) and Suite (i)*	Daily	35	portable turbidity meter	

Notes: Priority monitoring boreholes in bold.

 ∞ Suite (d) to be monitored on a weekly basis at the river crossings.

* Analysis for TBM greases to be undertaken on a daily basis with frequency reducing if no detections / borehole not close to alignment.

Monitoring to be reduced to maximum frequency of weekly during period when TBM1 is >150m up gradient AND TBM2 is >300m downgradient

Trigger levels set (based on professional judgement) as values that merit further investigation by Align and are not indicative of an impact at an Affinity PWS.

Monitoring positions at CSP, CSG and Amersham shafts (as indicated in Column 3) are already being monitoring as part of shaft construction (refer to CSP shaft SSMP (1MC05-AL)-EV-REP-CS02_CL04-000059) and Amersham shaft SSMP (1MC05-AL)-EV-REP-CS02_CL04-000067) for further details.

The inclusion of suite (d) was derived from the listed requirement for monitoring of Iron and Manganese from four Priority boreholes near the river crossings. This is solely because of their status as priority holes and is not driven by a technical requirement associated with the tunnel crossing of the Misbourne.

Table 6: Monitoring frequency and determinands after both TBMs have passed monitoring location.

Location	Well Screen mbgl	Purpose	Start Date	End Date	Water Level	Water Quality sample suites (as per Table 3)	Monitoring Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
ML031-CR013	15 - 35	M25	August 2021	September 2021	Manual dip	Suite (a)	Monthly	20		
ML032-RC001	23.5 - 64.02	West Hyde SPZ 1	November 2021	December 2021	Logger	Suite (a)	Weekly	35		
ML032-RC004	28 - 64.01	West Hyde SPZ 1	November 2021	December 2021	Manual dip	Suite (a)	Weekly	45		
ML032-RC014	37.8 - 57.8	West Hyde SPZ 1	November 2021	December 2021	Manual dip	Suite (a)	Weekly	45	Purging with direct analysis	
ML032-RC006	33.5 - 54	West Hyde SPZ 1	December 2021	January 2022	Manual dip	Suite (a)	Weekly	50	of purged water quality	500 NTU pH <5 or > 9
ML032-RC009	49.5 - 64.03	West Hyde SPZ 1	December 2021	January 2022	Manual dip	Suite (a)	Weekly	55	using a portable	EC >1000
ML033-RC423	47.5 - 64.5	CSP shaft	April 2022	May 2022	Logger	Suite (a)	Monthly	55	turbidity	
ML034-CR001	55 - 75	CSP shaft	April 2022	May 2022	Manual dip	Suite (a)	Weekly	60	meter	
ML034-RC007	52 - 63	CSP shaft	April 2022	May 2022	Manual dip	Suite (a)	Monthly	55		
ML034-RO407	42 - 62.4	CSP shaft	April 2022	May 2022	Logger	Suite (a)	Weekly	55		
ML034-RO408	42 - 67	CSP shaft	April 2022	May 2022	Logger	Suite (a)	Weekly	55		
ML034-RD400 deep	76.55 - 86.55	CSP shaft	April 2022	May 2022	Manual dip	Suite (a)	Quarterly	80		
ML034-RD401 shallow	43.96 - 49.96	CSP shaft	April 2022	May 2022	Manual dip	Suite (a)	Monthly	45		
ML034-RD401 deep	74.11 - 85.11	CSP shaft	April 2022	May 2022	Logger	Suite (a)	Monthly	75	1	

Location	Well Screen mbgl	Purpose	Start Date	End Date	Water Level	Water Quality sample suites (as per Table 3)	Monitoring Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
ML035-RC016	21 - 31.5	River Misbourne Crossing #1	May 2022	June 2022	Manual dip	Suite (a)	Weekly	25		
ML035- RO002a	6 - 16	River Misbourne Crossing #1	May 2022	June 2022	Manual dip	Suite (a)	Weekly	10		
ML035- RO003a	3 - 6	River Misbourne Crossing #1	May 2022	June 2022	Manual dip	Suite (a)	Weekly	4	Purging with	
ML035- CR003	13.5 - 34.5	River Misbourne Crossing #1	June 2022	July 2022	Logger	Logger Suite (a) and (d)	Weekly	25	direct analysis of purged water quality	500 NTU
ML035- CR004 (CHK)	18 - 28	River Misbourne Crossing #1	June 2022	July 2022	Manual dip	Suite (a) and (d)	Weekly	25	using a portable turbidity	pH <5 or > 9 EC >1000
ML035- CR004 (RTD)	0.5 - 6	River Misbourne crossing #1	June 2022	July 2022	Logger	Logger Suite (a) and (d)	Weekly	3	meter	
ML035-RC012	19 - 40.25	CSG PWS	June 2022	July 2022	Logger	Suite (a)	Weekly	35	-	
ML035- RO001	4.5 - 50	CSG PWS	June 2022	July 2022	Manual dip	Suite (a)	Weekly	30		
ML035- RC013	14.5 - 61.5	CSG PWS	June 2022	July 2022	Manual dip	Suite (a)	Weekly	40		
ML036-RC004	43 - 63	CSG PWS	July 2022	August 2022	Manual dip	Suite (a)	Weekly	55		

Location	Well Screen mbgl	Purpose	Start Date	End Date	Water Level	Water Quality sample suites (as per Table 3)	Monitoring Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
ML037- RC001	30 - 40	CSG shaft	October 2023	November 2023	Logger	Suite (a)	Monthly	35		
ML037-RC003	28 - 39	CSG shaft	October 2023	November 2023	Manual dip	Suite (a)	Monthly	30		
ML037-RC019	17.5 - 37.5	CSG shaft	October 2023	November 2023	Logger	Suite (a)	Monthly	30		
ML037-RO439	46.69 - 56.69	CSG shaft	October 2023	November 2023	Manual dip	Suite (a)	Weekly	50		
ML037- RC014	37.5 - 65	CSG shaft	October 2023	November 2023	Manual dip	Suite (a)	Monthly	50		
ML037-CR433	25.4 - 43.4	CSG shaft	October 2023	November 2023	Logger	Suite (a)	Weekly	30		
ML037-RC012	23 - 37	CSG shaft	October 2023	November 2023	Logger	Suite (a)	Weekly	30	Purging with direct analysis	
ML037-RC009	22 - 43	CSG shaft	October 2023	November 2023	Manual dip	Suite (a)	Weekly	30	of purged water quality	500 NTU
ML037-RO440	48.36 - 58.36	CSG shaft	October 2023	November 2023	Manual dip	Suite (a)	Weekly	50	using a portable	pH <5 or > 9 EC >1000
ML038-RC004	43 - 53.5	Tunnel alignment	November 2022	December 2022	Manual dip	Suite (a)	Weekly	45	turbidity meter	
ML039-RC010	71.07 - 61.07	Amersham shaft	March 2023	April 2023	Manual dip	Suite (a)	Monthly	65]	
ML039- RC015	31 - 41	Amersham shaft	March 2023	April 2023	Logger	Suite (a)	Monthly	35]	
ML040- RC004c	27 - 47	Amersham shaft	March 2023	April 2023	Manual dip	Suite (a)	Weekly	40]	

Location	Well Screen mbgl	Purpose	Start Date	End Date	Water Level	Water Quality sample suites (as per Table 3)	Monitoring Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
ML040-RC434	37.5 - 55.5	Amersham shaft	March 2023	April 2023	Logger	Suite (a)	Weekly	45		
ML039- RO002	27 - 70	Amersham shaft	March 2023	April 2023	Logger	Suite (a)	Weekly	45		
ML040-RO409	15.89 - 30.89	Amersham shaft	March 2023	April 2023	Manual dip	Suite (a)	Weekly	25		
ML040-RO406	53.24 – 63.24	Amersham shaft	March 2023	April 2023	Manual dip	Suite (a)	Weekly	55	-	
ML040-RO001	54.7 - 64.7	Amersham shaft	March 2023	April 2023	Manual dip	Suite (a)	Weekly	55	-	
ML040- RO007	10 - 50	River Misbourne crossing #2	April 2023	May 2023	Manual dip	Suite (a)	Weekly	40		
ML040-RC012	54.5 - 75.5	River Misbourne crossing #2	April 2023	May 2023	Manual dip	Suite (a)	Weekly	65		
ML041- RO001	5 - 30.2	River Misbourne crossing #2	May 2023	June 2023	Manual dip	Suite (a)	Weekly	25		
ML041-RC007	5 - 60	River Misbourne crossing #2	May 2023	June 2023	Manual dip	Suite (a)	Weekly	45	Purging with direct analysis	500 NTU pH <5 or > 9
ML041-RC010	27 - 39	River Misbourne crossing #2	May 2023	June 2023	Manual dip	Suite (a)	Weekly	30	of purged water quality using a	EC >1000

Location	Well Screen mbgl	Purpose	Start Date	End Date	Water Level	Water Quality sample suites (as per Table 3)	Monitoring Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
ML041- RC012	5 - 25	River Misbourne crossing #2	June 2023	July 2023	Manual dip	Suite (a)	Weekly	20	portable turbidity meter	
ML042- RC002	20 - 30	River Misbourne crossing #2	June 2023	July 2023	Logger	Logger Suite (a)	Weekly	25		
ML042- CR001a (shallow)	0.8 – 6	Shardeloes Lake	June 2023	July 2023	Manual dip	Suite (a) and (d)	Weekly	3		
ML042- CR001a (deep)	20 - 31	River Misbourne crossing #2	June 2023	July 2023	Logger	Logger Suite (a) and (d)	Weekly	25		
ML042- RO004	1 - 3	River Misbourne crossing #2	June 2023	July 2023	Logger	Logger Suite (a)	Weekly	2		
ML042- CR003	14.9 - 35.1	River Misbourne crossing #2	July 2023	August 2023	Logger	Logger Suite (a) and (d)	Weekly	30		
ML042-RC010	23 - 33	River Misbourne crossing #2	July 2023	August 2023	Manual dip	Suite (a)	Weekly	25		
ML042-RC013	17 - 37	River Misbourne crossing #2	July 2023	August 2023	Manual dip	Suite (a)	Weekly	30		
ML042- RC014	22.5 - 33	Little Missenden shaft	August 2023	September 2023	Manual dip	Suite (a)	Monthly	25		

Location	Well Screen mbgl	Purpose	Start Date	End Date	Water Level	Water Quality sample suites (as per Table 3)	Monitoring Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
ML042-CR439	26 - 44	Little Missenden shaft	August 2023	September 2023	Manual dip	Suite (a)	Weekly	30		
ML042- RC021	50 - 65	Little Missenden shaft	August 2023	September 2023	Logger	Suite (a)	Weekly	55		
ML043-CR438	31 - 41	Little Missenden shaft	August 2023	September 2023	Logger	Suite (a)	Weekly	35		
ML043-RO404	51.70 – 61.70	Little Missenden shaft	August 2023	September 2023	Manual dip	Suite (a)	Weekly	55		
ML042-RC020	23 - 55	Little Missenden shaft	August 2023	September 2023	Logger	Suite (a)	Weekly	35		
ML042-RC001	21.5 - 42	Little Missenden shaft	August 2023	September 2023	Manual dip	Suite (a)	Weekly	35	Purging with direct analysis	
ML043-RO405	50.40 – 60.40	Little Missenden shaft	August 2023	September 2023	Manual dip	Suite (a)	Weekly	55	of purged water quality	500 NTU
ML043-RO403	50 - 60	Little Missenden shaft	August 2023	September 2023	Manual dip	Suite (a)	Weekly	55	using a portable	pH <5 or > 9 EC >1000
ML043-RC004	30 - 40	Dry valley from tunnel route to Misbourne valley	August 2023	September 2023	Manual dip	Suite (a)	Weekly	35	turbidity meter	
ML043-RC007	32.5 - 43	Dry valley from tunnel route to Misbourne valley	August 2023	September 2023	Manual dip	Suite (a)	Weekly	35		

Notes: Priority monitoring boreholes in bold.

Nominal 4 weeks of weekly monitoring before frequency is reduced to monthly.

Trigger levels set (based on professional judgement) as values that merit further investigation by Align and are not indicative of an impact at an Affinity PWS. Monitoring positions at CSP, CSG and Amersham shafts (as indicated in Column 3) are already being monitoring as part of shaft construction (refer to CSP shaft SSMP (1MC05-ALJ-EV-REP-CS02_CL04-000059) and Amersham shaft SSMP (1MC05-ALJ-EV-REP-CS02_CL04-000059) and Amersham shaft SSMP (1MC05-ALJ-EV-REP-CS02_CL04-000059) for further details.

The inclusion of suite (d) was derived from the listed requirement for monitoring of Iron and Manganese from four Priority boreholes near the river crossings. This is solely because of their status as priority holes and is not driven by a technical requirement associated with the tunnel crossing of the Misbourne.

Table 7: Monitoring frequency and determinands post tunnel construction.

Location	Well Screen mbgl	Purpose	Start Date	End Date	Water Level	Water Quality sample suites (as per Table 3)	Monitoring Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
ML031-CR013	15 - 35	M25	October 2021	October 2022	Manual dip	Suite (a)	Monthly	20		
ML032-RC001	23.5 - 64.02	West Hyde SPZ 1	January 2022	January 2023	Logger	Suite (a)	Monthly	35		
ML034-RO407	42 - 62.4	CSP shaft	May 2022	May 2023	Logger	Suite (a)	Monthly	55		
ML035- RO002a	6 - 16	River Misbourne Crossing #1	July 2022	July 2023	Manual dip	Suite (a)	Monthly	10		
ML035- RO003a	3 - 6	River Misbourne Crossing #1	July 2022	July 2023	Manual dip	Suite (a)	Monthly	4	Purging with direct analysis of purged	50 NTU
ML035- CR003	13.5 - 34.5	River Misbourne Crossing #1	August 2022	August 2023	Logger	Logger Suite (a) and (d)	Monthly	25	water quality using a portable	pH <5 or > 9 EC >1000
ML035- CR004 (CHK)	18 - 28	River Misbourne Crossing #1	August 2022	August 2023	Manual dip	Suite (a) and (d)	Monthly	25	turbidity meter	
ML035- CR004 (RTD)	0.5 - 6	River Misbourne crossing #1	August 2022	August 2023	Logger	Logger Suite (a) and (d)	Monthly	3		
ML035- RO001	4.5 - 50	CSG PWS	August 2022	August 2023	Manual dip	Suite (a)	Monthly	30		
ML035- RC013	14.5 - 61.5	CSG PWS	August 2022	August 2023	Manual dip	Suite (a)	Monthly	40		

Location	Well Screen mbgl	Purpose	Start Date	End Date	Water Level	Water Quality sample suites (as per Table 3)	Monitoring Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
ML037- RC001	30 - 40	CSG shaft	November 2022	November 2023	Logger	Suite (a)	Monthly	35		
ML037- RC014	37.5 - 65	CSG shaft	November 2022	November 2023	Manual dip	Suite (a)	Monthly	50		
ML039- RC015	31 - 41	Amersham shaft	April 2023	April 2024	Logger	Suite (a)	Monthly	35		
ML040- RC004c	27 - 47	Amersham shaft	April 2023	April 2024	Manual dip	Suite (a)	Monthly	40		
ML039- RO002	27 - 70	Amersham shaft	April 2023	April 2024	Logger	Suite (a)	Monthly	45		
ML040- RO007	10 - 50	River Misbourne crossing #2	June 2023	June 2024	Manual dip	Suite (a)	Monthly	40		
ML041- RO001	5 - 30.2	River Misbourne crossing #2	July 2023	July 2024	Manual dip	Suite (a)	Monthly	25	Duraina uith	
ML041- RC012	5 - 25	River Misbourne crossing #2	August 2023	August 2024	Manual dip	Suite (a)	Monthly	20	Purging with direct analysis of purged	50 NTU
ML042- RC002	20 - 30	River Misbourne crossing #2	August 2023	August 2024	Logger	Logger Suite (a)	Monthly	25	water quality using a portable turbidity	pH <5 or > 9 EC >1000
ML042- CR001a (shallow)	0.8 – 6	Shardeloes Lake	August 2023	August 2024	Manual dip	Suite (a) and (d)	Monthly	3	meter	

Location	Well Screen mbgl	Purpose	Start Date	End Date	Water Level	Water Quality sample suites (as per Table 3)	Monitoring Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
ML042- CR001a (deep)	20 - 31	River Misbourne crossing #2	August 2023	August 2024	Logger	Logger Suite (a) and (d)	Monthly	25		
ML042- RO004	1 - 3	River Misbourne crossing #2	August 2023	August 2024	Logger	Logger Suite (a)	Monthly	2		
ML042- CR003	14.9 - 35.1	River Misbourne crossing #2	September 2023	September 2024	Logger	Logger Suite (a) and (d)	Monthly	30		
ML042- RC014	22.5 - 33	Little Missenden shaft	September 2023	September 2024	Manual dip	Suite (a)	Monthly	25		
ML042- RC021	50 - 65	Little Missenden shaft	September 2023	September 2024	Logger	Suite (a)	Monthly	55		

Notes: Priority monitoring boreholes in bold.

Monitoring positions at CSP, CSG and Amersham shafts (as indicated in Column 3) are already being monitoring as part of shaft construction (refer to CSP shaft SSMP (1MC05-AL)-EV-REP-CS02_CL04-000059) and Amersham shaft SSMP (1MC05-AL)-EV-REP-CS02_CL04-000067) for further details.

The inclusion of suite (d) was derived from the listed requirement for monitoring of Iron and Manganese from four Priority boreholes near the river crossings. This is solely because of their status as priority holes and is not driven by a technical requirement associated with the tunnel crossing of the Misbourne.

Cross Passages

- 3.1.14 Cross passage construction would take place a few months after the TBMs have passed the cross passage location. Monitoring during cross passage construction will be focussed at locations in proximity to significant groundwater and surface water receptors.
- 3.1.15 Baseline monitoring will not be required as all monitoring locations will have been monitored during either tunnel or shaft construction in advance of cross passage construction. Monitoring would initially be daily during cross passage construction but would be reduced to weekly. Monitoring would continue at a weekly frequency until cross passage construction was completed and would then reduce to monthly / for 6 months after cross passage construction was completed. If significant changes in water quality are detected then discussions would be held with the Environment Agency, Affinity Water and HS2 before any change in monitoring frequency is implemented.
- 3.1.16 Groundwater level monitoring would be undertaken by manual dipping using a portable dip meter. Water quality monitoring would consist of in field analysis of well head parameters (turbidity, pH, electrical conductivity, temperature, DO, Redox) using portable equipment.
- 3.1.17 Trigger levels are provided in column 11 of Tables 8 and 9 for the parameters being monitored. These levels have been set based on professional judgement and are designed to provide an indication when additional action may be required by Align. In the event of a trigger level being exceeded the Align shaft environment manager would contact the EA, HS2 and Affinity Water to notify them, to make them aware of the exceedance and to discuss if additional monitoring is required. The notification procedure is discussed further in section 7.
- 3.1.18 The groundwater quality samples would be collected following purging which would be conducted in the same way as that used during tunnel monitoring described above.
- 3.1.19 As part of the preparation of this monitoring plan an audit has been commenced to confirm those boreholes that are available for monitoring. Due to land access constraints only a small number of onsite boreholes have been visited, with the remainder to be checked as soon as access is allowed. Once the audit is complete the available boreholes will be assessed and any replacements will be made.

Table 8: Monitoring frequency and determinands during cross passage construction.

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Location	Well Screen (mAOD)*	Purpose	Start Date	End Date	Water Level	Water Quality sample suites (as per Table 3)	Monitoring Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
ML032-RC004	28 - 64	CP3	December 2021	March 2022	Manual dip	Suite (a)	Daily/ weekly	45		
ML032-RC009	49.50 - 64	CP4	December 2021	April 2022	Manual dip	Suite (a)	Daily/ weekly	55		
ML035-RC016	21 - 31.50	CP10	May 2022	August 2022	Manual dip	Suite (a)	Daily/ weekly	25		
ML035-CR004 (CHK)	18 – 28	CP11	June 2022	October 2022	Manual dip	Suite (a)	Daily/ weekly	25	Purging with direct	
ML035-CR004 (RTD)	0.5 - 6	CP11	June 2022	October 2022	Logger	Logger Suite (a)	Daily/ weekly	3	analysis of purged	500 NTU
ML035-RC013	14.50 - 61.50	CP12	July 2022	October 2022	Logger	Suite (a)	Daily/ weekly	40	water quality	pH <5 or > 9
ML037-CR433	25.40 - 43.40	CP15	October 2022	January 2023	Logger	Suite (a)	Daily/ weekly	30	using a portable	EC >1000
ML039-RC015	31 – 41	CP22	March 2023	May 2023	Logger	Suite (a)	Daily/ weekly	35	turbidity meter	
ML040-RC434	37.50 - 55.50	CP23	March 2023	June 2023	Manual dip	Suite (a)	Daily/ weekly	45		
ML041-RC007	5 - 60	CP27	June 2023	September 2023	Manual dip	Suite (a)	Daily/ weekly	45		
ML042-RC002	20 - 30	CP28	July 2023	October 2023	Logger	Logger Suite (a)	Daily/ weekly	25		

Location	Well Screen (mAOD)*	Purpose	Start Date	End Date	Water Level	Water Quality sample suites (as per Table 3)	Monitoring Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
ML042-CR001a (Shallow)	0.80 – 6	Shardeloes Lake	July 2023	October 2023	Manual dip	Suite (a)	Daily/ weekly	3		
ML042-CR001a (deep)	20 - 31	Shardeloes Lake	July 2023	October 2023	Logger	Logger Suite (a)	Daily/ weekly	25		
ML042-RO004	1 - 3	Shardeloes Lake	July 2023	October 2023	Logger	ТВС	Daily/ weekly	2		
ML042-CR003	14.90 – 35.10	Shardeloes Lake	August 2023	November 2023	Logger	Logger Suite (a)	Daily/ weekly	30		
ML042-RC010	23 - 33	CP29	August 2023	November 2023	Manual dip	Suite (a)	Daily/ weekly	25		
ML042-CR439	26 - 44	CP30	August 2023	December 2023	Manual dip	Suite (a)	Daily/ weekly	30		
ML043-RO403	50 - 60	CP31	August 2023	December 2023	Manual dip	Suite (a)	Daily/ weekly	52		

Notes: Priority monitoring boreholes in bold.

Monitoring to begin on a daily basis but will be reduced to weekly (dependent upon data obtained) with agreement from Affinity Water, Environment Agency and HS2.

Table 9: Monitoring frequency and determinands post cross passage construction.

Location	Well Screen (mAOD)*	Purpose	Start Date	End Date	Water Level	Water Quality sample suites (as per Table 3)	Monitoring Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
ML032-RC004	28 - 64	CP3	April 2022	September 2022	Manual dip	Suite (a)	Monthly	45		
ML032-RC009	49.50 - 64	CP4	May 2022	October 2022	Manual dip	Suite (a)	Monthly	55		
ML035-RC016	21 - 31.50	CP10	September 2022	February 2023	Manual dip	Suite (a)	Monthly	25		
ML035-CR004 (CHK)	18 – 28	CP11	November 2022	April 2023	Manual dip	Suite (a)	Monthly	25	Purging	
ML035-CR004 (RTD)	0.5 - 6	CP11	November 2022	April 2023	Logger	Logger Suite (a)	Monthly	3	with direct analysis of	
ML035-RC013	14.50 - 61.50	CP12	November 2022	April 2023	Manual dip	Suite (a)	Monthly	40	purged water	50 NTU pH <5 or >
ML037-CR433	25.40 - 43.40	CP15	February 2023	July 2023	Manual dip	Suite (a)	Monthly	30	quality using a	9 EC >1000
ML039-RC015	31 – 41	CP22	June 2023	November 2023	Manual dip	Suite (a)	Monthly	35	portable turbidity	
ML040-RC434	37.50 - 55.50	CP23	July 2023	December 2023	Manual dip	Suite (a)	Monthly	45	meter	
ML041-RC007	5 - 60	CP27	October 2023	March 2024	Manual dip	Suite (a)	Monthly	45		
ML042-RC002	20 - 30	CP28	November 2023	April 2024	Logger	Logger Suite (a)	Monthly	25		
ML042-CR001a (Shallow)	0.80 – 6	Shardeloes Lake	November 2023	April 2024	Manual dip	Suite (a)	Monthly	3		

Location	Well Screen (mAOD)*	Purpose	Start Date	End Date	Water Level	Water Quality sample suites (as per Table 3)	Monitoring Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
ML042-CR001a (deep)	20 - 31	Shardeloes Lake	November 2023	April 2024	Logger	Logger Suite (a)	Monthly	25		
ML042-RO004	1 - 3	Shardeloes Lake	November 2023	April 2024	Logger	Logger Suite (a)	Monthly	2		
ML042-CR003	14.90 - 35.10	Shardeloes Lake	December 2023	May 2024	Logger	Logger Suite (a)	Monthly	30		
ML042-RC010	23 - 33	CP29	December 2023	May 2024	Manual dip	Suite (a)	Monthly	25		
ML042-CR439	26 - 44	CP30	January 2024	June 2024	Manual dip	Suite (a)	Monthly	30		
ML043-RO403	50 - 60	CP31	January 2024	June 2024	Manual dip	Suite (a)	Monthly	52		

Surface Water

- 3.1.20 Monitoring of surface water will consist of flow logger data collection at each of the Misbourne crossings with water quality samples collected upstream and downstream of the flow logger location. In addition, water quality samples and visual observation records will be collected from Shardeloes Lake to check for any water quality impacts that may be caused by TBM operations.
- 3.1.21 Baseline monitoring will be undertaken in summer 2021 to gain baseline low flow data and during February or March 2022 to ensure that the Misbourne is flowing in order to collect baseline quality samples in advance of the TBM reaching the first Misbourne crossing in April 2022.
- 3.1.22 Water quality monitoring during tunnel construction will begin at each location on a weekly basis when the TBM is within 300m of the surface water feature, increasing to daily when the TBM approaches within 150m. If no significant effects are encountered then monitoring will decrease to weekly once the TBM has moved beyond 150m from the monitoring location and will continue at this frequency until the TBM has moved >300m up gradient of the water feature. Monitoring frequency will then reduce to monthly, for a period of 12 months.
- 3.1.23 Water level monitoring would be undertaken by manual measurement using a stage board, where practicable, with flow data collected using a data logger. Water quality monitoring would consist of in field analysis of well head parameters (turbidity, pH, electrical conductivity, temperature, DO, Redox) using portable equipment, with sample collection for laboratory analysis of suspended solids and hydrocarbons.
- 3.1.24 Trigger levels are provided in column 10 of Table 10 for the parameters being monitored. These levels have been set based on limited baseline data provided by HS2 and Align and are designed to provide an indication when additional action may be required by Align. These trigger levels will be reviewed following further collection of baseline data by Align. In the event of a trigger level being exceeded the Align environment manager would contact the EA, HS2 and Affinity Water to notify them, to make them aware of the exceedance and to discuss if additional monitoring is required. The notification procedure is discussed further in section 7.

Table 10: Surface water monitoring

Location	Easting	Northing	Start Date	End Date	Water Level	Water Quality	Monitoring Frequency	Comments	Trigger Level for notification
ML035-FG001	499163	193667	April 2022	July 2023	Logger	-	Continuous	water level and spot gauging to be undertaken	-
ML042-FG001	494513	197922	April 2023	September 2024	Logger	-	Continuous	water level and spot gauging to be undertaken	-
			April 2022	May 2022			Daily		
ML035-SW001	499163	193676	May 2022	June 2022	Manual		Weekly	R. Missenden upstream of tunnel crossing	
			July 2022	July 2023			Monthly	Crossing	
			April 2022	May 2022			Daily	R. Missenden downstream of tunnel	
ML035-SW002	499159	193657	May 2022	June 2022	Manual	Suite (a) (g),	Weekly	crossing	
			July 2022	July 2023		Suspended	Monthly		
			April 2023	June 2023		solids	Daily	R. Missenden downstream of tunnel	Turbidity >50 NTU
ML042-SW002	494690	197920	July 2023	August 2023	Manual		Weekly	crossing and Shardeloes Lake	pH <5 or > 9
			September 2023	September 2024			Monthly		EC >1000
			April 2023	June 2023			Daily	R. Missenden downstream of tunnel	Any hydrocarbons
ML042-SW003	493996	198213	July 2023	August 2023	Manual		Weekly	crossing and up stream of Shardeloes	(both visual and
	155550	190219	September 2023	September 2024	manaar		Monthly	Lake (also monitored for Little Missenden shaft construction)	laboratory signatures)
ML042-WFD001	493420	198455	April 2023	September 2024	None	WFD suite	Quarterly	River Misbourne for WFD	-
			April 2023	June 2023			Daily	Shardeloes lake to be monitored for	
Shardeloes lake	494440	197940	July 2023	August 2023	None	C_{ij}	Weekly	potential quality impacts from tunnel	
			September 2023	September 2024		Suite (a) (g), Suspended	Monthly		_
			April 2023	June 2023		solids	Daily		
ML043-SW001	492794	198874	July 2023	August 2023	023 Manual Weekly crossing	Manual	ekly crossing		
			September 2023	September 2024		N		crossing	

Notes: Baseline monitoring to be undertaken in February/March 2022 to ensure the Misbourne is flowing in order to collect quality data. All data to be obtained subject to whether the Misbourne is flowing.

Suite (d) was a requirement for priority monitoring boreholes only and so was not included as a requirement for surface water monitoring.

4 Monitoring during accidents or incidents

4.1.1 In the event of an incident or accident involving hazardous or contaminative fluids this would be dealt with as detailed in the Align Pollution Incident Control Plan⁴, including (if required) reporting via the Environment Agency pollution reporting system. Monitoring would be implemented following any such loss in order to determine if mitigation is appropriate and successful and to identify if there could be a potential significant effect on an Affinity Water source, private abstraction or groundwater in general. All such monitoring would be implemented as soon as practicable and agreed with HS2, the Environment Agency and Affinity Water.

5 Post construction monitoring

- 5.1.1 The duration of monitoring post construction is stated in the Asset Protection Agreement (APA) as 30 years from completion, or such other date as may be agreed between HS2 and Affinity Water. This monitoring work is outside of the terms of Align's contract but the detail is included here for information. The monitoring would comprise both water level and water quality monitoring after completion of construction activities. An indicative frequency is provided in Table 11, anticipated as decreasing over time although this will depend on the results of monitoring during and after construction. Any changes would need the agreement of Affinity Water and HS2 and would be based on data interpretation.
- 5.1.2 HS2 would issue the data, once it has been checked and approved, to Affinity Water after each round of monitoring. In the period to December 2032 annual interpretative reports would be prepared, with 5 yearly reports after that date (unless a change in frequency was agreed). The reports would include time series data analysis to look at trends using all collected data.

⁴ Align, 2020, Pollution Incident Control Plan, Document no: 1MC05-ALJ-EV-PLN-C001-000028

Table 11: Monitoring frequency and determinands after construction.

Location	Well Screen (mAOD)*	Purpose	Start Date	End Date	Water Level	Water Quality	Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
	23.50 - 64.02	West Hyde SPZ 1	April 2023	October 2026		Suite (a)	Quarterly			
ML032-RC001			2027	2031	Manual dip		Annually	35		
			2032	2052			Every 5 years			
N4024 BO 407	42 - 62.40	CSP shaft	October 2023	October 2026		Suite (a)	Quarterly			
ML034-RO407			2027	2031	Manual dip		Annually	55		
			2032	2052			Every 5 years			
ML035-		River	October 2023	October 2026			Quarterly		Purging with	
RO002a	6 - 16	Misbourne	2027	2031	Manual dip	Suite (a)	Annually	10	direct analysis of purged	>50 NTU
		Crossing #1	2032	2052			Every 5 years	-		pH <6 or >9
ML035-		River	October 2023	October 2026			Quarterly		water quality using a	EC >1000
RO003a	3 - 6	Misbourne	2027	2031	Manual dip	Suite (a)	Annually	4	portable	
		Crossing #1	2032	2052			Every 5 years	1	turbidity meter	
	13.50 -	River	October 2023	October 2026		Logger	Quarterly			
ML035-CR003	34.50	Misbourne	2027	2031	Logger	Suite (a) and	Annually	- 25		
	54.50	Crossing #1	2032	2052		(d)	Every 5 years			
		5.	October	October			Quarterly			
ML035-CR004	10 20	River	2023	2026				25		
(CHK)	18 - 28		2027	2031	Manual dip	Suite (a)	Annually	- 25		
		Crossing #1	2032	2052			Every 5 years	7		

Location	Well Screen (mAOD)*	Purpose	Start Date	End Date	Water Level	Water Quality	Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
		River	October	October		Logger	Quarterly			
ML035-CR004	0.50 - 6	Misbourne	2023	2026	Logger	Suite (a) and		- 3		
(RTD)	0.50 0	crossing #1	2027	2031	Logger	(d)	Annually	5		
		crossing #1	2032	2052		(u)	Every 5 years			
			October	October			Quarterly			
ML035-RO001	4.50 - 50	CSG PWS	2023	2026	Manual dip	Suite (a)		- 30		
WILUSS-KOUUT	4.50 - 50	C30 F W3	2027	2031	Mariua up	Suite (a)	Annually	50		
			2032	2052			Every 5 years			
			October	October			Quarterly			
	14.50 -		2023	2026		Suite (a)		10	Purging with	
ML035-RC013	61.50	CSG PWS	2027	2031			Annually	40		
			2032 2052		Every 5 years		direct analysis	>50 NTU		
			January	October			Quarterly		of purged water quality	pH <6 or >9
	20 40		2024	2026				25		EC >1000
ML037-RC001	30 - 40	CSG Shaft	2027	2031	Logger	Suite (a)	Annually	35	using a	
			2032	2052			Every 5 years		portable turbidity meter	
			January	October	Manual dip		Quarterly		turbially meter	
	27.50 65		2024	2026				50		
ML037-RC014	37.50 - 65	CSG Shaft	2027	2031		Suite (a)	Annually	50		
			2032	2052			Every 5 years			
ML039-RC015				October			Quarterly		1	
			July 2024	2026						
	31 - 41	Amersham shaft	2027	Logger Suite	Suite (a)	Annually	35			
			2032	2052	1		Every 5 years	1		
ML040- RC004c	27 - 47	Amersham shaft	July 2024	October 2026	Manual dip	Logger Suite (a)	Quarterly	40	1	

Location	Well Screen (mAOD)*	Purpose	Start Date	End Date	Water Level	Water Quality	Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
			2027	2031			Annually			
			2032	2052			Every 5 years			
	27 70	A secondaria se alta fi	July 2024	October 2026			Quarterly	45		
ML039-RO002	27 - 70	Amersham shaft	2027	2031	Logger	Suite (a)	Annually	45		l
			2032	2052			Every 5 years		_	
		Diver		October			Quarterly			
ML040-RO007	10 - 50	River Misbourne		2026	Manual dip	Suite (a)		40		
WIL040-KO007	10 - 50	crossing #2	2027	2031	ivialiual uip	Suite (a)	Annually	40		
		crossing #2	2032	2052			Every 5 years		Duration	
		River	October	October	Manual dip		Quarterly		Purging with direct analysis of purged water quality using a	>50 NTU
ML041-RO001	5 - 30.20	Misbourne	2024	2026		o Suite (a)		25		
WIL041-K0001	5 - 50.20	crossing #2	2027	2031			Annually	25		pH <6 or >9
		crossing #2	2032	2052			Every 5 years			EC >1000
	5 25	River	October 2024	October 2026			Quarterly	20	portable turbidity meter	
ML041-RC012	5 - 25	Misbourne	2027	2031	Manual dip	Suite (a)	Annually	20	turbiaity meter	
		crossing #2	2032	2052			Every 5 years			
		River	October	October			Quarterly			
ML042-RC002	20 - 30	Misbourne	2024	2026	Logger	Suite (a)		- 25		
WIL042-RC002	20 - 30		2027	2031	Logger	Suite (a)	Annually	25		
		crossing #2	2032	2052			Every 5 years			
ML042-		River	October	October			Quarterly			
CR001a	0.8 - 6	-	2024	2026	2026 Manual din	Suito (a)		- 3		
(shallow)	0.0 - 0	Misbourne	2027	2031		ip Suite (a)	Annually	5		
(Shanow)	crossing #	crossing #2	2032	2052			Every 5 years			

Location	Well Screen (mAOD)*	Purpose	Start Date	End Date	Water Level	Water Quality	Frequency	Depth of sampling (mbgl)	Method of Sampling and analysis	Trigger Level for notification
ML042-		River	October 2024	October 2026		Logger	Quarterly			
CR001a (deep)	20 - 31	Misbourne	2027	2031	Logger	Suite (a) and	Annually	25		
		crossing #2	2032	2052		(d)	Every 5 years			
		River	October 2024	October 2026		Logger	Quarterly			
ML042-RO004	1 - 3	Misbourne crossing #2	2027	2031	Logger	Suite (a)	Annually	2		
			2032	2052			Every 5 years		Purging with direct analysis of purged water quality	
	14.90 -	River	October 2024	October 2026		Logger	Quarterly			>50 NTU pH <6 or >9
ML042-CR003	35.10	Misbourne	2027	2031	Logger	Suite (a) and	Annually	30		EC >1000
		crossing #2	2032	2052		(d)	Every 5 years		using a portable	
	22.50.22	Little	October 2024	October 2026			Quarterly	25	turbidity meter	
ML042-RC014	22.50 - 33	Missenden shaft	2027	2031	Manual dip	Suite (a)	Annually	25		
			2032	2052			Every 5 years			
			October	October			Quarterly			
ML042-RC021	50 - 65 I	Little Missenden shaft	2024	2026	Logger	Suite (a)		- 55		
			2027	2031		Suite (a)	Annually			
			2032	2052			Every 5 years			

Notes: Turbidity threshold reduced to 50 NTU as turbidity generation not anticipated during post construction period.

6 Mitigation requirements

- 6.1.1 Mitigation of the risk to public water supplies is being implemented in the form of construction of a turbidity treatment plant at Amersham to treat water from both Amersham and Chalfont St Giles. This turbidity treatment plant will be operational prior to the start of tunnel construction. Avoidance of Affinity Water's peak demand period is not feasible given the 3-year duration of the tunnelling works. The type of TBM has been selected specifically to minimise the potential effects on the groundwater environment.
- 6.1.2 Further mitigation is not anticipated to be required during tunnel construction. However, the purpose of the monitoring is to ascertain whether there are changes that do require mitigation and if so options for this would be discussed with HS2, Affinity Water and the Environment Agency prior to implementation.
- 6.1.3 If the monitoring data do indicate that water quality impacts are occurring and mitigation is required then mitigation options could include the use of existing boreholes or new boreholes to act as scavenger wells and contain any contaminated groundwater. Modification of the approach to construction of some of the cross passages could be implemented and also changes in how TBM2 is operated could be made if effects are identified from TBM1.
- 6.1.4 If significant negative effects on the River Misbourne are detected then localised stream lining may be necessary. It is also possible that there may be a beneficial effect.
- 6.1.5 Negative impacts at unlicensed abstraction CFA08-GWUA03, located near Amersham and approximately 140m south-west of the tunnel may require mitigation in the form of provision of a temporary alternative water supply. This may involve provision of a temporary main or paying for additional water use if a main is already present on site or use of tankers depending upon the volume of water required and the quality required. This would only likely to be required for a period of 10 to 15 days for each TBM.

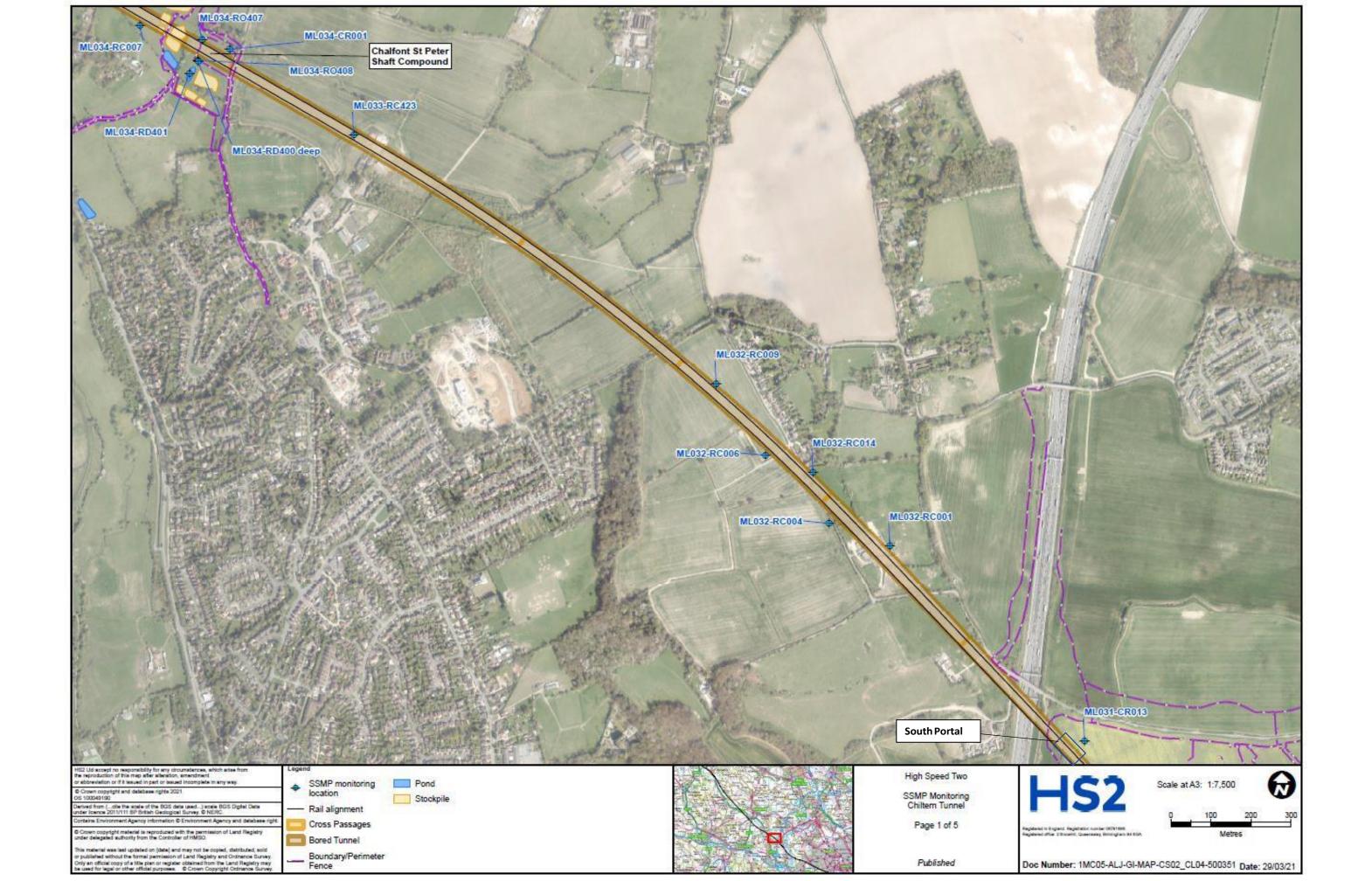
7 Communication

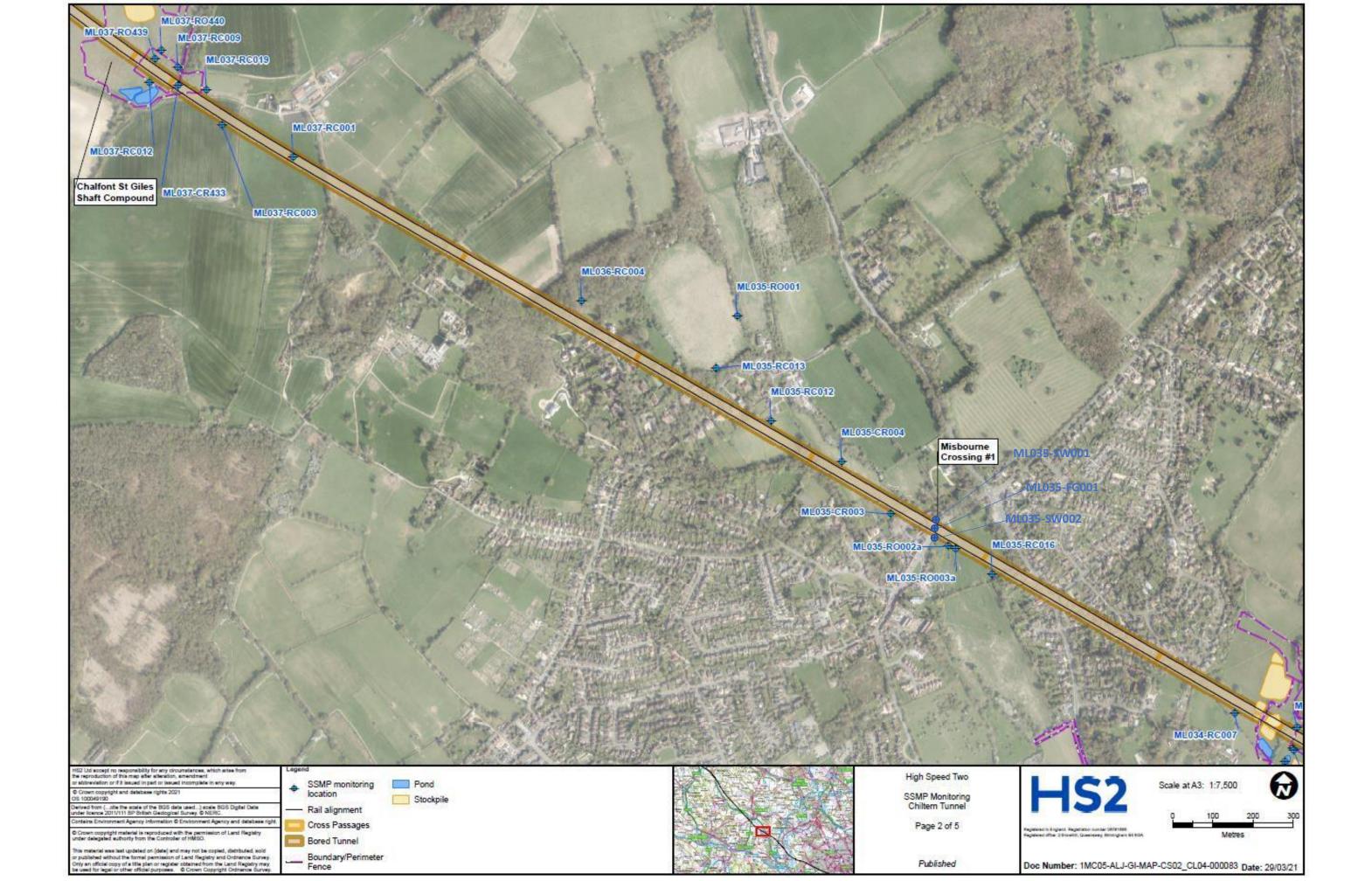
7.1.1 Communication between Align, HS2, the Environment Agency and Affinity Water will be critical during the periods when the TBM is in close proximity to the most sensitive receptors including the Affinity Water PWS and the two River Misbourne crossings. Relevant contacts are listed in Table 12.

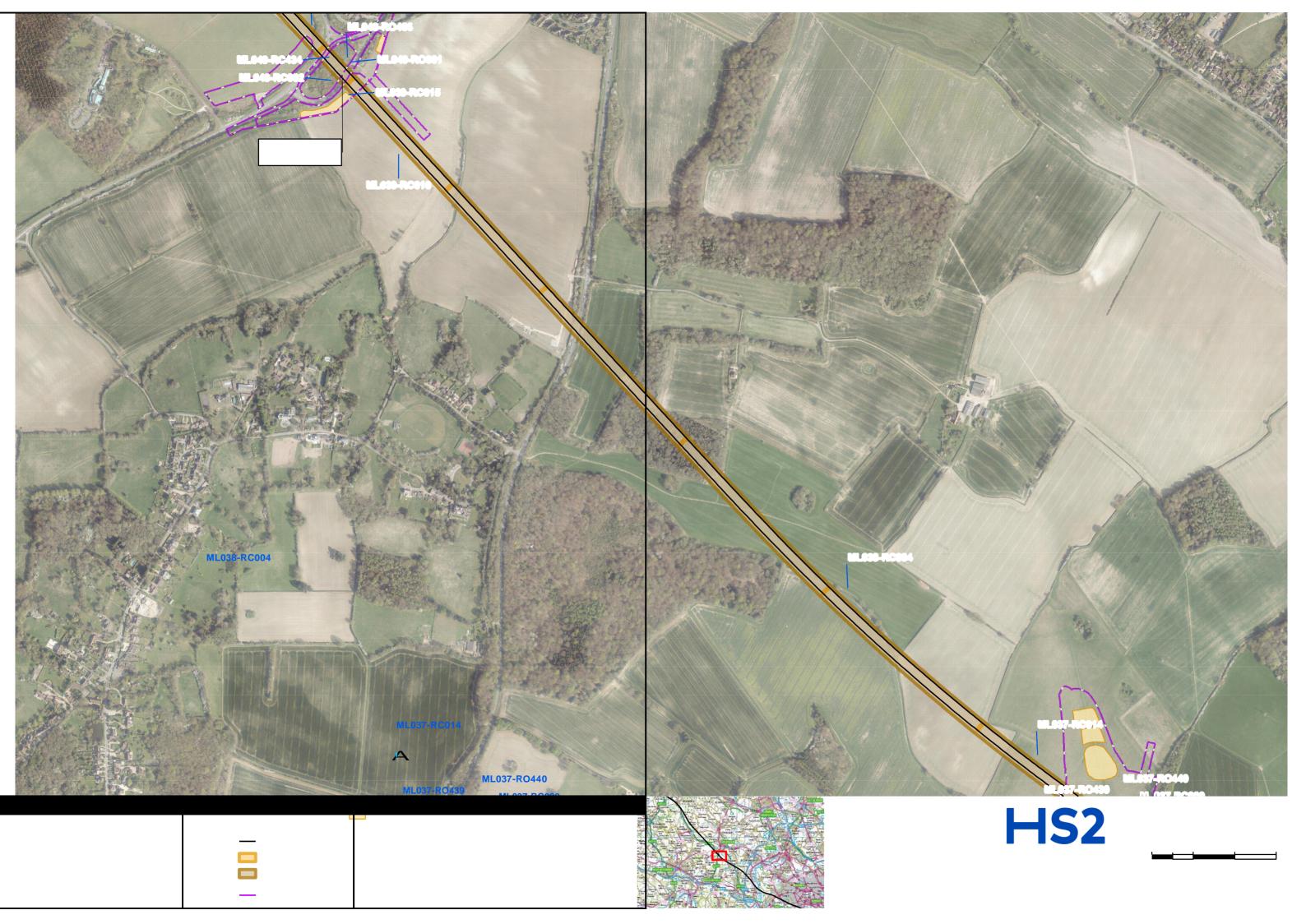
- 7.1.2 Communication will be undertaken on an agreed regular timescale but this will be the basic communication schedule and will not preclude flexibility to change this, or additional *ad hoc* communication in response to specific activities or monitoring findings. The basic communication will include:
 - Daily phone contact between Align tunnel environment manager or Align groundwater data manager and Affinity Water. Others to join as required.
 - Weekly forward look call on Monday morning between Align tunnel environment manager, HS2, EA, and Affinity Water. Align tunnel Manager as required.
 - Monthly meeting at Main Compound between Align tunnel environment manager, Align tunnel Manager, HS2, EA, and Affinity Water.
- 7.1.3 Reporting during construction will include the following:
 - Daily/weekly data transfer in excel format by email from Align to EA and Affinity Water during periods of daily and weekly monitoring. Any significant changes in water level or water quality would be flagged.
 - Monthly transfer of data logger information, except where there are specific requirements for more frequent data transfer associated with activities that could affect water levels. The data transfer would include a summary of any significant changes in water level or water quality.
 - Monthly monitoring reports summarising the data collected over the past month and flagging any issues, trends or deviations from expected results.
 - Annual formal interpretative assessment reports of all water monitoring data.
 - In the event of any sudden or unexpected changes or significant anomalies in the collected data then these would be checked and reported to HS2, the Environment Agency and Affinity Water immediately, especially if they are likely to result in a significant effect on Affinity Water sources.
- 7.1.4 In the event that real time data are required from selected locations due to a particular risk or issue then a telemetry system could be installed.

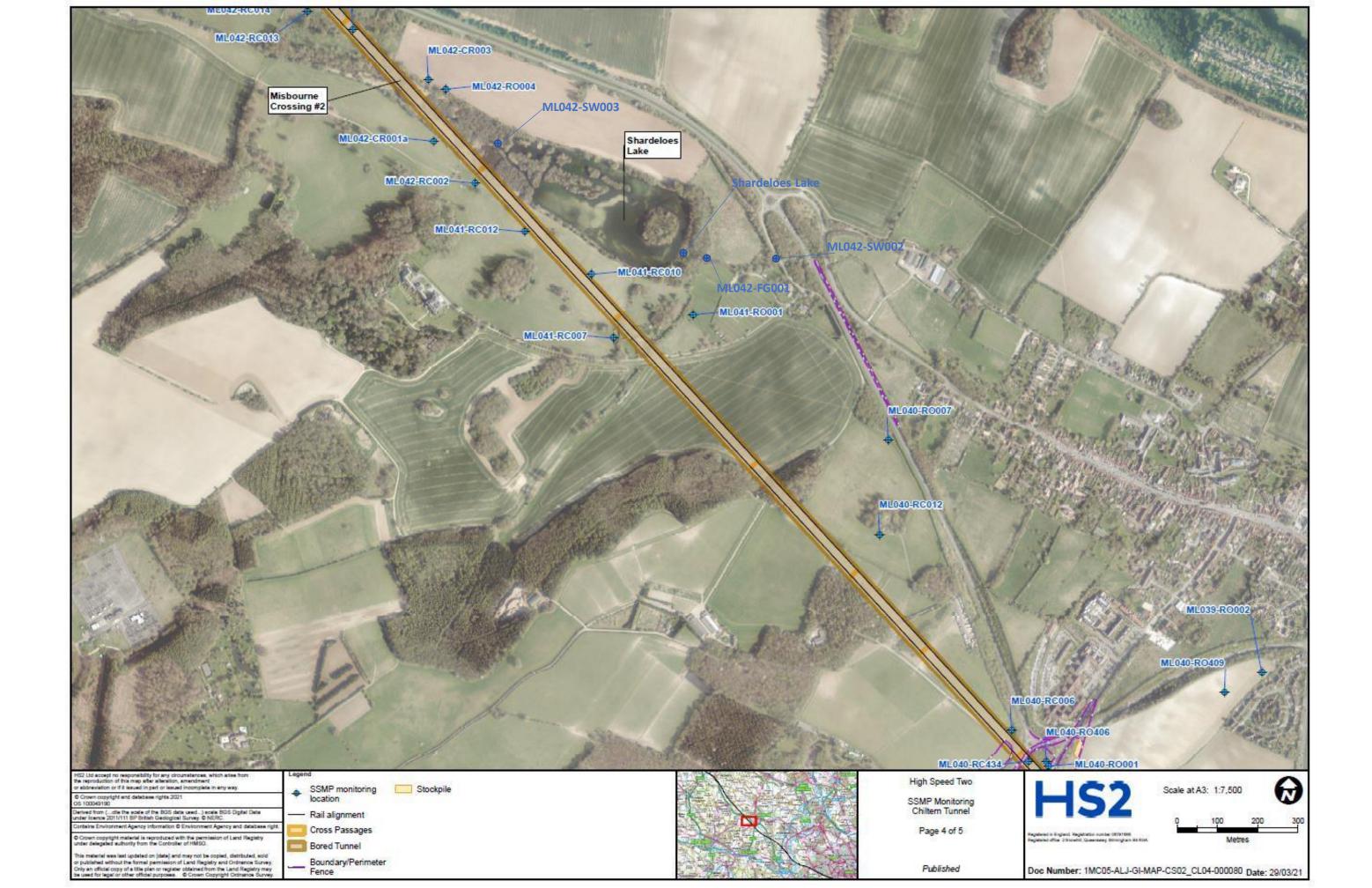
Name	Organisation	Contact No.	Role	Email address
			Key points of contact	
XXXX	Align	XXXX	Align Water Manager	XXXX
XXXX	Align	XXXX	Groundwater data manager	XXXX
XXXX	HS2	XXXX	HS2 water lead	XXXX
XXXX	Environment Agency	XXXX	Consenting Officer (Groundwater)	XXXX
	·		Other contacts	
XXXX	Affinity Water	XXXX		XXXX
XXXX	Affinity Water	XXXX		XXXX
XXXX	Affinity Water	XXXX	Groundwater technical specialist	XXXX
XXXX	Affinity Water	XXXX	Affinity Water / HS2 manager	XXXX
XXXX	Environment Agency	XXXX	Water Quality Permitting Lead	XXXX
XXXX	Align	XXXX	ТВС	XXXX
XXXX	Align	XXXX	ТВС	ХХХХ
XXXX	Align	XXXX	Early Works Environment Manager	XXXX
XXXX	Align	XXXX	Environment Manager	XXXX
XXXX	Align	XXXX	Align groundwater specialist	XXXX
XXXX	Align	XXXX	Align groundwater specialist	XXXX
XXXX	Align	XXXX	Align surface water specialist	XXXX

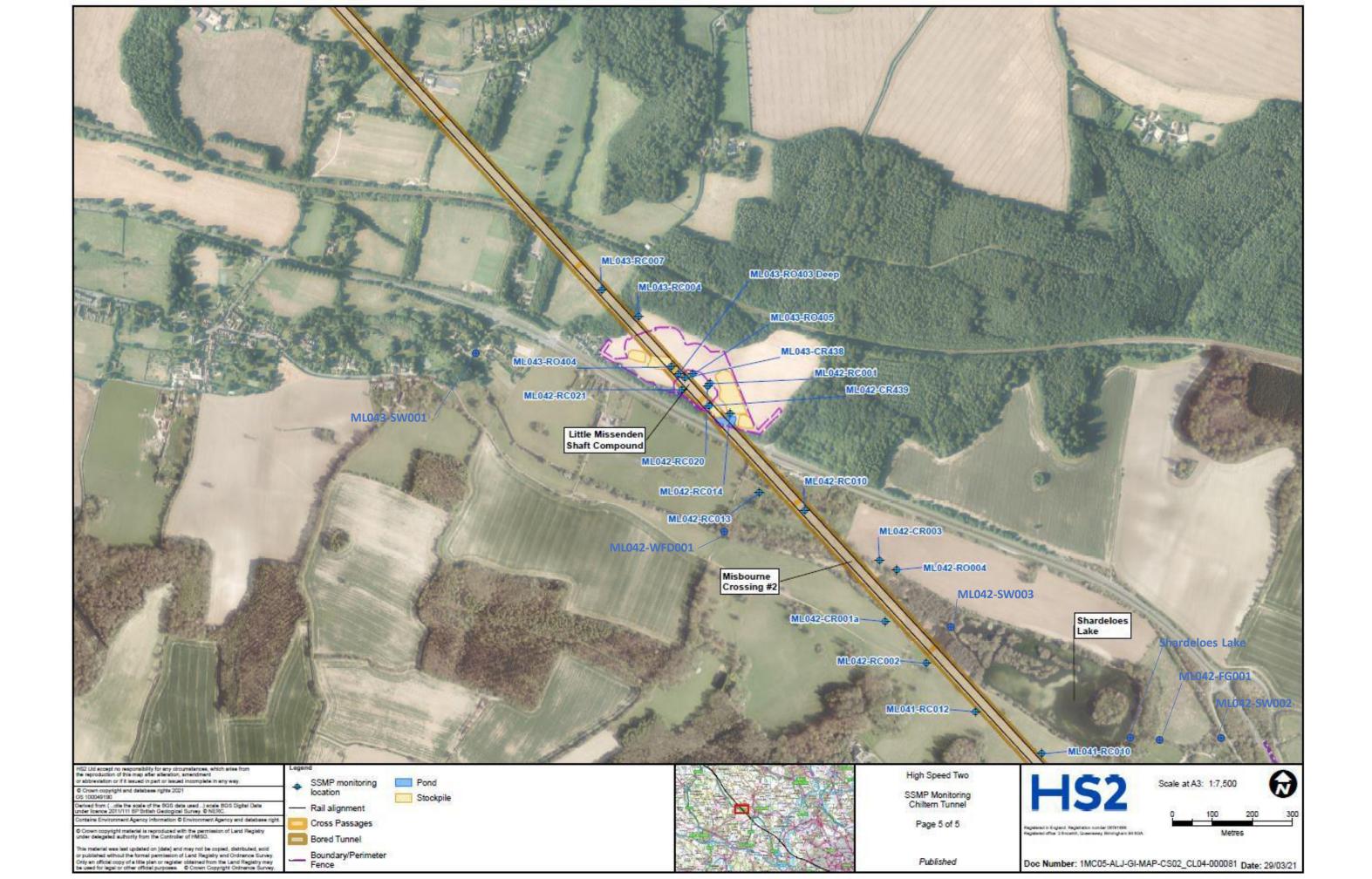
Appendix A Monitoring Locations











Appendix B Borehole logs



Drilled BH/CJ Logged CM Checked MM Approved MM	Start 07/11/201 End 28/11/201	6 Co Ha 1.2	uipment, Methods and Re omacchio 305 and dug inspection pit fro 20m to 20.50m./Rotary o		20m. Op from 20.5	en hole rotary drilling from 20.00 50m to 43.50m.	(m) 20.00 21.50	Dlameter Ca (mm) 200 150 146	sing Depth (m) 20.00 21.50	Ground L Coordina National (tes (m)		E 501	6 mOD 761.29 929.49	
Samples an		•				Strata Description									
Depth (m)	TCR SCR RQD	lf	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main		Detail		Depth, (m) (Thicknes:	Level (mbgl) S	Legend	Water- strike	Backfill	
0.30 - 0.50	B 1A			07/ 11/1 6 0.00	0950 Dry	Grass over soft brown slightly sar slightly gravelly CLAY. Gravel is angular to subrounded fine to medium of flint.	dy							· · · · · · · · · · · · · · · · · · ·	
0.60 - 0.80	B 2A														
1 1.00 - 1.20	В ЗА			07/ 11/1 6 0.00	1600 Dry										
2				08/11/16 0.00	0900 Dry	Sandy CLAY. Flush returns are brown. (Driller's description). (Probably BEACONSFIELD GRAVEL)				1.20	+85.96				
.3															
4							1		295	0	3				
5							<u>v</u>	*						12	
3 Groundwater Entrie No. Depth Strike		5		Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks	<u>}</u>			Hard Bo Depths (Duration (n	nins)Toc	els used	
Notes: For explanatio abbreviations see Ke All depths and reduce hickness given in bra Scale 1:25	y to Explorato ed levels in m ackets in depti (c) l	ry Hole etres, S h colun ESG ww	Stratum nn. Projec		D60	rsham Tunnel (Chiltern) Area C 77-16 1 Speed Two (HS2) Limited				Borehole N	/L0	32-R (Sheet 1 of 9		1	



hrilled BH/CJ Start ogged CM 07/11/2016 Checked MM End pproved MM 28/11/2016	Equipment, Methods and Rer Comacchio 305 Hand dug inspection pit fro 1.20m to 20.50m./Rotary c	m GL to 1.20	m. Oper om 20.50	n hole rotary drilling from 0,00 0m to 43.50m.	to (m) 20.00 21.50 43.50	Dlameter (mm) 200 150 146	Casing Depth (m) 20.00 21.50	Ground Level Coordinates (m National Grid		87.16 mOD E 501761.29 N 191929.49
Samples and Tests			5	Strata Description						
Depth SCR If (m) RQD	Records/Samples	Casing	Time & Water (m)	Main		Detail		Depth, Leve (m) (mbgl (Thickness		^{Water-} Backfill
(m) 300 RQD 1 6		(mbgl)	(m)	Sandy CLAY, Flush returns are brown. (Driller's description). (Probably BEACONSFIELD GRAVEL)	2			I (m)		
vo. Depui Suike (iii) Kemarks		Depth Seale	a (m)	Depths (m) Remarks				Depths (m)	Duration (m	ins)Tools used
tes: For explanation of symbols an breviations see Key to Exploratory depths and reduced levels in metri	Hole Records,	i No.	Amer D607	rsham Tunnel (Chiltern) Area C				Borehole)32-R(



rilled BH/CJ		Equipment, Methods and Ren	narks		Dept	h from to m) (m)	(mm)	Casing Depth (m)	Ground Level		87.16 mOD	
ged CM cked MM		Comacchio 305 Hand dug inspection pit fro 1.20m to 20.50m./Rotary of	m GL to 1.2	20m, Ope	en hole rotary drilling from 20	00 20.00 .00 21.50 .50 43.50	200 150 146	(m) 20.00 21.50	Coordinates (m) National Grid		E 501761.29 N 191929.49	
roved MM	28/11/2016	1.20m to 20.30m./Notary 0	ore animing i			43.30	140					
amples and					Strata Description				Depth, Level	<u> </u>		-
Depth (m)	TCR SCR IF RQD	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main		Detail		(m) (mbgl) (Thickness	Logond	Water- strike Backfi	"
					Sandy CLAY. Flush returns are brown. (Driller's description). (Probably BEACONSFIELD GRAVEL)							
2												
14					GRAVEL. Flush returns are br (Driller's description) (Probably BEACONSFIELD GRAVEL)		AC	,eQ	13.80 + 13.31			
			08/11/16 0.00	1600 1.60		n		-				/
<u>; </u>									15.00 +72.10	·····		
oundwater Entries	(m) Remarks		Depth Sea		Depth Related Remarks Depths (m) Remarks					Duration (mi	ins)Tools used	
tes: For explanation previations see Key depths and reduce kness given in bra cale 1:25	y to Exploratory H ed levels in metre ackets in depth co (c) ESG	Hole Records, es, Stratum plumn, AGS Project		D60	ersham Tunnel (Chiltern) Area C 77-16 h Speed Two (HS2) Limited					32-RC Sheet 3 of 9	001	



Drilled BH/CJ Logged CM Checked MM Approved MM	Start 07/11/2016 End 28/11/2016	Equipment, Methods Comacchio 305 Hand dug inspectic 1.20m to 20.50m./F	n pit from GL to 1,2	0m. Op rom 20.9	en hole rotary drilling from 20	h from to m) (m) .00 20.00 0.00 21.50 1.50 43.50	Dlameter ((mm) 200 150 146	casing Depth (m) 20.00 21.50	Ground Level Coordinates (m) National Grid		87.16 E 5017 N 1919	61.29
Samples an	d Tests	•			Strata Description							
Depth (m)	TCR SCR IF RQD	Records/Sam	Date & Casing (mbgl)	Time & Water (m)	Main		Detail		Depth, Level (m) (mbgl) (Thickness	Legend	Water- strike	Backfill
			09/11/16 0.00	0600 Dry	Dense GRAVEL with flint. (Dril description). (Probably BEACONSFIELD GRAVEL)	ler's						
16			09/11/16 15.00	1830 6.50							 	
			10/11/16 15.00	0720 6.90								
- 17												
									bř.	C)		
- 19					Structureless CHALK. (Drillers description). (SEAFORD CHAI FORMATION - Ungraded)	LK	Acc	e Q	19.50 +67.60			
						n l		-			1	
20 Groundwater Entries No. Depth Strike	s (m) Remarks		Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks 19.00 - 20.00 Bentonite seal (Aqu	iler protection),			Hard Boring Depths (m)	Duration (n	ins)Tool:	s used
Notes: For explanatio abbreviations see Key All depths and reduce thickness given in bra Scale 1:25	y to Exploratory ed levels in meti ackets in depth (c) ES	Hole Records. es. Stratum	Project Project No. Carried out for	D60	ersham Tunnel (Chiltern) Area C 77-16 1 Speed Two (HS2) Limited				Borehole MLO	32-R (Sheet 4 of 9		1



Drilled BH/CJ .ogged CM Checked MM Approved MM	Start 07/11/2 End 28/11/2	2016	Equipment, Methods and Comacchio 305 Hand dug inspection pit 1.20m to 20.50m./Rotar	from GL to 1.2		en hole rotary drilling from	(m) (i 0.00 20 20.00 21	to Dlameter (m) (mm) 0.00 200 1.50 150 3.50 146	Casing Depth (m) 20.00 21.50	Ground Coordin National	ates (m)		E 501	6 mOD 761.29 929.49
Samples an						Strata Description								
Depth (m)	TCR SCR RQD	lf	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main		Detail		Depth, (m) (Thickne:	Level (mbgl) SS	Legend	Water- strike	Backfill
			_	10/11/16 20.50 17/11/16	1545 5.52 0800	Structureless CHALK. (Dnll description). (SEAFORD C FORMATION - Ungraded) Core recovered non-intact, presumably due to drilling t fints, Recovered materials	HALK			20.50	+66.66			
20.50 - 21.00	94 0 0	NIDD		20.50	Dry	medium and large flints. (S CHALK FORMATION - Ung	EAFORD						, ,	
21.00 - 21.50	100 0 0	NIDD NIDD												
22		NIDD NIDD NIDD				Core NIDD, recovered as a gravel of weak medium der CHALK with black specklin surfaces. (SEAFORD CHA FORMATION - Ungraded)	nsity white g on			21.60	+65.56			
22.15 - 22.40 21.50 - 23.00	95 23 23	60 80 130	- C 1			Weak medium density whith with occasional grey wispy seams. Fractures are horizi two sets at 70 to 85 degree spaced (60/80/130) undular closed with black speckling occasional orange staining surfaces. (SEAFORD CHAI FORMATION - Grade B2)	marl ontal and is closely ting rough and 22 on 22 LK	2.50 Grey wispy m 2.60 Grey marl se	-		+65.01			
23 23.50 - 23.72		60 80 120	C 2			Lamination (10mm thick) of MARL. (Possibly SHOREH MARL. LEWES NODULAR FORMATION) Weak medium density whiti with occasional grey wispy seams. Fractures are horiz- two sets at 70 to 85 degree spaced (60/80/130) undula closed with black speckling occasional orange staining surfaces. (LEWES NODUL CHALK FORMATION - Gra Recovery is of stronger ma	AM CHALK CHALK marl ontal and ss closely ting rough and on AR dde B2)	2.90 Medium nodu	-	22.80 23.00	+64.36			
23.00 - 24.50 24	68 31 10	NA NA NA	_			Weaker material not recover Recovered material compri- medium to high density whi CHALK. Fractures are horiz 85 degrees closely spaced (60/80/120) undulating roug slight black speckling on su (LEWES NODULAR CHAL FORMATION- Grade A2) AZCL. Driller's description: (LEWES NODULAR CHAL FORMATION - Ungraded) Recovery is of stronger ma	ered. ses weak ite 22 flin cc gh with rfaces. K CHALK. K terial.	8,80-23.90 Medium nt surrounded by omminuted chalk (illing induced).	-	23.90	+62.76			
24.50 - 25.00 25	94 12 0					Weaker material not recove Recovered material compri medium to high density whi CHALK, Fractures are hori; 85 degrees closely spaced (60/80/120) undulating roug slight black speckling on su (LEWES NODULAR CHAL	ses weak ite zontal and 22 gh with irfaces, st K	4.70 Smc ¹ nodula 4.75-75.00 40 deg cture with heavy uning on surface. 5.00 Small nodula	ree - orange -					
Depth Froundwater Entrie No. Depth Strike		narks	Records	Depth Sea	lled (m)	Depth Related Remarks Depths (m) Remarks	0002			Hard Bo Depths		Duration (n	nins)Too	ols used
lotes: For explanations see Ke bbreviations see Ke Il depths and reduce hickness given in bra Scale 1:25	y to Explo ed levels i ackets in o	oratory H in metre depth cc (c) ESG	Iole Records. s. Stratum Jumn.	ject ject No. ried out for	D60	ersham Tunnel (Chiltern) Area C 77-16 h Speed Two (HS2) Limited				Borehol	NL0	32-R (Sheet 5 of 6		1



Drilled BH/CJ Logged CM Checked MM Approved MM	Start 07/11/2 End 28/11/2	2016 (H 1	Equipment, Methods and Rem Comacchio 305 Hand dug inspection pit fror L20m to 20.50m./Rotary co	n GL to 1.2	20m. Op from 20.5	en hole rotary drilling from 60m to 43,50m.	to Dlameter Casing Depth (m) (mm) (m) 20.00 20.00 20.00 21.50 150 21.50 43.50 146 146	Ground Level Coordinates (m) National Grid	87.16 mOD E 501761.29 N 191929.49
Samples an		ts				Strata Description		Depth, Level	
Depth (m)	TCR SCR RQD	lf	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main	Detail	(m) (mhdl)	Legend ^{Water-} Backfill
25.00 - 26.00	63 38 38					FORMATION- Grade A2)	25.30 Medium nodular flint, surrounding chalk has orange speckling.		
26.50 - 26.70 26.00 - 27.50 27	63 34 22	60 80 120	C 3				26.30 Horizontal fracture infilled (10mm) of with comminuted chalk. 26.45 Medium nodular flint.	27.50 +59.66	
27.50 - 28.25 - ²⁸ 28.25 - 28. 44	45 0 0	NIDD NIDD 190	C 4			Partial recovery. Core loss presumed to be due to erosion of chalk during drilling. Recovered material comprises medium nodular flints. (LEWES NODULAR CHALK FORMATION - Ungraded) Partial recovery. Core loss presumed to be due to erosion of chalk during drilling. Recovered material comprises weak medium density white CHALK. (LEWES NODULAR		27.50 +59.66	
28.25 - 29.00 - 29	11 0					CHALK FORMATION - Ungraded) No recovery. Driller's description: CHALK, (LEWES NODULAR CHALK FORMATION - Ungraded)	28.90 Medium nodular flint.	29.00 +58.16	
29.00 - 30.50 39	0 0	NA NA NA					2. Acces		
Notes: For explanatic abbreviations see Ke	(m) Rem on of symi y to Explo	bols and pratory H	, Stratum		Ame	Depth Related Remarks Depths (m) Remarks ersham Tunnel (Chiltern) Area C		Borehole	uration (mins)Tools used
hickness given in bra Scale 1:25	ackets in o	(c) ESG	umn. www.esg.co.uk /2017 11:41:29 Project Carried			77-16 n Speed Two (HS2) Limited			2-RC001 heet 6 of 9



Drilled BH/CJ Logged CM Checked MM Approved MM	Start 07/11/2 End 28/11/2	2016	Equipment, Methods and Re Comacchio 305 Hand dug inspection pit fr 1.20m to 20.50m./Rotary (om GL to 1.2	20m. Op from 20.3	en hole rotary drilling from 50m to 43.50m.	to Dlameter Casing Depth (m) (mm) (m) 20.00 200 20.00 21.50 150 21.50 43.50 146 146	Ground Level Coordinates (m) National Grid	87.16 mOD E 501761.29 N 191929.49
Samples an	d Tes	ts			1	Strata Description			
Depth (m)	TCR SCR RQD	lf	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main	Detail	Depth, Level (m) (mbgl) (Thickness	Water- strike Backfill
			-			No recovery. Dniller's description: CHALK. (LEWES NODULAR CHALK FORMATION - Ungraded) Weak medium density white CHALK. Fractures are horizontal and 80 degrees very closely to closely spaced (30/50/100), undulating rough with slight black speckling on surfaces. (LEWES NODULAR		30,50 +56,66	
- 3131.00 - 31.32 30.50 - 32.00	99 38 31	30 50 100	C 5			CHALK FORMATION - Grade B3/ B4)	31.00 Large nodular flint. — 31.00-31.40 80 degree fracture with heavy orange staining on surface. 31.50 Medium nodular flint. –		
				17/11/16 20.50	1730 Dry				
- 32 32.00 - 33.00 32.60 - 32.90	100 45 30		C 6	18/11/16 20.50	0800 Dry	Weak medium density white CHALK. Fractures are horizontal and 80 degrees closely spaced (100/150/200) undulating rough with slight black speckling on surfaces. (LEWES NODULAR CHALK FORMATION- Grade A2)		32.10 +55.00	
- 33 33.00 - 33.50	100 0 0	100 150					33.30-33.70 Highly fractured (probably drilling induced) with occasional small nodular flints.		
- 3433.50 - 34.50 34,10 - 34,30	100 51 51	200	C 7				equ		
34.50 - 35.00	100 0 0						34.75 Occasional orange o, eck-es through core (p ssib-e sponge bed).		
Groundwater Entrie No. Depth Strike		arks	1	Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks	,	Hard Boring Depths (m) Duration	(mins)Tools used
Notes: For explanatic abbreviations see Ke All depths and reduce thickness given in bra Scale 1:25	y to Explo ed levels i ackets in o	n metres n metres depth co (c) ESG	ole Records, s, Stratum lumn, AGS		D60	ersham Tunnel (Chiltern) Area C 77-16 h Speed Two (HS2) Limited		Borehole ML032-R Sheet 7 of	



Drilled BH/CJ .ogged CM Checked MM	Start 07/11/ End	2016 C		m GL to 1,2		en hole rotary drilling from 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,00 20,000 20,00 20,00 20,00 20,00 20,00 20,00 20,000	to Dlameter Casing Depth (m) (mm) (m) 20.00 200 20.00 21.50 150 21.50 42.50 146 21.50	Ground Level Coordinates (m) Natjonal Grjd	87.16 mOD E 501761.29 N 191929.49
pproved MM	28/11/	2016	.20m to 20.50m./Rotary c	ore arilling f	rom 20.		43.50 146		101323.43
Samples an		ts		D.: 6	7 5. 4	Strata Description		Depth, Level	
Depth (m)	TCR SCR RQD	lf	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main	Detail	(m) (mbgl) Lege	nd ^{Water-} Backfill
35.33 - 35.53			С 8			Partial recovery. Core loss presumed to be more weathered material. Material recovered comprises weak medium to high density white nodular CHALK with a purplish hue. Occasional orange speckling throughout. (LEWES NODULAR CHALK FORMATION - Ungraded)			
35.00 - 36.50	37 20 20						35.90-36,15 Drill cuttings of		
36		NIDD					chalk and flint. 		
		NIDD		18/11/16 20.50	1500 Dry	Partial recovery, Core loss presumed	seams. 36.30 Horizontal fracture infilled with 10mm comminuted chalk.	36.50 +50.66	
3736.50 - 37.50	26 0 0			24/11/16 20.50	1100 Dry	to be due to erosion of chalk by drilling process. Recovered material comprises a mixture of comminuted CHALK and medium nodular flints. (LEWES NODULAR CHALK FORMATION - Ungraded)			
				24/11/16 20.50	1830 33.00			37.50 +49.66	
37.50 - 38.00	100 40 40	NIDD NIDD 200		25/11/16 20.50	0800 Dry	White CHALK with much flint. Recovered as predominately fine and coarse gravel of flint. (LEWES NODULAR CHALK FORMATION - Ungraded)	37.80-38.00 Medium bed of white chalk.		
38							38.00-38.20 NIDD, recovered- as gravel of flint with brown		
38.00 - 38.50	100 20 0		NIDD 50 100			Weak medium density white nodular CHALK with rare orange speckles. Fractures are predominantly horizontal occasionally 45 degrees	staining. 38.20 Medium nodular flint. 38,40 Medium nodular flint.	38,20 +48,96	
38,45 38,50 - 39,00	20 0		D 9 NA NA NA			very closely to closely spaced and locally non-intact (NI/50/100) stepped and rough (LEWES NODULAR CHALK FORMATION - Grade A3)		38.50 +48.66	
39	0		-			AZCL. Driller's description: CHALK. (LEWES NODULAR CHALK FORMATION - Ungraded) Weak medium density white nodular CHALK with rare orange speckles.	38.80 Medium nodular flint. 38.95 Medium nodular flint.	38.80	
39.00 - 39.50	100 26 0	NIDD 50 100		25/11/16 20.50	1400 Dry	Fractures are predominantly horizontal occasionally 45 degrees very closely to closely spaced and locally non-intact (NI/50/100) stepped and rough (LEWES NODULAR CHALK FORMATION - Grade A3)	39.20-39.37 Soft comminue of chalk. 39.30 Horizontal fracture infilled 15mm of soft provin slightly sandy c a		
39.70 - 40.00		60 160 440	C 10	28/11/16 20.50	0800 21.50	Weak high density white nodular CHALK with occasional grey marly pockets (up to 15mm) and with occasionally slightly sandy texture. Fractures are predominantly horizontal very close to medium spaced (60/200/440) and	39.38-39.45 45 de grue fracture closed with orange staining on surface. 39.40 Grey wispy marl seam. 39.60 Medium nodular flint.		
40 39.50 - 40.50						occasionally 80 degrees. A-			<u>-+</u> _0H0
No. Depth Strike	(m) Rem	bols and	Projec	Depth Sea		Depth Related Remarks Depths (m) Remarks ersham Tunnel (Chiltern) Area C		Hard Boring Depths (m) Duratio Borehole	on (mins)Tools used
bbreviations see Ke II depths and reduce hickness given in bra Scale 1:25	y to Explo ed levels ackets in	oratory Ho in metres depth colu (c) ESG \	ole Records. Stratum umn. Project		D60	77-16 h Speed Two (HS2) Limited		ML032-	



orilled BH/CJ ogged CM shecked MM	Start 07/11/2 End	2016 C H 1	quipment, Methods and Rer Comacchio 305 land dug inspection pit fro .20m to 20.50m./Rotary c	om GL to 1,2	20m. Op from 20.5	en hole rotary drilling from	0.00 20.00	to Dlameter (m) (mm) 20.00 200 21.50 150 43.50 146	Casing Depth (m) 20.00 21.50	Ground Le Coordinat National G	es (m)		87.1 E 501	6 mOD 1761.29 1929.49
pproved MM Samples an	28/11/2 d Tes					Strata Description								
Depth (m)	TCR SCR RQD	lf	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main		Detail			Level (mbgl)	Legend	Water- strike	Backfill
	100 84 52		-			fractures are undulating roug slight black speckling on surf (LEWES NODULAR CHALK FORMATION - Grade A2/A3) Weak high density white CH/ with occasional grey wispy m seams. Fractures are horizor closely to medium spaced	faces.) ALK harl ntal	40.20 Small nodul	- - - - - - - - - - - -	40.30	+46.86			
11 40 ,50 - 41 ,50	100 62 33					(90/160/240) and occasionall degrees. All fractures are und rough closed with slight black speckling on surfaces. (LEW NODULAR CHALK FORMAT Grade A3)	dulating 2 k 2 /ES 1 FION -	40.65 Grey wispy 40.70 Medium noo with slight orange 40.90 Small nodul	lular flints - speckling -					
		90 160 240					5	41.40 Small nodul surrounded by hea staining.	avy orange	- - - - -				
41.50 - 42.00 41.80 - 42.00	100 60 60		C 11				2	41.65 Grey wispy seams. 41.70 Small nodul 42.00 Orange stai	ar flint - -					
42							(2 5	42.00 Orlange star (30mm diameter), 42.10 Slight orang speckling, 42.25 Small nodul	e _					
42.00 - 43.50 43	40 9 9	NA NA NA	-			AZCL, Driller's description: C (LEWES NODULAR CHALK FORMATION - Ungraded)				42.60	+44.56			
				28/11/16 20.50	1715 38.12	END OF EXPLORATORY				43.50	+43.66			
44						END OF EAFLORATORY	NULL					Ċ,		
								AC	.eqt	0,				
45														
is roundwater Entrie No. Depth Strike		arks		Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks	300			Hard Bor Depths (r		Duration (n	nins)To	ols used
otes: For explanation breviations see Ke I depths and reduce ckness given in bra Scale 1:25	y to Explo ed levels i ackets in c	n metres n metres depth coli (c) ESG 1	Stratum		D60	ersham Tunnel (Chiltern) Area C 77-16 h Speed Two (HS2) Limited				Borehole N		32-R (Sheet 9 of 9)1



Orilled AP/GR .ogged CG Checked MM Approved MM	Start 14/11/2016 End 08/12/2016	Equipment, Methods and Re Comacchio 305 Hand dug inspection pit fro 1.20m to 14.50m./Rotary o	om GL to 1.2	20m. Op 14.50m t		n to (m) 14.50 30.05 50.60	Dlameter (mm) 200 150 146	Casing Depth (m) 30.05	Ground Le Coordinat National G	es (m)		94.27 E 5016 N 1919	
Samples an	d Tests		Data 8	Time 9	Strata Description				Depth,	Level			
Depth (m)	SCR IF RQD	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main		Detail		(m) (Thickness	(mbgi)	Legend	Water- strike	Backfill
			14/11/16 0.00	0800 Dry	Grass over firm brown slightly sand slightly gravelly CLAY. Sand is fine i coarse. Gravel is subangular to subrounded fine to coarse. Occasional pockets of light brown slightly sandy clay. Gravel from 0.50m. (Possibly TOPSOIL)					+93.67			0
1			14/11/16 0.00	1600 Dry	Stiff orangish brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to wel rounded fine to coarse of flint. (Possibly CLAY WTH FLINTS) Firm to stiff orangish brown slightly sandy CLAY. Sand is fine to mediur Occasional reddish brown fine to medium sand. (Possibly CLAY WTI FLINTS)	n.			 0.90 1.20	+93.37			
			15/11/16 0.00	0800 Dry	Stiff brown gravelly CLAY, (Driller's description). (Possibly CLAY WITH FLINTS)								
2													
4					Soft CHALK. (Driller's description). (SEAFORD CHALK FORMATION - Ungraded)				3.50	+90.77			
5						2 2	Pcc	e	0				
roundwater Entrie No. Depth Strike	(m) Remarks	, , ,	Depth Sea		Depth Related Remarks Depths (m) Remarks 1.00 - 50.00 Natural growna logging.				Hard Bor Depths (r		Duration (n	nins)Too	ls used
lotes: For explanatic bbreviations see Ke II depths and reduce hickness given in bra Scale 1:25	y to Exploratory ed levels in metri ackets in depth c (c) ES	Hole Records, es, Stratum column, Projec		D60	ersham Tunnel (Chiltern) Area C 77-16 h Speed Two (HS2) Limited				Borehole N		32-R (Sheet 1 of 1		4



Description Strata Description Trim Trial Description Trim Trial Description Trial Event Strata Description Trial Description Trial Event Trial Event
Optimization Optimization<
\sim



rilled AP/GR ogged CG :hecked MM pproved MM	Start 14/11/2 End 08/12/	2016 (2016	Equipment, Methods and Re Comacchio 305 Hand dug inspection pit fr I.20m to 14.50m./Rotary	om GL to 1.2			to Dlameter (m) 14.50 200 30.05 150 50.60 146	Casing Depth (m) 30.05	Ground Level Coordinates (m) N at ional Grid		94.27 mOD E 501608.91 N 191986.38
Samples and Depth (m)	TCR SCR RQD	lis If	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Strata Description	Detail		Depth, Level (m) (mbgl) (Thickness	Legend	^{Water-} Backfill
				15/11/16 0.00	1700 3.00	Soft CHALK. (Dnller's description). (SEAFORD CHALK FORMATION - Ungraded)) (m) 		
1				16/11/16 0.00	0800 Dry						
12											
13									10 C		
				16/11/16 11.10	1700 5.00			e P	14.50 +79.77		
014 50 - 45 50			NA NA NIDD NIDD - NIDD	17/11/16 11.10	0800 8.45	White CHALK recovered non-intact as comminuted chalk with fragments of weak to strong low density chalk. (Probably disturbed by drilling). (SEAFORD CHALK FORMATION - Ungraded) Recovery is of stronger materials. Weaker materials not recovered.	14.50-14.70 A 201 14.77-14.84 2 subh (b degrees) brown partings (probably of disturbed).	clay _	 14.85 +79.42		
oundwater Entrie No. Depth Strike		lf arks	Records	Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks 14.50 - 15.00 Coring through housing pr	viously drilled by open he	ble methods.	Hard Boring Depths (m)	Duration (mi	ns)Tools used
otes: For explanatio ibreviations see Ke I depths and reduce ckness given in bra Scale 1:25	y to Explo ed levels i ackets in o	oratory H in metres depth col (c) ESG	s, Stratum lumn. AGS		D60	ersham Tunnel (Chiltern) Area C 77-16 h Speed Two (HS2) Limited				32-RC Sheet 3 of 11	



orilled AP/GR ogged CG Checked MM	Start 14/11/ End	2016 (m GL to 1.2		en hole rotary drilling from 14.50	to Dlameter Casing Depth (m) (mm) (m) 14.50 200 30.05 30.05 150	Ground Level Coordinates (m) National Grid	94.27 mOD E 501608.91 N 191986.38
pproved MM	епа 08/12/		.20m to 14.50m./Rotary c	oring from 1	4.50m t	o 50.60m. 30.05	50.60 146	National Grid	N 191900.36
Samples an	d Tes	ts				Strata Description			
Depth (m)	TCR SCR RQD	lf	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main	Detail	Depth, Level (m) (mbgl) (Thickness	Legend ^{Water-} Backfill
15.02 - 15.26	80 50 27	50 90 170	C 1 NIDD NIDD 30 40			Recovered material comprises very weak medium to high density white unstained CHALK with light grey and light yellow mottling (possible burrows). Shell fragments (2-5mm thick) scattered throughout. Fracture Set 1 - subhorizontal (5 degrees) closely to medium spaced	inclined joints moderately black speckles and greenish brown staining. 15.26-15.40 Recovered as NI. with flint fragments (up to		
15.50 - 16.00 16	4 0 0 0		50 NIDD NIDD NIDD NIDD NIDD NIDD			(70/100/250) slightly to moderately black speckled undulating rough. Se 2 - 30 degrees probably closely spaced slightly to moderately black speckled planar to undulating rough. Set 3 - 55-60 degrees with slight to moderate black speckling and slight greyish brown staining planar rough. Set 4 - Subvertical (90 degrees)	70mm) and one shell fragment 90x2mm thick. 15.40-15.50 Two parallel subvertical (85 degrees) joints, moderate black speckling. 15.50-15.80 AZCL 15.50-16.00 Recovery is NI of sand sized flint and chalk		
16.00 - 16.50 16.30 - 16.45	50 40 30		NA NA NA C 2			Sightly to moderately black speckled locally moderately orangish brown stained planar rough, (SEAFORD CHALK FORMATION - Grade A3/ B3, where recovered)	debris (cuttings) fragments (up to 60mm) of very weak medium density chalk. 15.97 5x50mm lens of orangish brown sitty clay. Small nodular flint. 16.00 Black sitt.	- - - - - - - - - - - - - -	
16.50 - 17.00 17	100 100 24	NDP NDP NDP	NA				16.00-16.25 AZCL 16.25-16.30 Fragments (up to 100mm) of flint. 16.45-16.46 Comminuted chalk due to drilling. 16.56-16.58 Moderate heavy orangish brown staining on subvertical (90 degrees)		
17.00 - 17.50	60 0 0		NA NA NIDD NIDD NIDD				fracture surface (fracture combines to end of run 17.00m moderate black speckles along whole length). 17.00-17.20 AZCL. 17.20-17.50 Recovered NI as fragments (up to 100mm) of very weak medium density	17.50 +76.77	
17.50 - 18.00 18	50 0 0					Partial recovery. Core loss presumed to be more weathered material. Recovered core comprises extremely weak to weak medium density, locally high density, white CHALK recovered non-intact as gravel and cobble fragments in a comminuted chalk matrix. Occasional brown staining, black	CHALK with slight black speckles on surfaces, flint fragments (up to 70mm) and compact comminuted chalk with 5mm thick shell fragments. 17.50-17.75 AZCL. 17.75-18.00 Recovered NI as fragments (30mm) of		
18.00 - 18.50	4 0 0 0					specking or grey mail on fragment surfaces and occasional 5mm thick shell fragments. (SEAFORD CHALK FORMATION - Ungraded)	extremely weak to very weak low to medium density chalk		
18,50 - 19,00 ¹⁹	30 20 20	100					NI. Recovered material is compact comminuted chalk fragments (70mm) of very weak to weak medium high density chalk. Occasional brown staining and black speckles on surfaces. 18.50-18.75 AZCL.	, tai	
19.00 - 19.50 19.40 - 19.50	30 20 20		C 3	18/11/16 17/11/16 14,50 11,10	0800 1700 Dry Dry		18.85-19.00 Recovered as NI, Recovered material is fragments (60mm) of very weak to weak medium high density with a little black speckling and grey (nr.w) surfaces. Occasiona - that fragments (20mm,)		
2019.50 - 20.50 -		70 110 140				Recovery is of stronger material. Weaker materials not recovered. Recovered material comprises very weak to weak medium to high density white unstructured CHALK with wispy marl seams alternating	19.00-19.25 A 7CI. 19.25-19.40 Recovered as NI. Recovered material is fragments (90mm) of very what to weak medium high density chalk a little black sp. ckling and grey marty surfaces.	19.60 +74.67	
Froundwater Entrie No. Depth Strike		harks	1	Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks 29.50 - 30.00 150mm c sing surged belo barrel. 30.40 - 37.90 Optical imaging.	w base of borehole to help free core	Hard Boring Depths (m)	Duration (mins)Tools used
lotes: For explanations see Ke obreviations see Ke III depths and reduce nickness given in bra Scale 1:25	y to Explo ed levels ackets in	oratory H in metres depth col (c) ESG	Stratum		D60	rsham Tunnel (Chiltern) Area C 77-16 1 Speed Two (HS2) Limited			32-RC004



Drilled AP/GR Logged CG Checked MM	Start 14/11/ End	2016 (quipment, Methods and R Comacchio 305 Hand dug inspection pit f 1.20m to 14.50m./Rotary	rom GL to 1,2		Depth from (m) 0.00 o 50.60m. 30.05	to Dlameter Casing Depth (m) (mm) (m) 14.50 200 30.05 30.05 150 50.60 146	Ground Level Coordinates (m National Grid) E5	.27 mOD 01608.91 91986.38
Approved MM	08/12/	2016	,							
Samples and Depth (m)	TCR SCR RQD	If	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Strata Description	Detail	Depth, Leve (m) (mbg (Thickness		
	65 18 10	NA NA NA	NIDD NIDD NIDD			with rubbly chalk. Shell fragments (2mm thick) scattered throughout. Fracture set 1 - subhorizontal (5-10 degrees) closely to medium spaced (120/160/200) with moderate black speckling and slightly to moderately orangish brown yellow staining undulating rough. Set 2 - Subvertical (85-90 degrees) with moderate black	19.60-19.70 Wispy marl seams. 19.80-19.90 Fragmented flint probably medium nodular flint. 19.90-20.00 Moderate orangish brown staining and patchy brown clay sear on subvertical (85 degrees)	20,10 +74.		
20.70 - 21.00 2120.50 - 21.50	100 80 60	45 140 370	C 4	24/11/16 18/11/16 14.50 14.50	0800 1600 Dry Dry	(Searching undulating rough. (SEAFORD CHALK FORMATION - Possibly Grade A2 to B3, where trecovered) AZCL, Driller's description: Badly broken CHALK and flints. (SEAFORD CHALK FORMATION - Ungraded) Recovery is of stronger material. Weaker materials not recovered. Recovered material comprises very weak to weak medium to high density white unstructured CHALK with wispy marl seams alternating with rubbly chalk. Shell fragments (2mm thick) scattered throughout.	fracture. 20.05-20.10 Recovered NI as compact comminuted chalk, fragments (60mm) of extremely weak to very weak low to medium density chalk and flint fragments (120mm). 20.60-21.15 Frequent grey wispy marl seams. 21.25 Shell fragments (40mm) 5mm to 6mm thick layered and ridged (1mm). 21.25-21.35 Slight orangish brown and yellowish staining			
21.50 - 22.25 22	53 24 13	NIDD NIDD NIDD	-			Fracture set 1 - subhorizontal (5-10 degrees) closely to medium spaced (45/140/370) with moderate black speckling and slightly to moderately orangish brown yellow staining undulating rough. Set 2 - Subvertical (85-90 degrees) with moderate black speckling undulating rough. (SEAFORD CHALK FORMATION - Possibly Grade A2 to B3, where recovered)	on 75 degree fracture. 21.50-22.25 Slight to moderate orangish brown staining on 55 to 90 degree fractures and on surfaces of NI material. 21.58-22.15 Recovered as NI as finit fragments (90mm) and chalk fragments (80mm) with some speckles and staining on surfaces.			
22.25 - 22.75	100 76 76	50 100 260		24/11/16 22.45 25/11/16 22.45	1700 Dry 0800 Dry		22.25-22.75 Slight brown mottling trace fossils. 22.35 Conical void orangish brown stained 3mm to 10mm diameter 10mm deep, Shell – fragments 1mm thick, 22.65 Small nodular flint,			
²³ 22.75 - 23.75	50 50 4 5	NA NA NA	-			AZCL. Driller's description: Broken CHALK and flints. (SEAFORD CHALK FORMATION - Ungraded) Recovery is of stronger material.		22.75 +71. 23.35 +70.		
23.75 - 23.92		- 100 100	C 5			Weaker materials not recovered. Recovered material comprises very weak to weak medium to high density white structureless CHALK with wispy marl seams alternating with rubbly chalk. Shell fragments (2mm thick) scattered throuchout.	1mm to 5mm wispy marl seams.			
2423.75 - 24.2 5	100 100 100	500				Fracture set 1 - subhorizontal (5-10 degrees) closely to medium spaced (120/20/550) with moderate black speckling and slightly to moderately orangish brown yellow staining undulating rough. Set 2 - Subvertical				
	95 67		- NIDD NIDD NIDD -			(85-90 degrees) with moderate black speckling undulating rough. (SEAFORD CHALK FORMATION - Possibly Grade A2 to B3, where recovered)	24.25-24.50 Recovered N a. flint fragments (up to 90 nm some medium to large nodular flints and fragments (80mm) of very weak to weak – medium to high density chalk with sligh to moderate black			
24.25 - 25.25 25	38						specking on surfaces.			
Groundwater Entrie No. Depth Strike		narks	1	Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks 37.80 - 50.00 Acoustic i naging,	4	Hard Boring Depths (m)	Duration (mins)]	ools used
Notes: For explanation abbreviations see Ke All depths and reduce hickness given in bra Scale 1:25	y to Explo ed levels ackets in	oratory H in metres depth col (c) ESG	umn. UProje	ct ct No. ed out for	D60	ersham Tunnel (Chiltern) Area C 77-16 h Speed Two (HS2) Limited		Borehole ML()32-RC0 Sheet 5 of 11	04



Drilled AP/GR .ogged CG Checked MM	Start 14/11// End	2016 C		om GL to 1.2		Depth from (m) 0.00 14.50	to Dlameter Casing Depth (m) (mm) (m) 14.50 200 30.05 30.05 150	Ground Level Coordinates (m) National Grid	94.27 mOD E 501608.91 N 191986.38
approved MM	08/12/	2016	.20m to 14.50m./Rotary of	oring from 1	14.50m t		50.60 146	National Grid	N 191980.38
Samples an	d Tes	ts	1			Strata Description		Depth, Level	
Depth (m)	TCR SCR RQD	lf	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main	Detail	(m) (mbgl) (Thickness	Water- strike Backfill
				25/11/16 25.25 28/11/16	1600 Dry 0800	Recovery is of stronger material. Weaker materials not recovered. Recovered material comprises very weak to weak medium to high density white structureless CHALK with wispy marl seams alternating	25.15-25.25 Very closely spaced subvertical (85 degrees) fractures with moderate black speckling.		
25.25 - 25.95	100 86 14	40 200 380		25.25	Dry 1800	with rubbly chalk. Shell fragments (2mm thick) scattered throughout. Fracture set 1 - subhorizontal (5-10 degrees) closely to medium spaced (120/200/550) with moderate black speckling and slightly to moderately orangish brown yellow staining			
26			NA NA NA	25.95 29/11/16 25.95	1.70 0800 5.00	undulating rough. Set 2 - Subvertical (85-90 degrees) with moderate black speckling undulating rough. (SEAFORD CHALK FORMATION - Possibly Grade A2 to B3, where	_		
25.95 - 26.75	38 0		_	20.90	5.00	recovered)	26,25-26,65 Recovered NI as fragments (80mm) of very		
20.00 20.10	0	NIDD NIDD NIDD					weak to weak medium to high density chalk with moderate black speckling on - surfaces. 26.65-26.75 Medium (90mm) nodular flint.		
27		NA NA NA	-			AZCL. Driller's description: Broken CHALK and flints. (SEAFORD CHALK FORMATION - Ungraded)			
26.75 - 27.75	50 45 30		NIDD NIDD NIDD			Recovery is of stronger material. Weaker materials not recovered.	27.20-27.30 Recovered NI. 27.30-27.40 Orangish brown	27.20 +67.07	
27.51 - 27.68		100 135 170	C 6	29/11/16 27.75	1800 Dry	Recovered material comprises very weak to weak medium to high density white unstructured CHALK with wispy marl seams alternating with rubbly chalk. Shell fragments (2mm thick) scattered throughout. Fracture set 1 - subhorizontal (5-10	wispy staining. Chalk is fragmented.		
2827.75 - 28.25	50 40 40		- NA NA NA	30/11/16 27.75	0800 Dry	degrees) closely to medium spaced (100/135/200) with moderate black speckling and slightly to moderately orangish brown yellow staining undulating rough. Set 2 - Subvertical (85-90 degrees) with moderate black	27.75-28.00 AZCL 28.00-28.75 Core smeared in- brown sandy clay (drilling related).		
28,25 - 28,75	100 80	100				speckling undulating rough. (SEAFORD CHALK FORMATION - Possibly Grade A2 to B3, where recovered)	28.35-28.45 Recovered NI as fragments (60mm) of very weak medium density chalk	28.50 +65.77	
20,20 20,70	50	150 200				Recovery is of stronger material. Weaker materials not recovered. Recovered material comprises very weak medium to high density white CHALK with shell fragments (2mm	and fragments (20mm) of flint. 28.55-28.75 Extremely closely spaced near vertical fractures unstained and		
29 28.75 - 29.2 5	70 40 40		NIDD	30/11/16 29.25	1800 27.60	thick) scattered throughout, Fracture Set 1 - subhorizontal (5-10 degrees) close to medium spaced (100/250/500) moderately orangish brown stained undulating rough. Set 2- 85-90 degrees with moderate	unspeckled (drilling induced). 29.10-29.25 Recovered NI as		
				01/12/16	0800	black speckling locally extremely to very closely spaced with some orangish brown and yellowish brown	fragments (60mm) of very weak medium density cha	29.25 +65.02	
		NA NA NA		25.25	Dry	staining planar to undulating rough. (SEAFORD CHALK FORMATION - Possibly Grade A2 to B2) NO CORE RECOVERY - core lost due to over-drilling to free Geobor barrel. (SEAFORD CHALK FORMATION - Ungraded)	2 ACCON		
30	c					Death Balatard Dame 1		30.00 +64.27	4_040
roundwater Entrie No. Depth Strike		arks		Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks		Hard Boring Depths (m) Duration	(mins)Tools used
lotes: For explanatic bbreviations see Ke II depths and reduce nickness given in bra Scale 1:25	y to Explo ed levels i ackets in o	oratory Ho in metres depth coli (c) ESG	Stratum umn. AGS		D60	ersham Tunnel (Chiltern) Area C 77-16 h Speed Two (HS2) Limited		Borehole ML032-F Sheet 6 of	



Drilled AP/GR .ogged CG Checked MM	Start 14/11/ End	2016 (H 1	equipment, Methods and Rer Comacchio 305 Hand dug inspection pit fro .20m to 14.50m./Rotary c	m GL to 1.2		en hole rotary drilling from 0.00 0.50,60m. 0.05	to Dlameter Casing Depth (m) (mm) (m) 14.50 200 30.05 30.05 150 50.60 146	Ground Level Coordinates (m) National Grid	94.27 mOD E 501608.91 N 191986.38
Samples an	08/12/ d Tes					Strata Description		1	
Depth (m)	TCR SCR RQD	lf	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main	Detail	Depth, Level (m) (mbgl) (Thickness	d ^{Water-} Backfill
30.00 - 30.25 30.00 - 30.50	50 50 50		NA NA C 7 NDP NDP NDP			Recovery is of stronger material. Weaker materials not recovered. Recovered material comprises very weak medium to high density white CHALK with shell fragments (2mm thick) scattered throughout, Fracture Set 1 - subhorizontal (5-10 degrees) close to medium spaced	30.25-30.50 AZCL.		
30.50 - 31.00	30 0 0	NIDD NIDD NIDD		01/12/16 30.05	1700 Damp	(100/250/500) moderately orangish brown stained undulating rough. Set 2- 85-90 degrees with moderate black speckling locally extremely to very closely spaced with some orangish brown and yellowish brown staining, undulating rough. (SEAFORD CHALK FORMATION -	30.50-31.00 NIDD, recovered - as chalk fragments (up to 130mm) and flint fragments (90mm).		
³¹ 31.00 - 31.50	60 20 20		NA NA NIDD NIDD NIDD NIDD			Possibly Grade A2 to B2)	31.00-31.20 AZCL. – 31.20-31.30 NIDD, recovered as very weak to weak chalk fragments (up to 90mm) and filnt fragments (up to 80mm). 31.40-31.50 NIDD, recovered as upon the weak the weak the		
31.50 - 32.00 ³²	40 40 20		NDP NDP NIDD NIDD NIDD NA NA NA				as very weak to weak chalk fragments (up to 90mm) and flint fragments (up to 80mm). 31.50-31.80 AZCL.		
32.00 - 32.50	60 20 20		NIDD NIDD NIDD NA NA NA				32.10-32.30 NIDD, recovered as fragments (50mm) of very weak to weak medium to high density chalk with little yellow staining. 32.50-33.00 Predominantly		
32.50 - 32.60 32.50 - 33.20	100 100 14	NDP NDP NDP	C 8				very weak medium density chalk. 32,65 Flint fragments 50mm. 33,00-33,20 NIDD, recovered		
33.20 - 34.20 33.80 - 33.98	95 50 50	100 200 300	NIDD NIDD C 9	05/12/16 30.05	0800 32.50		as fragments (70mm) of very weak to weak medium to high density chalk and occasional flint fragments (60mm). 33.20-33.30 85 degree fractures slightly to moderately black speckled – and very closely spaced. 33.60 Small to medium (60mm) nodular flint. 33.60-34.20 2 parallel 85 degree fractures with slight black speckling and slightly locally moderate orangish		
34			NA NA NA				brown staining.		
34.20 - 35.60 35	82 29 29						2. ACU		
Groundwater Entrie No. Depth Strike		narks	1	Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks	4	Hard Boring Depths (m) Duration	(mins)Tools used
Notes: For explanations abbreviations see Ke All depths and reduce hickness given in bra Scale 1:25	y to Expl ed levels ackets in	oratory H in metres depth col (c) ESG	. Stratum umn. AGS		D60	rsham Tunnel (Chiltern) Area C 77-16 n Speed Two (HS2) Limited		Borehole ML032-F Sheet 7 of	



Drilled AP/GR .ogged CG Checked MM Approved MM	Start 14/11/2 End 08/12/2	2016 (Equipment, Methods and Rer Comacchio 305 Hand dug inspection pit fro 1.20m to 14.50m./Rotary c	m GL to 1.2		en hole rotary drilling from (m) 0.00 14.50 0.50.60m.	to Dlameter Casing Depth (m) (mm) (m) 14.50 200 30.05 30.05 150 50.60 146	Ground Level Coordinates (m) National Grid	94.27 mC E 501608. N 191986.	.91
Samples an						Strata Description				
Depth (m)	TCR SCR RQD	lf	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main	Detail	Depth, Level (m) (mbgl) (Thickness	Legend ^{Water-} Bac	kfill
35.62 - 35.92		100 200 300	- NA			Recovery is of stronger material. Weaker materials not recovered. Recovered material comprises very weak medium to high density white CHALK with shell fragments (2mm thick) scattered throughout. Fracture Set 1 - subhorizontal (5-10 degrees) close to medium spaced (100/250/500) moderately orangish brown stained undulating rough. Set 2- 85-90 degrees with moderate	35.00-35.10 Small to medium (up to 50mm) nodular flints and flint fragments, 35.10-35.40 Moderate orangish brown staining on subvertical fracture surfaces, 35.60-35.63 Very stiff greenish sitly CLAY with	35.60 +58.67		
³⁶ 35.60 - 36.60	75 75 54	80 365 650	NA C 10			black speckling locally extremely to very closely spaced with some orangish brown and yellowish brown staining, undulating rough. (SEAFORD CHALK FORMATION - l. Possibly Grade A2 to B2) Very thin bed (30mm) of very stiff greenish brown silty CLAY with orangish brown spots and speckling. (Probably SHORHAM MARL, LEWES NODULAR CHALK	(Probably SHORHAM MARL) (Probably SHORHAM MARL) 36.35 Impression of flint.			
			NA NA	05/12/16 30.05	1700 32.90	FORMATION) Recovery is of stronger material. Weaker materials not recovered, Recovered material comprises very	36.35-36.60 AZCL.			P
36.60 - 37.10 ³⁷	100 26 26		- NIDD NIDD - 20 - 40 - 60 NIDD	06/12/16 30.05	0800 34.30	weak to weak medium to high density white unstained CHALK with light grey mottling and occasional wispy marl seams. Occasional dark grey zoophycos. Fractures are subhorizontal (0-10 degrees) medium spaced (20/300/650) slightly	36.60-36.82 NIDD, recovered as fragments (100mm) of very weak medium density chalk with evidence of very closely spaced subvertical fractures with moderately orangish brown staining and brown day smearing.			
37.33 - 37.48 37.10 - 37.60	100 70 30	NDP NDP NDP	NIDD NIDD C 11			to moderately black speckled and slightly orangish brown and grey stained planar to undulating rough. Occasional 20 degree and rare subvertical (85-90 degree) fractures with slight to moderate black speckles and slight orangish brown grey stained planar to undulating rough. (LEWES NODULAR CHALK FORMATION - Grade A2/B2)	36.82-36.96 3 very closely spaced 80 to 90 degree fractures with orangish brown staining. 36.96-37.10 NIDD, recovered as fragments (65mm) of very weak medium density chalk and flint fragments (40mm).	37.60 +56.67		
³⁸ 37.60 - 38.60	60 30 20	NA NA NA				AZCL, Driller's description: Broken CHALK and flints, (LEWES NODULAR CHALK FORMATION - Ungraded) Recovery is of stronger material. Weaker materials not recovered. Recovered material comprises very	- 38.00-38.10 NIDD, recovered- as flint fragments (40mm) in soft wet comminuted chalk. 38.15 Small nodular lint	 38.00 +56.27		
			50 140 230 NIDD NIDD NA NA NA			weak to weak medium to high density white unstained CHALK with light grey mottling and occasional wispy marl seams. Occasional dark grey zoophycos. Fractures are subhorizontal (0-10 degrees) medium spaced (20/300/650) slightly to moderately black speckled and slightly orangish brown and grey	38.35-38.60 NIDD, recovered as very weak to weak medium to high density chalk with evidence of moderate orangish brown staining and clay smeared fracture			
³⁹ 38.60 - 39.60	90 90 35	70 180 200	NA			slightly of anglish forwh and grey stained planar to undulating rough. Occasional 20 degree and rare subvertical (85-90 degree) fractures with slight to moderate black speckling and slight orangish brownish grey staining planar to undulating rough. (LEWES NODULAR CHALK FORMATION - Grade A2/B2)	surfaces. 38.60-38.70 AZCL. 38.80 Small nodular flint. 38.90 Marly bedding surface. 38.95 Zoophycos trace fossil. 39.10 85 degree fracture with brown staining. 39.20 Zoophycos trace fossil.	0		
			- NIDD NIDD				39.40-39.45 Wispy r and seams and mary bedoing surface. 39.60-39.70 NPDD, recovered as weak high density chalk			
39.70 - 39.88 39.60 - 40.10	100 100 40	50 160 360	NIDD C 12				fragments (70mm) and flint fragments (30mm).			
Froundwater Entrie No. Depth Strike		arks		Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks	,	Hard Boring Depths (m) I	Duration (mins)Tools us	sed
Notes: For explanations see Ke All depths and reduce hickness given in brace Scale 1:25	y to Explo ed levels i	n metres	ole Records, s, Stratum lumn, AGS		D60	ersham Tunnel (Chiltern) Area C 77-16 h Speed Two (HS2) Limited			32-RC004	_



Drilled AP/GR .ogged CG Checked MM	Start 14/11/ End	2016 (Equipment, Methods and Rer Comacchio 305 Hand dug inspection pit fro 1.20m to 14.50m./Rotary c	m GL to 1.2		Depth from (m) 0.00 14.50 0 50.60m.	to Dlameter Casing Depth (m) (mm) (m) 14.50 200 30.05 30.05 150 50.60	Ground Level Coordinates (m) National Grid	94.27 mOD E 501608.91 N 191986.38
Approved MM Samples an	08/12/ d Tes					Strata Description		-	
Depth (m)	TCR SCR RQD	If	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main	Detail	Depth, Level (m) (mbgl) (Thickness	
40.46 - 40.68 40,10 - 41.10	90 75 40	60 130 330	- NIDD NIDD NIDD C 13	06/12/16 30.05	1800 32.10	Recovery is of stronger material. Weaker materials not recovered. Recovered material comprises very weak to weak medium to high density white unstained CHALK with light grey mottling and occasional wispy marl seams. Occasional dark grey zoophycos. Fractures are subhorizontal (0-10 degrees) medium spaced (20/300/650) slightly to moderately black speckled and slightly orangish brown and grey stained planar to undulating rough. Occasional 20 degree and rare subvertical (65-90 degree) fractures with slight to moderate black	40.05 20 degree sheet flint (5-7mm thick). 40.20-40.35 NIDD, recovered as fragments (40mm) of flint, comminuted chalk, brown clay and chalk fragments (50mm). Possible infilled fracture. 40.45 Small nodular flint.	41.00 +53.2	
41.10 - 41.60	20 0 0	NA NA NA		07/12/16 30.05	0800 Dry	speckling and slight orangish brownish grey staining planar to undulating rough, (LEWES NODULAR CHALK FORMATION - Grade A2/82) Minimal core recovery, probably due to drilling through flints, Recovered core comprises fragments of probably large flint nodule, (LEWES NODULAR CHALK FORMATION - Ungraded)	subhorizontal orangish brown stained line possible sponge bed.		
41.60 - 42.10	80 70 70					Recovery is of stronger material. Weaker materials not recovered. Recovered material comprises very weak to weak medium to high density white unstained CHALK with light grey mottling and occasional wispy marl seams. Occasional dark		41.70 +52.5	
42.30 - 42.60 42.10 - 42.80	93 93 50	20 300 650	C 14			grey zoophycos. Fractures are subhorizontal (0-10 degrees) medium spaced (20/300/650) slightly to moderately black speckled and slightly orangish brown and grey stained, planar to undulating rough. Occasional 20 degree and rare subvertical (85-00 degree) fractures with slight to moderate black	42.30 Small nodular flint. 42.40-42.55 Series of zoophycos trace fossils.		
42.80 - 43.10 43			- NA NA NA 0 0			speckles and slight orangish brown grey stained planar to undulating rough. (LEWES NODULAR CHALK FORMATION - Grade A2/B2) No core recovery. Driller's description: Broken CHALK and flints. (LEWES NODULAR CHALK	42.70 Small nodular flints. 42.70-42.80 Irregular marly surfaces. 43.10-43.60 NIDD, recovered	42.80 +51.4 43.10 +51.1	
43.10 - 43.60	60 0 0	NIDD NIDD NIDD				FORMATION - Ungraded) Recovery is of stronger material. Weaker materials not recovered. Recovered material is NIDD, comprising fragments (70nm) of very weak to weak medium to high density chalk and fragments (100mm) of finit with 20nm diameter	as fragments (70mm) of very weak to weak medium to high density chalk and fragments (100mm) of flint with 20mm diameter void part infilled with orangish brown gritty material (sponge remains).		
						void part infilled with orangish brown gritty material (sponge remains). (LEWES NODULAR CHALK FORMATION - Ungraded)	43.60-43.90 AZCL. 43.90-43.95 NIDD, recovered as flint fragments.	43.95 50.3	
43.60 - 44.60 44.33 - 44.60	70 65 65	NDP NDP NDP	NIDD C 15			Very weak to weak medium to high density white unstained CHALK with light grey mottling and occasional wispy marl seams. (LEWES NODULAR CHALK FORMATION - Grade A1)	44.18 Small nodular flint. 44.33 Fragments (30mm, of 10mm thick sheet firit	0	
44.60 - 45.10	80 20 20		- NA NA NA			Very weak medium density white unstained CHALK. Fractures are subhorizontal (0-10 degrees) probably closely to medium spaced (85/300/400) with slight black speckling planar rough. (LEWES	44.60-44, ro Acoc 44.70-45.01 N.DD, recovered as very weak to weak m adum to high density chalk ar d fint fragments (60mm).	44.60 +49.6	
Froundwater Entrie No. Depth Strike		narks	1	Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks	/	Hard Boring Depths (m)	Duration (mins)Tools used
Notes: For explanation abbreviations see Ke All depths and reduce hickness given in bra- Scale 1:25	y to Explo ed levels ackets in	oratory H in metres depth col (c) ESG	iole Records. s, Stratum lumn. AGS		D60	ersham Tunnel (Chiltern) Area C 77-16 n Speed Two (HS2) Limited		Borehole MLO	32-RC004



ogged CG	Start 14/11/	2016	Equipment, Methods and Ren Comacchio 305 Hand dug inspection pit fro		:0m. ೧n	en hole rotarv drilling from	Depth from (m) 0.00 14.50	to Dlameter (m) (mm) 14.50 200 30.05 150	Casing Depth (m) 30.05	Coordinates (m)		94.27 mOD E 501608.91
hecked MM	End 08/12/	1	1.20m to 14.50m./Rotary co				30.05	50.60 146		National Grid		N 191986.38
Samples an	d Tes	ts	1	1		Strata Description	I	1				
Depth (m)	TCR SCR RQD	lf	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main		Detail		Depth, Level (m) (mbgl) (Thickness	1	Water- strike Backfill
45.10 - 45.60	40 0 0	NIDD NIDD NIDD				NODULAR CHALK FORM Possible Grade A2)	AATION-	45.10-45.60 NIDD.				
45.70 - 45.80			85 100 110						-		a de la de l	ofo
45.60 - 4 6.10	100 40 20		C 16 NIDD NIDD NIDD	07/12/16 30.05	1700 31.80			45.80-46.10 NIDD, as very weak medi chalk and flint fragr (50mm).	um density - nents			
46.10 - 46.60	70 60 20		- NA NA NA	08/12/16 30.05	0800 33.40			46.10-46.25 AZCL. 46.35-46.40 Patche and wisps of orang staining.	- - - es (15mm) -			
46.60 - 47.10 46.85 - 47.10 47	100 90 70	NIDD 200 350	C 17					46.60-46.65 NIDD, as flint fragments (2) very weak medium chalk fragments (5) comminuted chalk, 46.65 Medium nod 46.65-46.80 Spots speckles of orangis staining.	20mm), density 0mm) and ular flint, and sh brown			
47.32 - 47.50 47.10 - 47.60	80 80 44	NDP NDP NDP	NA NA C 18					47.10-47.20 AZCL				
47.60 - 48.10 48	80 50 20		NA NA NIDD NIDD NIDD NDP NDP NDP					47.60-47.70 AZCL. 47.70-47.85 NIDD, as very weak medi white chalk fragme (80mm) and flint fra (20mm), 47.85-48.10 Locall wispy marts (10mm)	um density nts agments y frequent thickness)			
48.10 - 48.60 48.35 - 48.55	80 60 40	NDP NDP NDP	NA NA NA C 19					48.10-48.20 AZCL. 48.20 40mm thick t diameter flint. 48.55 Flint fragmer	iull core - - - - -			
48.60 - 4 9.10 ⁴⁹	80 60 60		NA NA NDP NDP NDP					48.50 Fille Tragilier 48.60-48.70 AZCL. 48.70-48.80 NIDD, as flint fragments (i softened wet comm chalk.	recovered = 50mm) in =	, kai		
49.10 - 50.10	0 0 0	NA NA NA				No core recovery. Driller's description: Broken CHAL flints. (LEWES NODULAF FORMATION - Ungraded	-K and R CHALK	2. 20	e			
50 Froundwater Entrie						Depth Related Remarks				Hard Boring		,,
No. Depth Strike	on of syml	bols and pratory He	ole Records,	Depth Sea		Depths (m) Remarks	c c			Depths (m) Borehole		ins)Tools used
I depths and reduce hickness given in bra	ackets in o	donth coli	www.esg.co.uk	No.	D60	77-16				I MLO	32-RC	;004



Approved MM 08/12/2016 Samples autors Second from the second from	2016 Comacchio 305		en hole rotary drilling from	pth from to Dlameter (m) (m) (mm) 0.00 14.50 200 14.50 30.05 150 30.05 50.60 146	Casing Depth (m) 30.05 Coordinates (m National Grid	94.27 mOD) E 501608.91 N 191986.38
- 52 - 53 - 53 - 53 - 51 - 51 - 52 - 53 - 51 - 52 - 52 - 52 - 53 - 55 - 52 - 53 - 55 - 55 - 55 - 55 - 55 - 55 - 55		1	Strata Description	J		
50.10 - 50.60 50.48 - 50.60 51 52 53	If Records/Samples	Date & Time & Casing Water (mbgl) (m)	Main	Detai	Depth, Leve (m) (mbg (Thickness	ll Legend Water- strike Backfill
- 52	NIDD NIDD NIDD C 20 NDP NDP	08/12/16 1600 50.60 36.10	No core recovery, Driller's description: Broken CHALK at filnts, (LEWES NODULAR C (FORMATION - Ungraded) Very weak medium density w unstained CHALK, Fractures subhorizontal (0-10 degrees) probably closely to medium a with slight black speckling pl - rough, (LEWES NODULAR (FORMATION - Possible Grac	HALK vhite a as fragments (90) veak medium del anar CHALK	 D, recovered — mm) of very — nsity chalk	
53	NDP		END OF EXPLORATORY			
- 54						ane
					REdwit	
55 Groundwater Entries No. Depth Strike (m) Remarks	arks	Depth Sealed (m)	Depth Related Remarks Depths (m) Remarks	D. AC	Hard Boring Depths (m)	Duration (mins)Tools used
Notes: For explanation of symbols and abbreviations see Key to Exploratory H- All depths and reduced levels in metres thickness given in brackets in depth col	iols and Pr ratory Hole Records. n metres. Stratum	oject An	Depths (m) Remarks		Depths (m) Borehole	032-RC004



Drilled LG/NK Logged GC/ CM Checked MM Approved MM	Start 31/10/201 End 07/11/201	6 Comac Hand c 20m./F	nent, Methods and R cchio 305 dug inspection pit fi Rotary core drilled f eer's instruction.	rom GL to 1.2	2m, Rota 55m, Terr		n to Dlameter Casing Dep (m) (mm) (m) 2.50 200 2.50 20.00 160 20.00 65.00 146	th Ground Level Coordinates (m) National Grid	99.44 mOD E 501450.85 N 192155.04
Samples and				Date &	Time &	Strata Description		Depth, Level	
Depth (m)	TCR SCR RQD	lf	Records/Samples	Casing (mbgl)	Water (m)	Main	Detail	(m) (mbgl) (Thickness) (m)	d ^{Water-} Backfill
- 0.50 - 0.60	B 1A			31/10/16 0.00	0800 Dry	Soft brown slightly gravelly silty CLAY. Gravel is angular to subrounded fine to coarse of flint. (Possibly TOPSOIL)			
0.50 - 0.60	В 1А D 4А В 2А								
0.80 - 0.90 - 1 1.00 - 1.10 1.00 - 1.10	D 5A B 3A D 6A			31/10/16 0.00	1700 Dry				
				01/11/16 0.00	0800 Dry	Sandy CLAY with flint gravels, (Driller's description), Orange flush returns. (Possibly CLAY WITH FLINTS)		1.20 +98.24	
- 2									
- 3									
- 4							2. Accept		
Groundwater Entries No. Depth Strike	s (m) Remark	s		Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks	0	Hard Boring Depths (m) Duration	(mins)Tools used
Notes: For explanatio abbreviations see Key All depths and reduce thickness given in bra Scale 1:25	y to Explorate ed levels in m ackets in dept (c)	etres, Strati	um Proje AGS	ct ct No. ed out for	D60	ersham Tunnel (Chiltern) Area C 77-16 h Speed Two (HS2) Limited		Borehole ML032-F Sheet 1 o	



Drilled LG/NK Logged GC/ CM Checked MM Approved MM	31/10/2016	Equipment, Methods an Comacchio 305 Hand dug inspection p 20m./Rotary core drille Engineer's instruction.	oit from GL to 1.2 ed from 20m to 6	m. Rota 5m. Terr	ry open hole from 1.2m to 2.50 minated at 65m on	to Dlameter Casing Depth (m) (mm) (m) 2.50 200 2.50 20.00 160 20.00 65.00 146 20.00	Ground Level Coordinates (m) National Grid	99.44 mOD E 501450.85 N 192155.04
Samples and	TCR		Date &	Time & Water	Strata Description		Depth, Level (m) (mbgl)	
Depth (m)	SCR If RQD	Records/Sample	s Casing (mbgl)	Water (m)	Main	Detail	(Thickness	Legend Water- strike Backfill
- 6 - 7 - 8 - 9					Sandy CLAY with flint gravels. (Driller's description). Orange flush returns. (Possibly CLAY WITH FLINTS)	2 Accept		
Groundwater Entries No. Depth Strike	s (m) Remarks	ı	Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks	7	Hard Boring Depths (m)	Duration (mins)Tools used
Notes: For explanatio	n of symbols and	Ι _Ρ ι	roject	Am	ersham Tunnel (Chiltern) Area C		Borehole	
All depths and reduce hickness given in bra	y to Exploratory H	iole Records. s, Stratum lumn. AGS www.esg.co.uk	roject No. arried out for	D60	77-16 h Speed Two (HS2) Limited		ML0	32-RC006 Sheet 2 of 13



Drilled LG/NK Logged GC/ CM Checked MM Approved MM	31/10/2016 End	Equipment, Methods and Comacchio 305 Hand dug inspection pit 20m./Rotary core drilled Engineer's instruction.	from GL to 1.2	m. Rota 5m. Teri	ry open hole from 1.2m to minated at 65m on	to Dlameter Casing (m) (mm) (m 2.50 200 2.5 20.00 160 20.0 65.00 146) Coordinates (m)	99.44 mOD E 501450.85 N 192155.04
Samples an					Strata Description		Depth, Level	
Depth (m)	TCR SCR IF RQD	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main	Detail	(m) (mbgl) (Thickness	Legend Water- strike Backfill
- 11					Sandy CLAY with flint gravels. (Driller's description). Orange flush returns. (Possibly CLAY WITH FLINTS)		- ((m) 	
- 12								
- 13								
- 14 -						2. Acces		
Groundwater Entrie No. Depth Strike	s (m) Remarks		Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks 14.40 - 14.40 No flush r durns colow 14.40)m.	Hard Boring Depths (m)	Duration (mins)Tools used
Notes: For explanatio abbreviations see Ke All depths and reduce thickness given in bra Scale 1:25	y to Exploratory I	Hole Records, is, Stratum Dlumn, AGS	ject ject No. ried out for	D60	ersham Tunnel (Chiltern) Area C 77-16 h Speed Two (HS2) Limited			32-RC006 Sheet 3 of 13



Drilled LG/NK Logged CM CM Checked MM Approved MM	Start 31/10/2016 End 07/11/2016	Equipment, Methods and R Comacchio 305 Hand dug inspection pit f 20m./Rotary core drilled f Engineer's instruction.	rom GL to 1.2	?m, Rota 55m, Terr		to Dlameter Casing Depth (m) (mm) (m) 2.50 200 2.50 20.00 160 20.00 65.00 146	Ground Level Coordinates (m) National Grid	99.44 mOD E 501450.85 N 192155.04
Samples and Depth	TCR		Date &	Time & Water	Strata Description		Depth, Level (m) (mbgl) Legen	Weter
(m)	SCR If RQD	Records/Samples	Casing (mbgl)	Water (m)	Main Sandy CLAY with flint gravels.	Detail	(Thickness) (m)	d Water- strike Backfill
					(Driller's description). Örange flush returns. (Possibly CLAY WITH FLINTS)			
- 16			01/11/16 14.50	1700 Dry	Putty CHALK. (Driller's description) (SEAFORD CHALK FORMATION - Ungraded)			
- 17			02/11/16 13.70	0800 Dry				
- 18								
- 19						Accept		
20 Groundwater Entrie No. Depth Strike	S (m) Remarks		Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks 20.00 - 65.00 Unable to ecomposential gr flush.	oundwater strikes due to use of water	<u>20.00 +70.44</u> ' ' Hard Boring Depths (m) Duration	(mins)Tools used
Notes: For explanatio abbreviations see Ke All depths and reduce thickness given in bra Scale 1:25	y to Exploratory	Hole Records. es, Stratum olumn. AGS	ct ct No. ed out for	D60	rrsham Tunnel (Chiltern) Area C 77-16 n Speed Two (HS2) Limited		Borehole ML032-F Sheet 4 o	



Drilled LG/NK Logged GC/ CM Checked MM Approved MM	Start 31/10/2 End 07/11/2	2016 C H 2	quipment, Methods and Ren Comacchio 305 Iand dug inspection pit fro Om./Rotary core drilled fro ingineer's instruction.	m GL to 1.2	2m. Rota 35m. Terr	Depth from (m) 0.00 ry open hole from 1.2m to 2.50 ninated at 65m on	to Dlameter Casing Depth (m) (mm) (m) 2.50 200 2.50 20.00 160 20.00 65.00 146 20.00	n Ground Level Coordinates (m) National Grid	99.44 mOD E 501450.85 N 192155.04
Samples an		ts		Date &	T 0	Strata Description		Depth, Level	
Depth (m)	TCR SCR RQD	lf	Records/Samples	Casing (mbgl)	Time & Water (m)	Main	Detail	(m) (mbgl) (Thickness	gend ^{Water-} Backfill
20.00 - 21.50 - 21 21.00	97 0 0	NIDD NIDD NIDD	D 1			Weak low density white CHALK with black speckles on fracture surfaces. NIDD. recovered as angular gravel. (SEAFORD CHALK FORMATION - Ungraded)	20.00-20.35 Small and medium nodular flints recovered as gravel sized fragments in a matrix of comminuted chalk. - 21.10 Medium nodular flint. 21.30 Medium nodular flint.		
21.50 - 22.25 - 22 22.25 - 22.50	76 9 0		C 2			Recovery is of stronger material. Weaker material not recovered. Recovered material comprises weak low to medium density white CHALK with a purplish hue. Fractures are horizontal, vertical and 45 degrees very closely to closely spaced (50/90/140mm) planar to undulating rough with black speckling on	22.00 Shell fragments	21.75 +77.68	
22,25 - 23,00	53 45 0					surfaces, Occasional shell fragments. (SEAFORD CHALK FORMATION - Grade A3/4)	22.70 Horizontal fracture with slight orange staining on surface, 22.85 Orange speckled staining throughout core		
23.40 - 23.60		50 90 140	С 3				(possible sponge bed). – 23.10 Subhorizontal fracture with heavy black speckling and brown staining on surfaces.		
23.00 - 24.50	100 41 24						23.65-23.70 NIDD and small nodular flints.		
- 24 24.60 - 24.80			C 4				24.10 Small nodular flints.		
25			-			Weak medium density white CHALK. Fractures are horizontal and vertical very closely to closely spaced	24.90 Thin marl seams.	24.80 +74.64	
Groundwater Entrie No. Depth Strike		arks	1	Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks	1	Hard Boring Depths (m) Durat	tion (mins)Tools used
Notes: For explanatic abbreviations see Ke All depths and reduce hickness given in bra Scale 1:25	y to Explo ed levels i ackets in o	n metres n metres depth coli (c) ESG 1	Stratum		D60	ersham Tunnel (Chiltern) Area C 77-16 n Speed Two (HS2) Limited			-RC006



Drilled LG/NK .ogged GC/ CM Checked MM	Start 31/10/2 End 07/11/2	2016	Equipment, Methods and Re Comacchio 305 Hand dug inspection pit fro 20m./Rotary core drilled fr Engineer's instruction.	om GL to 1,2		ry open hole from 1.2m to		to Dlameter Casing Depth (m) (mm) (m) 2.50 200 2.50 20.00 160 20.00 65.00 146 146	Ground Level Coordinates (m) National Grid		99.44 E 5014 N 1921	50.85
Samples an		ts				Strata Description			Depth, Level			
Depth (m)	TCR SCR RQD	lf	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main		Detail	(m) (mbgl) (Thickness	Legend	Water- strike	Backfill
24.50 - 26.00	100 10 10	50 80 180				(50/80/180mm) undulating rou Black speckles on fracture su Occasional shell fragments. (SEAFORD CHALK FORMAT Grade A3)	ırfaces. TION -	25.00 Thick lamination (10mm) of light grey marl. 25.05 Orange stained speckles throughout core (possible sponge bed). 25.25 Orange stained speckles throughout core (possible sponge bed).				
²⁶ 26.25 - 26.45			C 5					26.00 Medium nodular flints. — - - - - -			1	
26.00 - 27.50	98 29 10					Weak medium density white C Fractures are horizontal and 2 degrees closely spaced (60/100/180mm) undulating ro with black speckling on surfac Occasional shell fragments. (SEAFORD CHALK FORMAT Grade A3)	45 ough ces.	26.50 Orange speckles and - striations throughout core. 26.50-27.00 NIDD, recovered as angular gravel of flint and chalk.	26.45 +72.99			
								27.05-27.55 AZCL				
27.50 - 28.25 28	93 55 21	60 100 180						27.55 Small nodular flint. 27.90 Large shell fragment.				
28.35 - 28.60 28.25 - 29.00	99 59 40		C 6									
29	40							28,70 Numerous shell fragments. 28.90 Medium nodular flints.	d tai			
	100 11 0							29,50 Medium of the r flints				
29.00 - 30.50 29.85 - 30.00			C 7			Very thin bed (60mm) of soft t CLAY with occasional flint gra (Probable fault gouge).		29.80-30.00 Chalk has brown st ining throughout.	29.80 +69.64			
Groundwater Entrie No. Depth Strike		arks		Depth Sea	aled (m)	Depth Related Remarks Depths (m) Remarks	500		Hard Boring Depths (m)	Duration (n	nins)Tool	s used
lotes: For explanatio bbreviations see Ke III depths and reduce nickness given in bra Scale 1:25	y to Explo ed levels i ackets in o	oratory H in metres depth co (c) ESG	Iole Records, s, Stratum Iumn.		D60	ersham Tunnel (Chiltern) Area C 77-16 h Speed Two (HS2) Limited				32-R (6



rilled LG/NK ogged GC/ CM hecked MM pproved MM	Start 31/10/ End 07/11/	2016 (2 2016 ^E	Equipment, Methods and Re Comacchio 305 Hand dug inspection pit fro 20m./Rotary core drilled fro Engineer's instruction.	om GL to 1,2			to Dlameter Casing Depth (m) (mm) (m) 2.50 200 2.50 20.00 160 20.00 65.00 146 20.00	Ground Level Coordinates (m) National Grid	99.44 mOD E 501450.85 N 192155.04
Depth (m)	d Tes TCR SCR RQD	ts #	Records/Samples	Date & Casing	Time & Water (m)	Strata Description	Detail	Depth, Level (m) (mbgl) (Thickness	Water- strike Backfill
		60 100 180		(mbgl)		Weak medium density white CHALK, Fractures are horizontal and 45 degrees closely spaced (60/100/180mm) undulating rough with brown staining and black speckling on surfaces. Occasional flints and shell fragments. (SEAFORD CHALK FORMATION - Grade B3)	30.20-30.60 NIDD, recovered as angular gravel of chalk. Occasional shell fragments.		
³¹ 30.50 - 32.00 31.40 - 31.64	89 41 32		C 8			Weak medium density white CHALK with occasional light grey mottling. Fractures are horizontal and vertical closely to medium spaced (80/120/230mm) undulating rough with slight black speckling on surfaces. (SEAFORD CHALK FORMATION - Grade A2/3)	31.10 Orange stained speckles and striations throughout core (possible sponge bed). 31.25 Small nodular flints.	31.00 +68.44 P	
3232.00 - 32.15			C 9				31.75 Large nodular flint.		
32.00 - 33.50 33	77 33 20	80 120 230		02/11/16 20.00	1700 Dry		32.20 Medium nodular flint.		
³⁴ 33,50 - 35,00 34,30 - 34,50	100 23 15		C 10	03/11/16	0800 Dry		34.00 Large nodular flint.		
85 Froundwater Entrie No. Depth Strike	(m) Rem			Depth Sea		Depth Related Remarks Depths (m) Remarks			mins)Tools used
lotes: For explanatic bbreviations see Ke II depths and reduce nickness given in bra Scale 1:25	y to Explo ed levels i ickets in o	oratory H in metres depth col (c) ESG	lole Records. s. Stratum lumn. AGS		D60	ersham Tunnel (Chiltern) Area C 77-16 h Speed Two (HS2) Limited		Borehole ML032-R Sheet 7 of	



rilled LG/NK ogged GC/ CM hecked MM pproved MM	Start 31/10/2 End 07/11/2		Equipment, Methods and R Comacchio 305 Hand dug inspection pit i 20m./Rotary core drilled Engineer's instruction.	rom GL to 1,2		ry open hole from 1.2m to minated at 65m on	Depth from (m) 0.00 2.50 20.00	to Diameter Casing Depth (m) (mm) (m) 2.50 200 2.50 20.00 160 20.00 65.00 146	Ground Level Coordinates (m) National Grid		99.44 mOD E 501450.85 N 192155.04
amples an	d Tes	ts				Strata Descriptio	n				
Depth (m)	TCR SCR RQD	ŀf	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main		Detail	Depth, Level (m) (mbgl) (Thickness		Water- strike Backfill
			_			Weak medium density w with occasional light grey Fractures are horizontal closely to medium space (80/120/230mm) undulat with slight black specklin surfaces, (SEAFORD Ch FORMATION - Grade A2 Telal Units of Carde	/ mottling. and vertical ing rough g on HALK 2/3) /	35.00-35.35 NIDD, recovered as gravel. 35.35-35.36 Thick lamination (10mm) of soft light grey clay. (Possibly SHOREHAM	-35.35 +64.0		
35.00 - 36.50	97 33 33					Thick lamination (10mm) grey CLAY. (Possibly SH MARL No 2, LEWES NO CHALK FORMATION) Weak medium density w with occasional flints. Fra horizontal and subvertic closely to closely spaced	OREHAM DULAR hite CHALK actures are al very	MARL No 2) 35.40-35.75 NIDD 35.90 Medium tubular flints / Shoreham flints and some			
⁶ 36.25 - 36.50			C 11			(50/120/200mm) closed occasional black speckle surfaces. (LEWES NOD CHALK FORMATION - C	es on IULAR	drilling disturbance. 36,10 Medium nodular flints and some drilling disturbance.			
36.50 - 36.80		50 120	C 12					36.80 Large nodular carious flint. 36.80-37.05 NIDD, Highly			
⁷⁷ 36.50 - 38.00	100 41 36	200						fractured			
38 -								37,80 Medium nodular flint. 38.00 Horizontal fracture with- orange staining on surface.			
38.00 - 38.75	97 63 32					Vary this had (25mm) of	light grou	38.25-38.35 NIDD. Highly fractured with orange speckling throughout core possible sponge bed), 38.40-38.85 Vertical fracture	- - - - 	' ' ' ' ' 2'	
38.60 - 38.74			C 13			Very thin bed (25mm) of CLAY incorporating a thii lamination (10mm) of sot clay. (Possibly SHOREH NO 1, LEWES NODULA FORMATION) Weak medium density w with occasional flints. Fra	ck ft brown AM MARL R CHALK hite CHALK	with slight black speckling. 38,52-38,53 Very thin bed (25mm) of light grey clay incorporating thick lamination (10mm) of soft brown clay. (Possibly SHOREHAM MARL NO 1)	Jai I		
38.75 - 39.50	97 44 17	50 120 200				horizontal and subvertica closely to closely spaced (50/120/200mm) closed occasional black speckle surfaces. (LEWES NOD CHALK FORMATION - C	al very I with es on PULAR	39.10 Medium nodular flints,	6		
39.90 - 40.05 ⁴⁹			C 14					39.65 Ors ye stained lens 30mm ong	-		
roundwater Entrie No. Depth Strike		arks		Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks			Hard Boring Depths (m)	Duration (n	nins)Tools used
otes: For explanatio obreviations see Ke Il depths and reduce ickness given in bra Scale 1:25	y to Explo ed levels i ackets in c	oratory H in metre depth co (c) ESG	Hole Records, s, Stratum plumn. AGS	ect ect No. ed out for	D60	ersham Tunnel (Chiltern) Area 177-16 h Speed Two (HS2) Limited	ıC		Borehole MLO	32-R	



necked MM oproved MM amples and	End 07/11/2 d Tes	20 1 6 E	0m./Rotary core drilled fro ingineer's instruction.	m 20m to e	John. Terr	minated at 65m on 20.00 Strata Description	65.00 146	National Grid		192155.04
Depth (m)	TCR SCR RQD	lf	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main	Detail	Depth, Level (m) (mbgl) (Thickness	Legend ^{Wa} str	^{ater-} Backfill
39.50 - 41.00	67 23 18	NA NA NA				Weak medium density white CHALK with occasional flints. Fractures are horizontal and subvertical very closely to closely spaced (50/120/200mm) closed with occasional black speckles on surfaces. (LEWES NODULAR CHALK FORMATION - Grade A3) AZCL. Driller's description. CHALK. (LEWES NODULAR CHALK FORMATION - Ungraded)	40.30-40.50 NIDD, recovered as angular gravel of chalk. 40.50-41.00 AZCL	40.50 +58.94		
1 41.00 - 41.50	68 12 0	50 120				Weak medium density white CHALK with occasional flints. Fractures are horizontal and subvertical very closely to closely spaced (50/120/200mm) closed with occasional black speckles on surfaces. (LEWES NODULAR CHALK FORMATION - Grade A3)	41.00 Medium nodular flints. — - - - - - - - - - - - - - - - - - - -	41.00 +58.44		
41.80 - 42.00 241.50 - 42.50	100 20 11	200	C 15 50 120 200			Weak medium density white CHALK. Fractures are horizontal and vertical (50/120/20mm) open with heavy orange staining and slight clay (up to 1mm) infill on surfaces. (LEWES NODULAR CHALK FORMATION -	41.70 Subvertical fracture, undulating rough with black speckling and slight orange staining on surface. 42.00-42.50 Vertical fracture with some clay coating, 42.05 Horizontal fracture with orange surface staining. 42.30 Small nodular flint.	42.05 +57.38 42.35 +57.09		
42.80 - 43,10 3 42.50 - 44.00	100 53 47	50 120 200	120			Grade C3) Weak medium density white CHALK with occasional flints. Fractures are horizontal very close to closely spaced (50/120/200mm) and occasionally subvertical undulating rough. (LEWES NODULAR CHALK FORMATION - Grade A3/4)	42.50 Medium nodular flint. 43.00-44.00 Occasional grey wispy marl seams. 43.20 Small nodular flints.			
4 -	45	NA NA NA				AZCL, Driller's description: CHALK, (LEWES NODULAR CHALK FORMATION - Ungraded)	43.90 Horizontal fracture with orange staining on surface. 43.90-44.10 NIDD, recovered as angular gravel of chalk.	44,00 +55.44		
44.00 - 45.50	21 13					Weak medium density white CHALK with occasional flints. Fractures are horizontal very close to closely spaced and occasionally subvertion	2. ACU	44.75 +54.69		
oundwater Entrie No. Depth Strike		arks		Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks		Hard Boring Depths (m)	Duration (mins	s)Tools used



Drilled LG/NK Logged CM Checked MM Approved MM	Start 31/10/2 End 07/11/2	2016 (H 2 2016 ^E	quipment, Methods and Ren Comacchio 305 Iand dug inspection pit fro Om./Rotary core drilled fro Engineer's instruction.	m GL to 1,2	2m. Rota 35m. Teri		to Dlameter Casing Depth (m) (mm) (m) 2.50 200 2.50 20.00 160 20.00 65.00 146 146	Ground Level Coordinates (m) National Grid	E 50	44 mOD 1450.85 2155.04
Samples an Depth	d Tes	ts #	Records/Samples	Date & Casing	Time & Water	Strata Description	Detail	Depth, Level (m) (mbgl)	Legend Water-	Backfill
(m) 45,50 - 45,65	RQD		C 17	(mbgl)	(m)	undulating rough. (LEWES NODULAR CHALK FORMATION - Grade A3/4)		(Thickness)(m) 	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
45.50 - 46.25 46	64 16 13	50 120 230					46.00-46.25 AZCL — 46.00-46.30 AZCL 46.05-46.25 AZCL 46.10 Medium nodular flints. 46.25-46.50 AZCL 46.30 Medium nodular flints.	- 		
46.45 - 46.60 46.25 - 47.00	57 19 19		C 18				47.00 Orange staining	47.00 +52.44		
47.10 - 47.40 47.00 - 47.50	100 100 100		50	occasional light Fractures are h occasionally ver medium spaced with slight vertic	Weak medium to high density white CHALK with occasional flints and occasional light grey marl seams. Fractures are horizontal and occasionally vertical closely to medium spaced (85/150/300mm) with slight vertical specks. (LEWES NODULAR CHALK FORMATION - Grade A2/3)	throughout core (possible sponge bed) 47.65 Medium nodular flint.				
48 47.50 - 48.5 0	97 55 55	NIDD 150 300					47.70-47.80 Very weak low density CHALK with occasional small nodular flints. 48.30-48.50 NIDD			
49 48 .50 - 4 9.50	100 65 44						48.50-48.70 Medium nodular – flints (with white cortex). 49.00 Small nodular flint.	No.		
49.35 - 49.50			C 20				ccept			
49.50 - 50.00 50	76 60 48						45.90-50.00 AZCL 49.95 Sheet flint 3mm thick.			
Groundwater Entrie No. Depth Strike		harks	1	Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks	<u> </u>	Hard Boring Depths (m)	Duration (mins)Te	ools used
Notes: For explanatio abbreviations see Ke All depths and reduce hickness given in bra Scale 1:25	y to Explo ed levels i ackets in o	oratory H in metres depth col (c) ESG	Stratum		D60	rsham Tunnel (Chiltern) Area C 177-16 h Speed Two (HS2) Limited			32-RC0	06



hecked MM pproved MM	End 07/11/2	2 2016 ^E	0m./Rotary core drilled fro ngineer's instruction.				20.00 160 20.00 65.00 146	National Grid	N 19	92155.04
Depth	TCR SCR	rs If	Records/Samples	Date &	Time & Water	Strata Description	Detail	Depth, Level (m) (mbgl)	Water	Backfill
(m)	RQD		Records/Samples	Casing (mbgl)	(m)	Weak medium to high density white	Bellow 49.20m slight gritty	(Thickness) (m)	Legend strike	
50.30 - 50.60 50.00 - 50.75	100 71 27		C 14A			CHALK with occasional flints and occasional light grey marl seams. Fractures are horizontal and occasionally vertical closely to medium spaced (85/150/300mm) with slight vertical specks. (LEWES NODULAR CHALK FORMATION - Grade A2/3)	texture. 50.20 Small nodular flints.			
							50.75 Medium nodular flints.	- - - - - -		
⁵¹ 50.75 - 51.50 51.25 - 51.40	96 75 64		C 21			Very weak to weak high density white nodular CHALK with occasional light grey wispy marl seams and light grey mottling. Fractures are horizontal to 30 degrees closely spaced (80/150/200mm) undulating rough,	51.20 Horizontal to 30 degree fractures with 5mm of soft comminuted chalk infill.	51.10 +48.34		
51.70 - 52.00			C 22			occasionally with 5mm infill of comminuted chalk. (LEWES NODULAR CHALK FORMATION - Grade A3/4, locally C3/4)				
5251.50 - 52.50	100 85 60									
52.50 - 53.00	100 58 20						52.60-52.65 NIDD.			
53 -		NIDD 150 200					fracture. 53.00 Medium nodular flint. 53.10-53.35 AZCL			
53.00 - 54.00	75 33 33						53.35-53.60 Small and medium nodular flints surrounded by NIDD chalk, recovered as gravel.			
5454.00 - 54.30			C 23				-	Jan 1		e lo
54.00 - 54.50	80 60 60			03/11/16 20.00	1800 54.00		54,40 Orangish brov r	0		
				04/11/16 20.00	0800 47.00		54.50 Medium nocu ar flints.	-		0///
5554.50 - 55.50							54.90 Horizontal fracture - infilled 5mm with comminuted 5 chalk.	-	<u></u>	$\langle \rangle$
roundwater Entrie No. Depth Strike		arks		Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks		Hard Boring Depths (m)	Duration (mins)To	ools used
otes: For explanatio bbreviations see Ke Il depths and reduce	y to Explo	oratory He	Stratum	t No.		ersham Tunnel (Chiltern) Area C 77-16		Borehole	32-RC0	



orilled LG/NK ogged GC/ CM Checked MM	Start 31/10/ End 07/11/	2016 (12 2016 ^E	Equipment, Methods and Rem Comacchio 305 Hand dug inspection pit fror 20m./Rotary core drilled fror Engineer's instruction.	n GL to 1.2	2m, Rota 35m, Ter	minated at 65m on	Depth from (m) 0.00 2.50 20.00	to Dlamete (m) (mm) 2.50 200 20.00 160 65.00 146	r Casing Depth (m) 2.50 20.00	Ground Level Coordinates (n National Grid	n)	E 501	4 mOD 450.85 155.04
amples an	d Tes	ts ⊮	Records/Samples	Date & Casing	Time & Water	Strata Descriptio	n	Deta		Dep t h, Lev (m) (mbg		Water-	Backfill
(m) 55.20 - 55.50	RQD 100 62 50		C 24	(mbgl)	(m)	Very weak to weak high white nodular CHALK wi occasional light grey wis seams and light grey mo Fractures are horizontal degrees closely spaced (80/150/200mm) undulat occasionally with 5mm ir	th by marl ttling. to 30 ing rough,			(Thickness) (m)		strike	111
55.50 - 56.00	100 40 40					comminued chalk, (LEV NODULAR CHALK FOR Grade A3/4, locally C3/4	VES MATION -	55.50 Medium n 55.68 Small shel (3mm thick). 55.80 Small nod	l fragments				111
5656,00 - 56,10	00		C 25			Weak high density white with many flints. Fracture probably horizontal and { undulating rough, occasi	es are 30 degrees onally with	56.00 Medium n 56.15 Medium n 56.15-56.30 Rec gravel with sligh staining and blac on surfaces.	odular flint. overed as orange	56.20 + 4 3.	24 		
56.00 - 57.00	98 26 10	NIDD NIDD 120				black speckling on surfac Generally NIDD, due to f recovered as gravel. Fra spacing not assessed. Fl small and medium nodul NODULAR CHALK FOR Possibly Grade A3)	ces. lints, cture ints are ar. (LEVVES						1111
57.00 - 57.50	100 0 0							57.35 Medium n	odular flint.				11
57.55 - 57.75 57.50 - 58.25 ⁵⁸	100 67 17		C 26			Weak medium to high de CHALK. Fractures are pr horizontal occasionally 8 closely spaced (60/120/2 undulating rough with lig mottling. (LEWES NODL CHALK FORMATION - C	edominantly 0 degrees :00mm) nt grey ILAR	57.80 15mm Thi	ck sheet flint.	57.50 +41.			KIII
58.25 - 59.00 59	93 47 47	NIDD 120 200						59.00 Large nod	ular flint and —	ja,			
59.45 - 59.55 59.00 - 60.00	100 0 0		C 27					NIDD chalk. 59.40-60.40 Mai recovered as an of chalk and finu drilling in treed). 59.60 Lar, e nod	urar gravel (probably				11/1/1
⁶⁰ roundwater Entrie No. Depth Strike		narks		Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks	,000	60.00 Large nod	ular flint.	Hard Boring Depths (m)	Duration (mins)Toc	ols used
lotes: For explanations bbreviations see Ke II depths and reduce hickness given in bra Scale 1:25	y to Explo ed levels i ackets in o	oratory H in metres depth col (c) ESG	s. Stratum		D60	ersham Tunnel (Chiltern) Area 177-16 h Speed Two (HS2) Limited	i C			Borehole ML	032-R		6



Drilled LG/NK Logged GC/ CM Checked MM	Start 31/10/ End 07/11/	2016 C H 2 2016 E	equipment, Methods and Ren Comacchio 305 Hand dug inspection pit fro Om./Rotary core drilled fro Engineer's instruction.	m GL to 1.2			Depth from (m) 0.00 2.50 20.00	to [(m) 2.50 20.00 65.00	Dlameter (mm) 200 160 146	Casing Depth (m) 2.50 20.00	Ground Le Coordinate National G	es (m)		E 50	44 mOD 1450.85 2155.04
Samples an	TCR			Date &	Time &	Strata Descriptio	n					Level mbgl)			
Depth (m)	SCR RQD	lf	Records/Samples	Casing (mbgl)	Water (m)	Main			Detail		(Thickness	inibgi)	Legend	Water- strike	Backfill
60.00 - 60.50	100 20 0					Weak medium to high de CHALK. Fractures are pr horizontal occasionally 8 closely spaced (60/120/2) undulating rough with ligh mottling. (LEWES NODU CHALK FORMATION - C	edominantly 0 degrees :00mm) nt grey ILAR								1111
61								60.65 Hor 20mm thie density w 60.80 Me	ck band o hite cha l k						111
60.50 - 62.00 61.30 - 61.50	100 61 27		C 28					61.30 Lar NIDD cha							111
62								NIDD cha	i l k. 20 Zooph	r flint and ycos trace spy marl					1111
62.00 - 63.50	98 74	NIDD NIDD 120	-			Moderately strong very h gritty white CHALK with o glauconitic nodules (<30) rare orange staining. (LE NODULAR CHALK FOR Ungraded, Possibly HARDGROUNDS - BEA Weak high density white	occasional mm) and WES MATION - CHY HEAD) ,				· · · · ·	+37.14 +36.79			111
6363,00 - 63,35	36		C 29			with light grey mottling. F horizontal closely to med (80/120/250mm). (LEWE NODULAR CHALK FOR Grade A2/3)	ium spaced ES	62.85-62. conjugate							N.
63.60 - 63.90			C 30	04/11/16 20,00 07/11/16	1400 49.00 0800 47.00					- - - - - - -					
6463.50 - 64.50	96 80 80	80 120 250		20.00	47.00			63.90 Sm	all nodula	r flint	0	ž			111
64.50 - 65.00	100 92 0			07/11/16	1630			64.30 Ligi seam. 64.45 Ligi seam.		OX -					1111
65				20.00	47.00			64.95 Slig	ght orange	- - e staining	65.00	+34.44			11
roundwater Entrie No. Depth Strike		arks	1	Depth Sea	led (m)	END OF EXPLORATO	DRY HOL	/			Hard Bori Depths (m		Duration (n	nins)To	ols used
Notes: For explanations between the see Ke All depths and reduce hickness given in brackale 1:25	y to Explo ed levels ackets in	oratory Ho in metres depth coli (c) ESG 1	Stratum umn. Project		D60	ersham Tunnel (Chiltern) Area 177-16 h Speed Two (HS2) Limited	i C				Borehole M		32-R ()6



led LR/MR												
gged /CM C	08/11/2016	Equipment, Methods and Rem Comacchio 305				Depth from to (m) (m) 0.00 1.20	(mm)	Casing Depth (m) 1.20	Ground Level Coordinates (m)			mOD 327.84
ecked MM	End	Hand dig inspection pit from 1.20m to 20.00m./Rotary co	GL to 1.20 re drilling fr	m. Rotar om 20.00	y open hole drilling from Om to 65.00m.	1.20 20.00 20.00 65.00	0 160	20.00	National Grid		N 1923	
	14/11/2016				Strata Description							
mples and			Date &		Strata Description				Depth, Level			
Depth (m) F	SCR If RQD	Records/Samples	Casing (mbgl)	Water (m)	Maln		Detall		(Thickness)	Legend	Water- strike	Backfi∎
Depth (m)	TCR RQD If	Records/Samples			Main (TOPSOIL) Dark brown gravelly silty fin coarse SAND with frequent Gravel is subangular to sub (predominantly fine to medil coarse of fint. Sandy CLAY with flint grave (Driller's description) (Possil WITH FLINTS) Sandy CLAY with flint grave returns are yellow. (Driller's description) (Possibly CLAY FLINTS)	rootlets. rounded um) fine to its. bly CLAY	Detall		(m) (mbgl)		Water-	
					Hole continues on next sh	ien C	ACCE					
oundwater Entries o. Depth Strike (m	n) Remarks		Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks	0.			Hard Boring Depths (m)	Duration (m	nins) Tool	s used
	of symbols and a			Ame	rsham Tunnel (Chiltern) Area C				Borehole			
S. For explanation of Key to Exploratory H ced levels in metres.										32-R0		



			Brinnig Ex										
lled LR/MR gged /CM	Start 08/11/2		Equipment, Methods and Rem Comacchio 305	arks			Depth from (m) 0.00	to Diameter Casing I (m) (mm) (m) 1.20 200 1.20	Depth Ground) Coordina			99.99 E 5013	mOD
ecked MM	End	ł	Hand dig inspection pit from 1.20m to 20.00m./Rotary co	GL to 1.20	m, Rotar	y open hole drilling from Om to 65.00m	1.20 20.00	(m) (mm) (m) 1.20 200 1.20 20.00 160 20.0 65.00 146	National			N 1923	
roved MM	14/11/2		1.20m to 20.00m shouly be	ie aniing i	0111 20.00		20100						
mples an	d Test	s				Strata Description	<u>n</u>						
Depth (m)	TCR SCR RQD	H	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main		Detall	Depth, (m) (Thicknes	Level (mbgl) S)		Water- strike	Backfi
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undwater Entrie						Hole continues on nex Depth Related Remarks	<u>त she भ</u>	1	Hard Be	oring	<u></u>	~	ιk
. Depth Strike		arks		Depth Sea	iled (m)	Depths (m) Remarks	5		Depths		Duration (m	ins) Tool	s used
s: For explanation Key to Explorato	ry Hole Re	cords, A	II depths and		Ame	ersham Tunnel (Chiltern) Area	C		Borehol				
ced levels in me tets in depth col	tres, Stratu	ım thickr	ness given in	No.	D60	77-16				MLO)32-R(2003)
ale 1:25	Print	(c) ESG Date 19/05	www.esg.co.uk AGS 5/2017 16:12:24 Carried	out for	Higl	h Speed Two (HS2) Limited					Sheet 2 of 13	5	



ged /CM 08/11/2016 Comacchio 305 Hand dig inspection p 1.20m to 20.00m./Ro mples and Tests Depth TCR RQD If Records/Sampl	pit from GL to 1.20m. Rotary open hole drilling from tary core drilling from 20.00m to 65.00m. Strata Descripti oles Date & Casing (mbgl)	20.00 65.00 146	Coordinates (m) E 501327.84 National Grid N 192333.19
mples and Tests	Strata Descripti	ion	Depth, Level (m) (mbgi) Legend Water- Backfill
	Date & Time & Casing Water Maln		(m) (mbgl) Legend Water- Backfi
Depth CCR RQD H Records/Samp	oles Casing Water Maln	Detali	(m) (mbgl) Legend Water- Backfi
		×2	
		Accepte	
Indwater Entries Depth Strike (m) Remarks	Hole continues on Depth Related Remarks Depth Sealed (m) Depths (m) Remarks	0	Hard Boring
Sound and the relians	Depth Sealed (m) Depths (m) Remarks		Depths (m) Duration (mins) Tools used
Key to Exploratory Hole Records, All depths and	Project Amersham Tunnel (Chiltern) A	rea C	Borehole
ced levels in metres. Stratum thickness given in kets in depth column.	Project No. D6077-16 Carried out for High Speed Two (HS2) Limited		ML032-RC009 Sheet 3 of 13



			-									
illed LR/MR gged /CM	Start 08/11/2016	Equipment, Methods and Rem Comacchio 305	arks			Depth from (m) 0.00	to Diameter Casing (m) (mm) (i 1.20 200 1.	g Depth m) 20 .00	Ground Level Coordinates (m)		99.99 E 5013	
ecked MM	End	Hand dig inspection pit from 1.20m to 20.00m./Rotary co	GL to 1.20 re drilling fr	m. Rotar om 20.0	y open hole drilling from Om to 65.00m.	1.20	20.00 160 20 65.00 146	.00	National Grid		N 1923	
proved MM	14/11/2016	,,										
mples an			1		Strata Description	<u>n</u>			Depth, Level			
Depth (m)	TCR SCR If RQD	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main		Detall		(m) (mbgl) (Thickness)	Legend	Water- strike	3ackfi l
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					CHALK (Driller's descript (SEAFORD CHALK FOR			δ	19.0 +80.99	للصلي	~	
					Ungraded).		*	0-			$\overline{\}$	11
							<u>_0</u>	-				11
								_	(1.00)		\sim	
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							N.	-			$\overline{\}$	
						<u></u> ງ		-				
indwater Entrie	s				Hole continues on nex	d shert	, 	_	20.00 +79.99	h, h,	~	ιk
undwater Entrie . Depth Strike			Depth Sea	lled (m)	Depth Related Remarks Depths (m) Remarks				Hard Boring Depths (m)	Duration (m	ins) Tools	s used
s: For explanation Key to Explorator	on of symbols and ry Hole Records.	d abbreviations Project All depths and		Am	ersham Tunnel (Chiltern) Area	C			Borehole			
ced levels in met tets in depth colu	tres, Stratum thic	kness given in	No.	D60	77-16				ML0	32-R(2005)
le 1:25	(c) ES	G www.esg.co.uk /05/2017 16:12:24 Carried	out for	Hig	h Speed Two (HS2) Limited					Sheet 4 of 13	5	



j				3							
rilled LR/MR	Start		Equipment, Methods and Rema Comacchio 305	arks			Depth from (m)	to Diameter Casing Depth (m) (mm) (m)			99.99 mOD
ogged /CM hecked MM	08/11/. End		Hand dig inspection pit from				0.00 1.20	1.20 200 1.20 20.00 160 20.00 65.00 146	Coordinates (m) National Grid		E 501327.84 N 192333.19
proved MM	14/11/		1.20m to 20.00m./Rotary co	e aniling tr	om 20.00	Jm to 65.00m.	20.00	65.00 146			102000.10
amples and	d Tes	ts				Strata Description	n				
Depth (m)	TCR SCR RQD	H	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main		Detail	Depth, Level (m) (mbgl) (Thickness) (m)	v	^{Vater-} Backfi∎
20.50 - 20.80			C 1			Weak medium to high de CHALK with occasional o speckling. Fractures are I and 75 degrees very clos medium spaced (60/120/ black speckling and oran on surfaces. (SEAFORD FORMATION - Grade A3	orange horizontal ely to 250mm) with ge staining CHALK	20.05-20.15 Medium nodular flint and highly fractured chalk (probably NIDD).			
20.00 - 21.50 M	100 55 37							20.80 Horizontal fractures with brown clay smear on surfaces and penetrative weakening (10mm) to comminuted chalk. 21.15 Occasional orange speckles. 21.35 Grey wispy marl seam.			
		50 120 250						21.45 Grey wispy marl seam. 21.60 Medium nodular flint and fractured chalk (probably NIDD).	(3.10)		
2222.00 - 22.25 21.50 - 23.00	100 35 31		C 2					21.90 Shell fragment 4mm thick with a fibrous texture on broken ends.			
								22.50 Small nodular flints.			
23 23.20 - 23.40		50 110 130	С 3			Weak high density noduli CHALK with numerous g marl seams. Fractures ar to 15 degrees very closed spaced (50/110/130mm) occasionally vertical. All f undulating rough with bla and occasional orange st surfaces. (SEAFORD CH	rey wispy e horizontal y to closely and ractures are ck speckling aining on	thick.	23.10 +76.85 (0.60)		
23.00 - 24.50 24	100 80 67					FORMATION - Grade A3 Weak medium to high de CHALK with occasional c speckling. Fractures are very closely to medium si (50/150/300mm) with slig speckling on surfaces. (S CHALK FORMATION - G) nsity white orange horizontal paced ht black EAFORD	23.95 Small and medium nodular flints.	23.70 +76.26		
24.90 - 25.20 25 Froundwater Entries	5		C 4			Hole continues on nex Depth Related Remarks	t sheet 2	24,75 Large nodular flint.	Hard Boring		
No. Depth Strike				Depth Sea		Depths (m) Remarks	5		Depths (m)	Duration (min	ns) Tools used
otes: For explanation ee Key to Explorator duced levels in metr ackets in depth colu	y Hole Re res, Strati	ecords, A um thick	Il depths and ness given in AGS		D60	ersham Tunnel (Chiltern) Area 77-16	C			32-RC	:009
Scale 1:25	Print	Date 19/0	5/2017 16:12:24 Carried	out for	Hig	h Speed Two (HS2) Limited				Sheet 5 of 13	



illed LR/MR gged /CM necked MM pproved MM	Start 08/11/2 End 14/11/2	ł	Comacchio 305 Hand dig inspection pit from 1.20m to 20.00m./Rotary cor	GL to 1.20 e drilling fre	m. Rotar om 20.00	y open hole drilling from	Depth from (m) 0.00 1.20 20.00	to Diameter Casing Depth (m) (mm) (m) 1.20 200 1.20 20.00 160 20.00 65.00 146	Coordinates (m) National Grid		99.99 mOD E 501327.84 N 192333.19
amples and						Strata Description					
Depth (m)	TCR SCR RQD	ŀf	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main		Detail	Depth, Level (m) (mbgl) (Thickness) (m)	Legend	Water- strike Backfi
24.50 - 26.00	100 97 82							25.25 Zoophycos trace fossil. 25.35 Small nodular flint.			
								25.70 Grey wispy marl seam. – 25.90 Shell fragment. –			
6			C 5					26.05 Small nodular flint.			
26.00 - 27.50 7	100 90 90							26.80 Zoophycos trace fossil.			
27.70 - 27.90		50 150 300	C 6					27.30-27.50 Numerous grey wispy marl seams. 27.45 Horizontal fracture with heavy black speckling on surfaces. 27.70 Medium nodular flint.	(7.20)		
8 27.50 - 29.00	99 82 77							27.95 Medium nodular flint. 			
				09/11/16 20.00	1800 2.40			wispy marl seams 28.35 Horizontal fracture with orange staining on surface	N _i ,		
9 -				10/11/16 20.00	0800				N.		
29.30 - 29.65	93 41 41		C7					29.25 Medium nodular rait surrounded by chark with slight orange spece ng			
29.00 - 30.50								20.00 Lerge podu or first			
o oundwater Entries Io. Depth Strike		arks		Depth Sea	led (m)	Hole continues on next s Depth Related Remarks Depths (m) Remarks		'90.00 Large nodu ar f int.	Hard Boring Depths (m)	Duration (m	ins) Tools used
tes: For explanation e Key to Exploratory duced levels in metr ackets in depth colu	y Hole Re res, Stratu	cords. A um thickr	II depths and	No.		ersham Tunnel (Chiltern) Area C 77-16			Borehole ML()32-R(2009



lled LR/MR gged /CM	Start 08/11/2	016	Equipment, Methods and Remai Comacchio 305 Hand dig inspection pit from (m. Roter	y open hole drilling from 1.20	to Diameter Casing Depth (m) (mm) (m) 1.20 200 1.20 20.00 160 20.00	Coordinates (m)		99.99 mOD E 501327.84
ecked MM proved MM	End 14/11/2	1	1.20m to 20.00m./Rotary core				65.00 146	National Grid		N 192333.19
amples and						Strata Description				
Depth (m)	TCR SCR RQD	lf	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main	Detail	Depth, Level (m) (mbgl) (Thickness) (m)	v	^{Water-} Backfi∎
-							30.30-31.00 Highly fractured (probably drilling induced). 30.40 Medium nodular flint. 30.50-30.60 NIDD.			
31.20 - 31.50 30.50 - 32.00	99 35 29		C 8			Weak medium to high density white CHALK, Fractures are horizontal and 45 degrees closely spaced (80/150/2c0omm) with slight black speckling on surfaces. Occasional grey wispy marl seams. (SEAFORD CHALK FORMATION - Grade A3)	31.05 Medium nodular flint.	30.90 +69.0s		
32.10 - 32.37		80 150 250	C 9				32.00 Large nodular flints.	(2.65)		
32.00 - 33.50	80 69 53						33.20 Orange speckling and lenses <20mm in diameter.			
33.50 - 35.00	100 0					Thick lamination (10mm) of grey CLAY, (Probably SHOREHAM MARL No 2, LEWES NODULAR CHALK FORMATION) Weak medium density white CHALK. Fractures are 75 degrees and randomly orientated very closely to closely spaced (40/60/100mm). Heavy black specking on some fracture surfaces, (LEWES NODULAR CHALK FORMATION - Grade A3/4)	33.50 Medium nodular flint. 33.55-33.56 Thick lamination (10mm) of day. (Probably Shoreham Marl No 2) 34.00 Small tubular flint. (Shoreham Flints)	33.55(0.00) +66.44		
34.50	0		D 10				35.00 Medium nodu ar fint.			
oundwater Entries o. Depth Strike (irks		Depth Sea	led (m)	Hole continues on next skiel Depth Related Remarks Depths (m) Remarks 35.00 - 65.00 No flucturet installed w 35m.		Hard Boring Depths (m)	Duration (mir	ns) Tools used
es: For explanation Key to Exploratory	y Hole Rec	ords, Al				ersham Tunnel (Chiltern) Area C 77-16		Borehole	32-RC	



lled LR/MR gged /CM ecked MM proved MM	Start 08/11/2 End 14/11/2	2016 2016	Equipment, Methods and Rema Comacchio 305 Hand dig inspection pit from 1.20m to 20.00m./Rotary cor	GL to 1.20	om 20.00	0m to 65.00m. 20.00	to Diameter Casing Depth (m) (mm) (m) 1.20 200 1.20 20.00 160 20.00 65.00 146 20.00	Coordinates (m) National Grid	99.99 mOD E 501327.84 N 192333.19
amples and	TCR SCR	IS If	Records/Samples	Date & Casing	Time & Water	Strata Description	Detail	Depth, Level (m) (mbgl)	Vater- Boold
(m) 35.00 - 36.50	RQD 100 20 8	40 60 100		(mbgl)	(m)		35.80 Medium nodular flint.	(Thickness) (m) (2.95)	
36.38 - 36.50 36.70 - 37.00			C 11 C 12			Moderately weak high density white CHALK with occasional light grey mottling and marly seams. Fractures are horizontal closely spaced (90/150/200mm) with occasional black speckling on surfaces. (LEWES NODULAR CHALK FORMATIONS Grade A3)	36.25 Medium sized nodular flints surrounded by comminuted chalk (probably drilling induced).	36.50 +63.49 (0.70)	
36.50 - 38.00	83 19 0	90 150 200				Very thin bed (30mm) of very weak light grey MUDSTONE. (Probably SHOREHAM MARL No 1, LEWES NODULAR CHALK FORMATION) Moderately weak high density white CHALK with occasional light grey mottling and marty seams. Fractures are honzontal closely spaced (90/150/200mm) with occasional black speckling on surfaces. (LEWES NODULAR CHALK FORMATIONS Grade A3) No core recovery. CHALK (Driller's	37.20-37.23 Very thin bed (30mm) of very weak light grey mudstone. (Shoreham Marl No 1) 37.65-37.68 Orange speckles and very thin horizontal bands. 37.65-37.69 Orange speckles and very thin horizontal orange bands (possible sponge bed).	37.20(0.00) +62.7 (0.80) 38.00 +61.9	
38.00 - 38.50	0 0 0 28	NA NA NA				description), (LEWES NODULAR CHALK FORMATION - Ungraded)		(0.86)	
38.50 - 39.00 ³⁹ 39.00 - 39.50	0 0 100 16 0		-			Medium density white CHALK. NIDD, recovered as angular gravel and cobbles. Occasional black and orange speckling on surfaces. (LEWES NODULAR CHALK FORMATIONS - Ungraded)	39.10 Medium nodular flints.	38.86 -61.13	
39.50 - 40.25 39.90 - 40.25 19 19 roundwater Entries	100 60 47		C 13			Hole continues on next sheet	ACU	(1.39)	
No. Depth Strike	(m) Rem n of symb y Hole Re res, Stratu imn.	ols and a cords, A um thickn (c) ESG	II depths and		Ame D60	Peptin Readed Remarks Depths (m) Remarks ersham Tunnel (Chiltern) Area C 77-16 In Speed Two (HS2) Limited		Depths (m) Borehole	Duration (mins) Tools used



ged /CM	08/11/2	F	Comacchio 305 land dig inspection pit from 0				(m) (mm) (m) 1.20 200 1.20 20.00 160 20.00	Coordinates (m)		E 501327.84
cked MM proved MM	End 14/11/:		.20m to 20.00m./Rotary core	e drilling fr	om 20.00	Om to 65.00m. 20.00	65.00 146	National Grid		N 192333.19
mples and	d Test	s				Strata Description			<u> </u>	
Depth (m)	TCR SCR RQD	lf	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main	Detail	Depth, Level (m) (mbgl) (Thickness) (m)	المستحد ال	Water- strike Backfi∎
		NIDD NIDD					-	-		
_		NIDD	-			Moderately weak high density white		40.25 +59.7	4	
						CHALK. Fractures are predominantly horizontal closely spaced	-	-		
	100					(90/160/200mm) and occasionally 75 degrees. All fractures undulating		-		
40.60 - 40.85 40.25 - 41.00	87 45		C 14			rough with slight black speckling on surfaces. (LEWES NODUALR CHALK FORMATION - Grade A3)	40.60 Medium nodular flints.	-	h h	
		90				CHALKE ONWATION - Orace A0)	-	-		
		160 200					-	(1.30)		
							-	-		
							-	-		
							41.30 Medium nodular flint - surrounded by chalk with	-		
							orange speckles.	41.55 +58.4		
	37					AZCL. CHALK (Driller's description) (LEWES NODULAR CHALK FORMATION - Ungraded)	-			
1.00 - 42.50	5 0					FORMATION - Originated)		-		
							-	-		
								-		
		NA					-			
		NA NA		10/11/16 20.00	1430 26.50		-	(1.45)		
-			-				42.50-42.65 NIDD -	-		
				11/11/16 20.00	0630 22.90		-	-		
				20.00	22.00		-	-		
2.90 - 4 3.00			C 15					-		
						Weak medium density white CHALK. Fractures are mainly horizontal		43.00 +56.9	94	
12.50 - 44.00	67 9					closely spaced (70/90/150mm) occasionally vertical. All fractures are	-	-		
2.00 11.00	Ő					undulating rough with slight black speckling on surfaces. (LEWES NODULAR CHALK FORMATION -		-		
						Grade A3)	40.55 Omell and des flinte	-		
		70					43.55 Small nodular flints.	-	ŢŢ	
		90 150					43.70 NIDD	(1.40)		
								NIC	The	
-							44.00 Medium nodular flints.			
4.20 - 44.35			C 16				44.15-44.20 Orange speck in a throughout (possible spins a)	1		
							bed). 44.35 NIDD, recovered us	44.40 +55.5	┉╨╖	
4.00 - 45.00	100 18					Weak medium density white CHALK with orange speckling throughout.	medium nodu ar Vinti.	+++,+v +55,5		
	0	NIDD				NIDD, generally recovered as chalk gravel with occasional flints. (LEWES NODULAR CHALK FORMATION -	44.60 14 72 NDD, recovered - as sm. " nodular flints and	-		
		NIDD NIDD				Ungraded)	cha·k g, avel.	(0.95)		
						(44.95 Medium nodular flints.	(0.85)		
undwater Entries						Hole continues on next shert		Hard Boring		<u> </u>
. Depth Strike ((m) Rem	arks		Depth Sea	iled (m)	Depths (m) Remarks		Depths (m)	Duration (mi	ns) Tools used
s: For explanation					Ame	ersham Tunnel (Chiltern) Area C		Borehole		
(ey to Exploratory			l depths and ess given in					1 NAL 2)32-RC	



		T		-							
rilled LR/MR ogged /CM hecked MM pproved MM	Start 08/11/2 End 14/11/2	2016	Equipment, Methods and Rema Comacchio 305 Hand dig inspection pit from 1 1.20m to 20.00m./Rotary com	GL to 1.20			Depth from (m) 0.00 1.20 20.00	to Diameter Casing Depth (m) (mm) (m) 1.20 200 1.20 20.00 160 20.00 65.00 146	Ground Level Coordinates (m) National Grid		99.99 mOD E 501327.84 N 192333.19
amples and						Strata Descriptior	<u>ו</u>				
Depth (m)	TCR SCR RQD	lf	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main		Detail	Depth, Level (m) (mbgl) (Thickness) (m)	Legend	^{Water-} strike Backfi∎
45.40 - 45.65 45.00 - 46.50	100 73 62		C 17			Weak medium to high der CHALK with occasional li- wispy marl seams and gr zones. Fractures are prec horizontal closely to medi (60/120/250mm) and occ degrees. All fractures und rough with slight black sp surfaces. (LEWES NODL CHALK FORMATION - G	ght grey ey mottled dominately um spaced asionally 80 ulating eckling on ILAR	46.10 Medium nodular flints.	45.25 +54.7		
46.50 - 46.70 -		60 120	C 18					46.30 Large nodular flints and locally NIDD.	(2.75)		
47 46.50 - 48.00	100 32 32	250						46.75-46.85 Occasional orange speckling throughout core. 47.00-47.30 Numerous small nodular flints recovered as gravel (drilling disturbed), (Possible sponge bed)			
48 -	100 50 40					Weak medium to high dei grey to white CHALK with light grey mottling and oc flints. Fractures are pred horizontal closely to medi (80/100/300mm) and occ degrees. All fractures are rough with slight black sp surfaces. (LEWES NODL CHALK FORMATION - G	occasional casional minantly um spaced asionally 80 undulating eckling on ILAR	48.50-48.55 NIDD, recovered as fine gravel. 48.70 Medium nodular flint.	48.00 +51,9		1
49 4 9.00 - 4 9.30 -			C 19					48.90-49.00 NIDD recovered as angular gravel. 49.60 Occasional orange	WIL		
49.95 - 50.20			C 20					speckles and locally NIDD around flints.	1		
roundwater Entries No. Depth Strike		arks		Depth Sea	iled (m)	Hole continues on nex Depth Related Remarks Depths (m) Remarks	shen C	49.95 Small nodular flint	Hard Boring Depths (m)	Duration (mi	ns) Tools used
otes: For explanation ee Key to Exploratory	of symb	ols and a	abbreviations Project		Ame	ersham Tunnel (Chiltern) Area	с		Borehole		
e Key to Exploratory duced levels in metr- ackets in depth colu	es, Stratu	m thickr	hess given in AGS	lo.	D60	77-16			MLO	32-R(009
			www.esg.co.uk	out for		h Speed Two (HS2) Limited					



orilled LR/MR	Start		Equipment, Methods and Rem	arks		Depth from (m)		Ground Level		99.99 mOD
ogged /CMI	08/11/		Comacchio 305 Hand dig inspection pit from	GL to 1.20	m. Rotar	0.00	(m) (mm) (m) 1.20 200 1.20 20.00 160 20.00	Coordinates (m)		E 501327.84
necked MM	End	ŕ	1.20m to 20.00m./Rotary co				65.00 146	National Grid		N 192333.19
amples an	14/11/ d Tes [.]					Strata Description		1		
	TCR			Date &	Time &			Depth, Level		
Depth (m)	SCR RQD	lf	Records/Samples	Casing (mbgl)	Water (m)	Main	Detail	(m) (mbgl) (Thickness) (m)	Legend	^{Water-} Backfi∎ strike
							-			
49.50 - 51.00								-	The Party of the P	
40.00 - 01.00							50.30 Grey wispy marl seam.	-		
	100 87						-			
	60						-	-		ŏĘ
							-	-		oHo
							50.80 Medium nodular flints.	-		oHa
								(0.00)		ď
1		1					-	(6.00)		
51.15 - 51.45			C 21				-	-	The	
							-		The	oĦa
							-	-		`Ħ
							51.50 Medium nodular flints. –	-		ŏĘ
	100						-	-		2H
51.00 - 52.50	60 4 8									
		NIDD					51.90 Medium nodular flints - surrounded by chalk with	-		°H°
2		100 300					orange speckles throughout. 52.00 Medium nodular flints.	-		f
							52,20-53,10 Orange -			oH oH
				11/11/16	1730		speckling. 52.25 5mm thick sheet flint.	-		oĦ
				20.00	23.00		-			οĦ
		1					-	-		- A
	100			14/11/16 20.00	0800 45.80		-		The second	oE
52.50 - 53.00	100 72						-	-		
							52.95 Grey wispy marl seam			oHo
3		1						-	<u>a, tr, tr</u>	
53.15 - 53.40			C 22				53.10 10mm thick sheet flint.	-	<u>a, b, b</u>	
							53.25-53.45 AZCL -	-		_ ₽₽
	65						53.45 Large nodular flints.	-		
53.00 - 54.00	26 0						53.50-53.65 AZCL	-		
	-						53.65 Small nodular flints.	-		- E
							- - 53.80 45 degree fracture with -	<i>N</i> ₂ .		οĘ
							occasional black speckling on surface.	JIV.		oE
54.00 - 54.25			- C 23			Weak medium to high density white	53.85 Small nodular flints.	54.0 +45.99		οĘ
						CHALK with occasional light grey mottling and rare grey wispy marl				B
						seams. Fractures are horizontal stepped rough with slight black	54.30 Medium nodu ir tint -	-		
	100					speckling on surfaces. (LEWES NODULAR CHALK FORMATION -	surrounded by chark with orange specking.			
5 4 .00 - 55.00	47 25					Grade A3)	54.35 5mm T. ick sheet flint.	-		oĦo
							54.70-1 4.90 Large nodular			`طٍ
							fint surrounded by angular	-		ŏ
						(cha k gravel (NIDD).			
5 oundwater Entra	-					Hole continues on next shert	1 -	line of D		OH (
oundwater Entrie Io. Depth Strike		narks		Depth Sea	iled (m)	Depth Related Remarks Depths (m) Remarks		Hard Boring Depths (m)	Duration (mi	ns) Tools used
es: For explanatio	n of symb	ols and a	abbreviations Project		Am	ersham Tunnel (Chiltern) Area C		Borehole		
Key to Explorator uced levels in met	y Hole Re res, Strati	ecords, A	II depths and			77-16			32-RC	2009
kets in depth colu ale 1:25		(c) ESG	www.esg.co.uk AGS	No. out for		177-16 h Speed Two (HS2) Limited			Sheet 11 of 13	
/uju 1.20	Print	Date 19/05	5/2017 16:12:24		g				Sheer II UI IS	



illed: LR/MR gged: /CM	Start 08/11/2		Equipment, Methods and Rer Comacchio 305	narks		De	epth from (m)	to Diameter Casing Depth (m) (mm) (m) 1.20 200 1.20			99.99 mOD 501327.84
gged /CM ecked MM	End		Hand dig inspection pit from					20.00 160 20.00	Coordinates (m) National Grid		192333.19
proved MM	14/11/2	2016	1.20m to 20.00m./Rotary c	ore aniling tr	om 20.0	Jm to 65.00m.	20.00	65.00 146		,	102000.10
mples an	d Test	s				Strata Description					
Depth (m)	TCR SCR RQD	lf	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main		Detail	Depth, Level (m) (mbgl) (Thickness)	Legend St	^{ater-} Backfi∎
									(m)		
								55.20 Medium nodular flint. –			0-0
								-			
	100							-			B
5.00 - 56.00	84 73							-			00
5.70 - 56.00			C 24					=			000
								-			0 (
								56.00 Large nodular flint.		The	0
											\sim
56.20 - 56.45			C 25								\sim
								=			
								-			\sim
								– – 56.65 Orange staining though		<u>, pp</u>	
6.00 - 57.50	9 4 70							core (possible sponge bed).			
	56							-			\sim
								_			\sum
								57.10 10mm thick sheet flint			
								-	(6.60)		\sim
		NIDD						-	(0.00)		\mathcal{N}
		90 270						57.50 Light brown staining. –			
		210						-			\mathcal{N}
								-			\sum
								57.90 Light brown staining. –		<u> </u>	
								58.00 Large nodular flint.			
	100							-			
57.50 - 59.00	62 31							-			
								-			
8.60 - 58.85			C 26					=			\mathcal{N}
								58.70 Light brown staining. –	\sim		
								58.80 Large nodular flint. –	$\langle U_{j_i} \rangle$		\sim
9.00 - 59.25			C 27						2.	للصليك	$\left(\right)$
								ć			\sum
								59.30 Medium nodu ir i n			
	100							59.40 30 degree fracture			\sum
	100 72 48							59.50 Orange staining.		<u></u>	(\mathbf{X})
	-0										\sum
59.00 - 60.50								59.75 Medium nodular flint – surrounded by highly –			\sum
								fractured chalk (NIDD).			\sum
undwater Entrie						Hole continues on next sa Depth Related Remarks	<u>e</u> n		Hard Boring		
. Depth Strike		arks		Depth Sea	lled (m)	Depths (m) Remarks	у с		Depths (m)	Duration (mins	:) Tools used
s: For explanatio Key to Explorator	n of symb	ols and	abbreviations Projec	t	Am	ersham Tunnel (Chiltern) Area C			Borehole		
ced levels in met tets in depth colu	res, Stratu	um thick	ness given in Project	t No.	D60	77-16			MLO	32-RC	009
		(c) ESG	www.esg.co.uk AGS Carrie	d out for	Lia	h Speed Two (HS2) Limited				Sheet 12 of 13	



rilled LR/MR	Start	E	Equipment, Methods and Rema	arks			Depth from		Ground Level		_	9 mOD
ogged /CM	08/11/	ŀ	Comacchio 305 Hand dig inspection pit from				(m) 0.00 1.20	(m) (mm) (m) 1.20 200 1.20 20.00 160 20.00	Coordinates (m)			1327.84
hecked MM pproved MM	End 14/11/		1.20m to 20.00m./Rotary cor	e drilling fr	om 20.00	0m to 65.00m.	20.00	65.00 146	National Grid		N 192	2333.19
amples an	d Tes	ts		1		Strata Description	้า					
Depth (m)	TCR SCR RQD	H	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main		Detail	Depth, Level (m) (mbgl) (Thickness) (m)	Legend	Water- strike	Backfi∎
									_			
									-	րիր		\sum
									-		-	\mathcal{I}
												\mathcal{N}
						Moderately strong very hi white nodular CHALK. Oc	casional		- 60.60 +39.39		ą	\mathcal{N}
		NIDD NIDD				orange speckling through glauconitic nodules up to diameter. Generally NIDE	20mm		(0.50)		2	$\langle \cdot \rangle$
31		100				as gravel. Fractures are p horizontal and two mutua	orobably Ily	_	-		a	1
	100		-			perpendicular sets at app 45 degrees. Black speckl surfaces. (LEWES NODL	ing on		61.10 +38.89			/ /
60.50 - 62.00	80 54					CHALK FORMATION Un Possibly HARDGROUND	graded.		-			11
						ROCK) Weak medium to high de			-	1 L L		/
6 1 .55 - 6 1 .82			C 28			CHALK with light grey mo occasional thin grey mark Fractures are horizontal o	seams.		-			
						medium spaced (50/200/ stepped rough, (LEWES	300) NODULAR		-	1 1 1 1	-	\mathcal{N}
		50 200				CHALK FORMATION - G	rade A2/3)	61.90 Medium nodular flint.	(1.65)	r p p		X.
52		300						-			2	\mathcal{I}
									-		-	//
CO 40 CO 70			0.00					60.40 Small particles flipt	-		-	/ /
62. 4 0 - 62.70			C 29					62.40 Small nodular flint.	-	, h h h		11
	100								-			11
62.00 - 63.50	95 53		NDP NDP			Moderately strong high do with light grey mottling no			62.75 +37.24	h h h		\sum
63			NDP			CHALK. (LEWES NODUL FORMATION - Ungraded	LAR CHALK . Possibly		(0.25) 63,00 +36,99			
						HARDGROUNDS - TOP Moderately weak high de CHALK with light grey mo	nsity white	1				X
						Fractures are horizontal of medium spaced (50/150/	closely to 300)		_			Q.
						stepped rough. (LEWES CHALK FORMTION - Gra	NODULAR ade A2/3)	63.35 Orange staining.	_		ר ו	
								- 63.60 Medium nodular flint.	_			/ /
												11
										<u> <u>p</u>ripresente en la seconda de la seconda </u>		\sum
64		50 150 300						5	(2.00)			\mathcal{N}
	97	300						64.20 Medium nodular in			-	\mathcal{N}
63.50 - 65.00	91 69								-		-	$\langle \cdot \rangle$
									-		-	1/
								N CC	-		8	/ /
				14/11/16	1800			1	-			11
				20.00	31.70					<u></u>		//
5 roundwater Entrie No. Depth Strike		narks		Depth Sea	led (m)	END OF EXPLORATO Depth Related Remarks	RY YO'F	•	65.00 34.90 Hard Boring		ing) T	
Deparounte	, Aeli			Depth dea	(111)	Depths (m) Remarks	5		Depths (m)	Duration (m	ins) To	ois used
otes: For explanatio e Key to Explorator					Ame	ersham Tunnel (Chiltern) Area	С		Borehole			
luced levels in met ackets in depth colu	res, Strat	um thickn	ess given in Project	No.	D60	77-16			MLO	32-R(C00	9
cale 1:25	Print	(c) ESG Date 19/05	www.esg.co.uk 5/2017 16:12:24 Carried	out for	Higl	h Speed Two (HS2) Limited				Sheet 13 of 13	3	



Drilled PC17 NH Logged CM Checked MM Approved MM	Start 30/11/20 End 07/12/20	016 C ⊢ 1	quipment, Methods and Re comacchio 305 land dug inspection pit fro .20m to 20.00m./Rotary of	m GL to 1.2	20m. Op from 20.1	en hole rotary drilling from (m) 0.00 20.00 20.00	to Dlameter Casing Dept (m) (mm) (m) 20.00 200 10.50 64.50 146	h Ground Level Coordinates (m) National Grid		98.58 E 50156 N 1921	58.53
Samples an	d Test	s		Date &	Time &	Strata Description		Depth, Level			
Depth (m)	SCR RQD	lf	Records/Samples	Casing (mbgl)	Water (m)	Main	Detail	(m) (mbgl) (Thickness) (m)	Legend	Water- strike	Backfill
						(TOPSOIL) Grass over soft brown gravelly CLAY with abundant rootlets. Brown sandy angular to subrounded fine to coarse GRAVEL of flint. (Probably BEACONSFIELD GRAVEL)	-			· · · · · · · · · · · · · · · · · · ·	
						SAND and GRAVEL, (Driller's description), (Probably BEACONSFIELD GRAVEL)	-	- - - - - - - - - - - - - - - - - - -		11111	
							-			111111	
										111111	
									C)		
							ccept			111111	
s roundwater Entrie	5					Depth Related Remarks	L.P	Hard Boring			
No. Depth Strike	(m) Rema		le	Depth Sea		Depths (m) Remarks 4.00 - 4.00 No flush r sturns colow 4.00r 4.00 - 4.00 No flush r sturns below 4.00r	n. n.	Depths (m)	Duration (n	nins)Tools	used
otes: For explanatio bbreviations see Ke Il depths and reduce lickness given in bra Scale 1:25	y to Explora ed levels in ackets in de	atory Ho metres, epth colu c) ESG v	Stratum umn. AGS		D60	ersham Tunnel (Chiltern) Area C 77-16 h Speed Two (HS2) Limited			32-R(Sheet 1 of 1		•



rilled PC17 NH GC/ ogged CM hecked MM	Start 30/11/2 End	2016 (Equipment, Methods and Rem Comacchio 305 Hand dug inspection pit from	n GL to 1.2	20m. Ope	en hole rotary drilling from	Depth from (m) 0.00 20.00	to (m) 20.00 64.50	Dlameter (mm) 200 146	Casing Depth (m) 10.50	Ground Level Coordinates (m National Grid)	E 501	8 mOD 568.53 113.17
pproved MM	07/12/:		1.20m to 20.00m./Rotary co	ore drilling f	from 20.0	00m to 64.50m.					National Gru		N 192	13.17
amples an	d Tes	ts				Strata Descriptio	n	1				. 1		
Depth (m)	TCR SCR RQD	lf	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main			Detail		Depth, Leve (m) (mbgl (Thickness	Legend	Water- strike	Backfill
						SAND and GRAVEL. (Dr description). (Probably BEACONSFIELD GRAV								
3						Possible CHALK. (Driller description). (SEAFORD FORMATION - Ungrader notes: 'Casing advancing with slight pump pressur would indicate cohesive	CHALK d). Driller g easier and e, which	_			6.00 +92.5			///////////////////////////////////////
7														1111111
8											Ň			1111
9				30/11/16 10.50	1800 Dry			n'	PCC	e ci	9 m			///////////////////////////////////////
10							2							
oundwater Entrie No. Depth Strike		arks		Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks	.00				Hard Boring Depths (m)	Duration (r	nins)Too	ls used
otes: For explanation breviations see Ke depths and reduc ckness given in br	y to Explo ed levels i	pratory H in metres	ole Records. s, Stratum			ersham Tunnel (Chiltern) Area 77-16	a C				Borehole ML()32-R	C01	4



orilled PCT/ NH ogged GC/ CM Checked MM	Start 30/11/2016 End 07/12/2016	Hand dug inspection pit fro 1.20m to 20.00m./Rotary of	om GL to 1.2	20m. Op from 20.0	en hole rotary drilling from 00m to 64.50m.	Depth from (m) 0.00 20.00	to (m) 20.00 64.50	Dlameter (mm) 200 146	Casing Depth (m) 10.50	Ground Level Coordinates (m) National Grid	1	98.58 E 50156 N 19211	8.53
Samples an					Strata Descriptio	n							
Depth (m)	TCR SCR If RQD	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main			Detail		Depth, Level (m) (mbgl) (Thickness	Legend	Water- strike E	ackfill
11			01/12/16	0800 Dry	Possible CHALK. (Driller description). (SEAFORD FORMATION - Ungrade notes: 'Casing advanciny with slight pump pressur would indicate cohesive) CHALK d). Driller g easier and e, which						1111111111111	
12												1111111111111	
14							n	PC	.eX	10 Mai		111111111	
15											<u>I</u> F I	1	
roundwater Entrie No. Depth Strike	(m) Remarks	·	Depth Sea		Depth Related Remarks Depths (m) Remarks	.000				Hard Boring Depths (m)	Duration (n	nins)Tools	used
otes: For explanatio bbreviations see Ke Il depths and reduce ickness given in bra Scale 1:25	ey to Exploratory ed levels in met ackets in depth (c) ES	r Hole Records. res. Stratum column.		D60	ersham Tunnel (Chiltern) Are 177-16 h Speed Two (HS2) Limited	a C				Borehole MLC	32-R Sheet 3 of 1		



Drilled PC17 NH .ogged CC/ CM Checked MM	Start 30/11/2016 End 07/12/2016	Equipment, Methods and Ren Comacchio 305 Hand dug inspection pit fro 1.20m to 20.00m./Rotary co	m GL to 1.20	0m. Opi om 20.0	en hole rotary drilling from 00m to 64.50m.	Depth from (m) 0.00 20.00	to (m) 20.00 64.50	Dlameter (mm) 200 146	Casing Depth (m) 10.50	Ground Level Coordinates (m) National Grid)	98.58 r E 50156 N 19211	8.53
Samples an					Strata Descriptio	n							
Depth (m)	TCR SCR If RQD	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main			Detail		Depth, Level (m) (mbgl) (Thickness		Water- strike B	ackfill
16					Possible CHALK. (Dniler description). (SEAFORD FORMATION - Ungrader notes: 'Casing advancing with slight pump pressur would indicate cohesive) CHALK d). Driller g easier and e, which						111111111111	
17												1111111	
18										ja,			
19							r	PC	چې	8			
20 Froundwater Entrie No. Depth Strike			Depth Seal	ed (m)	Depth Related Remarks Depths (m) Remarks	. 000				20.00 +78.5 Hard Boring Depths (m)	Buration (m	nins)Tools	used
lotes: For explanatic bbreviations see Ke II depths and reduce nickness given in bra Scale 1:25	ed levels in metri ackets in depth c (c) ES	Hole Records, es, Stratum olumn. AGS		D60	ersham Tunnel (Chiltern) Area 177-16 h Speed Two (HS2) Limited	a C				Borehole MLC)32-R(Sheet 4 of 1:		



Drilled PC17 NH GC/ CM Checked MM	Start 30/11/2 End 07/12/2	2016 C H 1	quipment, Methods and Ren Comacchio 305 land dug inspection pit fro .20m to 20.00m./Rotary co	m GL to 1.2		en hole rotary drilling from 0.00 20.00 20.00	to Dlameter Casing Depth (m) (mm) (m) 20.00 200 10.50 64.50 146	Ground Level Coordinates (m) National Grid	98.58 mOD E 501568.53 N 192113.17
Samples an						Strata Description			
Depth (m)	TCR SCR RQD	lf	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main	Detail	Depth, Level (m) (mbgl) (Thickness	d ^{Water-} Backfill
20.00 - 20.10	100 55 55	NIDD 50 400	C 1			Weak low density white CHALK with a purplish hue and occasional orange speckles. Fractures are horizontal very closely to medium spaced and locally non-intact (NIDD/50/400). (SEAFORD CHALK FORMATION - Grade A3/4. locally C3/4) Weak medium density white CHALK with occasional grey mottling and occasional finits. Fractures are horizontal and vertical closely to medium spaced and locally non- intact (NI/50/300) rough and	20,15 Orange Speckling. 20,55 Subhorizontal fracture infiled with 60mm of soft comminuted chalk. 20,80-20,95 NIDD, recovered as angular gravel. 20,95 Medium nodular flint.		
21,00 - 22.00 21.70 - 21.95	100 70 66	NIDD 150 300	C 1A			undulating with slight black speckling. (SEAFORD CHALK FORMATION - Grade A3)	21.50 Small nodular flint. 21.50-21.60 NIDD, recovered as angular gravel. 21.65 Grey wispy marl seam. 21.95 Grey wispy marl seam.		н н н н н н н н н н / / / / / / / / / /
22.00 - 23.00	100 12 12		-			Weak medium density white CHALK with occasional wispy marl seams and flints. Fractures are horizontal, vertical and 45 degrees very closely to closely spaced and locally non- intact (NI/50/150) rough undulating with black speckling on surfaces. (SEAFORD CHALK FORMATION - Grade A3/4)	22.25-22.35 NIDD, recovered as angular gravel. 22.68 Occasional orange speckling. 22.95 Small shell fragments.		н н н н н н н н - / / / / / / / / / / / / / / / / / / /
23.20 - 23.42 23.00 - 24.00	100 30 24	NIDD 50 150	C 2				23.10 Crinoid fossil fragments. 23.55 Medium nodular flint surrounded by comminuted chalk (probably NIDD). 23.90-24.00 NIDD, recovered		
24.25 - 24.52 24.00 - 25.00	100 30 30		С 3				as very weak low density chalk. 24.00 Small nodular flint. 24.05 Subhorizontal fracture with heavy black speckling on surface. 24.60 Hc. conc. rracture with heavy bra. speckling on surface. 24.60-24.70 Orange sp sck-ing through core (sp snge bed).		
25 Froundwater Entrie No. Depth Strike		harks		Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks		Hard Boring Depths (m) Duration	(mins)Tools used
lotes: For explanatic bbreviations see Ke III depths and reduce nickness given in bra Scale 1:25	y to Explo ed levels i ackets in o	oratory Ho in metres depth coli (c) ESG 1	. Stratum umn. Project		D60	ersham Tunnel (Chiltern) Area C 77-16 h Speed Two (HS2) Limited		Borehole ML032-F Sheet 5 o	



Drilled PC17 NH Logged CM Checked MM	Start 30/11/2 End 07/12/2	2016 (Equipment, Methods and Ren Comacchio 305 Hand dug inspection pit froi L20m to 20.00m./Rotary co	m GL to 1.2			m to Dlameter Casing Depti (m) (mm) (m) 20.00 200 10.50 64.50 146	h Ground Level Coordinates (m) National Grid	98.58 mOD E 501568.53 N 192113.17
Samples an _{Depth}	TCR			Date &	Time &	Strata Description		Depth, Level (m) (mbgl)	Water-
(m)	SCR RQD	lf	Records/Samples	Casing (mbgl)	Water (m)	Main Weak medium density white CHAL	Detail K	(Thickness) (m)	Water- strike Backfill
25.00 - 25.50 25.50 - 25.70	100 16 0		C 4			with occasional wispy mark seams and flints. Fractures are horizontal vertical and 45 degrees very close to closely spaced and locally non- intact (NI/50/150) rough undulating with black speckling on surfaces. (SEAFORD CHALK FORMATION Grade A3/4)	25.10 Horizontal fracture with heavy black speckling on y surface. 25.10-25.40 NIDD. 25.35 Small medium nodular flint		
2625,50 - 26,50	100 55 35						25.85-25.95 NIDD. 26.05-26.15 NIDD. 26.15-26.30 Vertical fracture with orange staining on surface. 26.30 Horizontal fracture infilled with comminuted chalk 10mm thick.		
26.50 - 27.00	94 28 28		-			Weak medium to high density white	26.50-26.59 AZCL 26.50-26.85 NIDD, recovered as angular gravel and cobbles. 26.59-26.94 NIDD, recovered as angular gravel and cobbles. 26.90 Occasional orange	27.00 +71.58	
27.35 - 27.60			C 5			CHALK with occasional light grey bioturbated areas, wispy marl sear and filnts. Fractures are horizontal and vertical closely to medium spaced and locally non-intact (NI/150/400) rough and undulating with slight black speckling on surfaces. (SEAFORD CHALK FORMATION - Grade A3, locally C	 speckles. 27.60 Grey wispy marl seam. 		
27.00 - 28.50 28	100 63 34						 27.65 Horizontal fracture with slight orangish brown staining on surface. 27.65-27.75 NIDD, recovered as highly fractured chalk. 27.70 Small nodular flint. 28.15 Horizontal fracture with slight brown clay infill. 		
28.80 - 28.93 ²⁹	100		C 6				28.85 Shell fragments. 28.90 Grey wispy marl seam. 28.95-29.00 Occasional orange speckling.		
28.50 - 30.00	39 20						29.45 Medium no autar fint. 29.50 Small no du ar fint. 29.85 Orange speckling. 29.95 Small nodular flint. 30.00-30.09 AZCL		
Groundwater Entrie No. Depth Strike		arks	·	Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks		Hard Boring Depths (m) Duration	(mins)Tools used
lotes: For explanatic bbreviations see Ke II depths and reduce nickness given in bra Scale 1:25	y to Explo ed levels i ackets in c	ratory H n metres lepth col (c) ESG	, Stratum		D60	rsham Tunnel (Chiltern) Area C 77-16 h Speed Two (HS2) Limited		Borehole ML032-R Sheet 6 of	



orilled PC17 NH GC/ CM Checked MM	Start 30/11/ End	2016 (quipment, Methods and Rem Comacchio 305 Hand dug inspection pit froi .20m to 20.00m./Rotary co	n GL to 1,2	20m. Op from 20.0	en hole rotary drilling from 00m to 64.50m,	Depth from (m) 0.00 20.00	to Dlameter Casing Degram (m) (mm) (m) 20.00 200 10.50 64.50 146	oth Ground Level Coordinates (m) National Grid	98.58 mOD E 501568.53 N 192113.17
pproved MM amples an	07/12/ d Tes					Strata Descriptio	n		_	
Depth (m)	TCR SCR RQD	lf	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main		Detail	Depth, Level (m) (mbgl) (Thickness	l) Legend Water- strike Backfill
30.00 - 31.50 30.85 - 31.00 ³¹	94 22 10	NIDD 150	C 7			Weak medium to high de CHALK with occasional I bioturbated areas, wispy and flints, Fractures are I and vertical closely to me spaced and locally non-ir (NI/150/400) rough and u with slight black specklin surfaces, (SEAFORD CH FORMATION - Grade A3	ight grey marl seams horizontal edium htact undulating g on IALK	 30.40 Small nodular flints, 30.40-30.50 NIDD, 30.65 Medium nodular flint, 30.70 Slight orange speckling, 30.85 Medium nodular flint, 30.95 Light grey bioturbated marl laminae, 31.05 Slight orange speckling, 31.20 Thin grey (2mm) marl seam. 31.20-31.30 NIDD. 31.55 Small nodular flint. 		
³² 31.50 - 33.00 32.55 - 32.78	100 72 72	400	C 8					32.10 Horizontal fracture with 10mm comminuted chalk infi and 2mm brown clay infill. 32.50 Medium nodular flint.		
33			NA NA NA					33.00-33.10 AZCL 33.00-33.30 AZCL 33.25 Large nodular flint.		
33,00 - 34,50 ³⁴	80 23 10	NIDD 150 400						34.00-34.50 NIDD. 34.10 Medium nodular flint.	No No	
34.66 - 34.83			NA NA NA C 9					34.50-34.71 AZC		
3534.50 - 35.50 roundwater Entrie	c						<u> </u>			
No. Depth Strike	(m) Ren	bols and pratory H in metres	, Stratum		Ame D60	Depth Related Remarks Depths (m) Remarks ersham Tunnel (Chiltern) Area 77-16 h Speed Two (HS2) Limited) nc		Hard Boring Depths (m) Borehole	Duration (mins)Tools used



Drilled PC17 NH Logged CM Checked MM Approved MM	Start 30/11/2 End 07/12/2	2016 C H 1	quipment, Methods and Ren Comacchio 305 Iand dug inspection pit fro .20m to 20.00m./Rotary c	m GL to 1.2	20m. Ope from 20.0	en hole rotary drilling from 0.00 20.00 20.00	to Dlameter Casing Depth (m) (mm) (m) 20.00 200 10.50 64.50 146	Ground Level Coordinates (m) National Grid	98.58 mOD E 501568.53 N 192113.17
Samples an						Strata Description			
Depth (m)	TCR SCR RQD	lf	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main	Detail	Depth, Level (m) (mbgl) (Thickness	Water- strike Backfill
	79 15 15	NIDD 150 400	NA			Weak medium to high density white CHALK with occasional light grey bioturbated areas, wispy marl seams and flints. Fractures are horizontal and vertical closely to medium spaced and locally non-intact (NI/150/400) rough and undulating with slight black speckling on surfaces. (SEAFORD CHALK	35,10 Medium nodular flint. 35,45 Horizontal fracture infilled with 8mm of soft		
35.50 - 36.00 ³⁶	88 26 26		- NA NA	01/12/16 10,50	1715 35.90	FORMATION - Grade A3, locally C3)	brown clay. 35.50-35.56 AZCL 35.55 Medium nodular flint.		
		NIDD 150 400		02/12/16 10.50	0800 Dry		36.25-36.75 NIDD. 36.50 Medium nodular flint.		
36.65 - 36.80 36.00 - 37.50	53 19 0		C 11			AZCL. Driller's description: CHALK.		37.00 +61.58	
		NA NA NA	_	02/12/16 10.50	1700 35.66	(SEAFORD CHALK FORMATION - Ungraded).			
[.] 3838.00 - 38.20			C 10	06/12/16 10.50	0745 Dry	with flint. Recovered non-intact as gravel in a matrix of comminuted chalk, Occasional orange stained areas, (Possibly SEAFORD CHALK FORMATION - Ungraded)	37.61 Small nodular flints, 38.05 Horizontal fracture along grey wispy marl seam.		
37,50 - 39,00	93 51 35	NIDD					38.10 Grey wispy mart seam. 38.25 Orange speckling.		
· 39		150 400					38.90-39.00 AZCL.		
39. 4 5 - 39.76	100 60 53		C 12				Accept		
39.00 - 40.50							29,80-39,95 Vertical fracture with orange staining on surface		
Groundwater Entrie No. Depth Strike		arks		Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks	,	Hard Boring Depths (m) Duration (r	mins)Tools used
Notes: For explanatic abbreviations see Ke All depths and reduce hickness given in bra Scale 1:25	y to Explo ed levels i ackets in o	n metres I metres Iepth coli (c) ESG	. Stratum umn. AGS Projec		D60	ersham Tunnel (Chiltern) Area C 77-16 n Speed Two (HS2) Limited		Borehole ML032-R Sheet 8 of 1	



Drilled PCT7 NH Logged CM Checked MM Approved MM	Start 30/11/ End 07/12/	2016 (H 1	Equipment, Methods and Ren Comacchio 305 Hand dug inspection pit fro J.20m to 20.00m./Rotary c	m GL to 1.2	20m. Op from 20.	en hole rotary drilling from 20.00 20.00 20.00	to Dlameter Casing Depth (m) (mm) (m) 20.00 200 10.50 64.50 146	Ground Level Coordinates (m) National Grid	98.58 mOD E 501568.53 N 192113.17
Samples an		ts			1	Strata Description		Depth, Level	
Depth (m)	TCR SCR RQD	lf	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main	Detail	(m) (mbgl) Leger (Thickness	nd ^{Water-} Backfill
			- NA - NA			Very weak low density white CHALK with flint. Recovered non-intact as gravel in a matrix of comminuted chalk. Occasional orange stained areas. (Possibly SEAFORD CHALK FORMATION - Ungraded)	40.25-40.50 Very closely fractured locally with black speckling on surfaces. 40.50-40.56 AZCL		
40.68 - 40.91 • 41			NA C 13				41.10 NIDD. Small nodular		
40.50 - 42.00	97 62 48	NIDD 150 400					flint surrounded by highly fractured chalk. 41.20 Light grey marl lens 10mm thick and occasional orange speckling. 41.30 NIDD. Small nodular flint surrounded by highly fractured chalk. 41.60 5mm thick sheet flint.		
- 42		NIDD 150 400	NA NA NA				42.00-42.10 AZCL		
42.00 - 43.50 - 4343.00 - 43.18	93 45 27	NIDD	C 14			Horizontal thick lamination (10mm) of soft brown CLAY. (Possibly SHOREHAM MARL No2. LEWES NODULAR CHALK FORMATION) Weak medium to high density white CHALK with occasional light grey mottling, grey wispy mark seams and flints. Fractures are horizontal and occasional 45 degrees closely to medium spaced and locally non- intat (NI/150/250) with slight black speckling on surfaces. (Possibly LEWES NODULAR CHALK FORMATION - Grade A3)	42.45 Horizontal thick lamination (10mm) of soft brown clay. (Possibly Shoreham Marl No2) 42.65 Grey wispy marl seams. 42.80 NIDD. Medium nodular flint surrounded by fractured chalk. 42.80-42.90 NIDD. Medium nodular flint surrounded by fractured chalk. 43.20-43.30 3 horizontal fractures (probably drilling induced).		
43.78 - 43.92 - 4443.50 - 44.50	100 48 29	250	C 15				43.40-43.50 Medium nodular flints. 43.45 Small nodular flints. 43.75 NIDD. Small nodular flint surrounded by chalk gravel and comminuted chalk.		
44.50 - 45.00	0 0 0	NA NA NA	-			No core recovery. Driller's description: CHALK. (LEWES NODULAR CHALK FORMATION - Ungraded)	2 ACCT	44.50 +54.08	
Groundwater Entrie No. Depth Strike		harks	1	Depth Sea	lled (m)	Depth Related Remarks Depths (m) Remarks	<u>.</u>	Hard Boring Depths (m) Duratio	n (mins)Tools used
Notes: For explanatic abbreviations see Ke All depths and reduce thickness given in bra Scale 1:25	y to Expl ed levels ackets in	oratory H in metres depth col (c) ESG	umn.		D60	ersham Tunnel (Chiltern) Area C 77-16 h Speed Two (HS2) Limited		Borehole ML032-I Sheet 9	



amples an	07/12/ d Tes					Strata Description		}		
Depth (m)	TCR SCR RQD	lf	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main	Detail	Depth, Leve (m) (mbgl (Thickness	0 w	ater- trike Backfill
			-			No core recovery. Driller's description: CHALK. (LEWES NODULAR CHALK FORMATION - Ungraded)	45.25 Small nodular flints.			
45.00 - 46.00 45.80 - 45.90	76 38 12	NIDD 150 250	C 16			Horizontal thick lamination (8mm) of soft brown CLAY. (Possibly SHOREHAM MARL No 1, LEWES NODULAR CHALK FORMATION). Weak medium to high density white CHALK with occasional light grey motiling, grey wispy mark seams	45.40 Horizontal thick lamination (8mm) of soft brown clay. (Possibly Shoreham Marl No 1). 45.45 Medium nodular flint.	. 4 5.40 +53.1		
⁶ 46.00 - 46.50	60 28 20		NA NA NA			and flints. Fractures are horizontal and occasional 45 degrees closely to medium spaced and locally non- intact (N/150/250) with slight black speckling on surfaces. (Possibly LEWES NODULAR CHALK FORMATION - Grade A3)	46.00-46.20 AZCL	- - - - - - - - -		
46.50 - 46.69		NIDD 150 250	C 17				46.40-46.45 Grey marl seam.	46.70		
746.50 - 47.50	92 20 20					Weak medium density white CHALK with occasional nodular flints. Recovered NI as gravel in a matrix of comminuted chalk. (Possibly LEWES NODULAR CHALK FORMATION - Ungraded)	46.70 Small nodular flints. 47.00 Medium nodular flints. 47.00-47.30 Orange staining throughout (possible sponge bed). 47.30-47.50 Light brown	46.70 +51.8		
47.50 - 48.00 ¹⁸	100 12 0	NIDD NIDD 60					comminuted chalk in clay matrix with some medium nodular carious flints. Probably fault gouge. 47.50-47.70 Small nodular flints. 47.80 Small nodular flints.			
48.00 - 49.00 48.67 - 48.81	90 44 24	NIDD 120 190	C 18			Weak medium density white CHALK with occasional flints and light grey mottling, occasional wispy marl seams and flints. Fractures are horizontal and occasionally vertical closely spaced and locally non-intact (NI/120/190) with slight black speckling on surfaces. (Possibly LEWES NODULAR CHALK FORMATION - Grade A3, locally C3)	48.20 Medium nodular flints. 48.55 NIDD, Medium nodular flints surrounded by comminuted chalk. 48.90-49.50 NIDD, recovered	48.15 +50.4		
⁹ 49.00 - 49.50	80 6 0		NA NA NA				as angular gravel of chalk. 49.05 Medium nodular flint. 49.05-49.15 AZCL	9 m		
240.50 50.50							49.60 Gr , wis, marl seams. 49.90 Horizontal fracture on mar seam with 20mm of			
oundwater Entrie No. Depth Strike		arks		Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks	angular chalk gravel.	Hard Boring Depths (m)	Duration (min	s)Tools used
	(m) Rem on of sym y to Explo	bols and pratory Ho in metres	. Stratum	:	Am	Depth Related Remarks Depths (m) Remarks ersham Tunnel (Chiltern) Area C		Depths (m) Borehole	Duration (min:	



ihecked MM pproved MM Samples an	End 07/12/	1 20 1 6	and dug inspection pit fro .20m to 20.00m./Rotary co	ore drilling t	20m, Op from 20.1	en hole rotary drilling from 20.00 20m to 64.50m. Strata Description	64.50 146	National Grid	N 192113.17
Depth (m)	TCR SCR RQD	lis If	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main	Detail	Depth, Level (m) (mbgl) (Thickness	gend Water- strike Backfill
50.50 51.00	100 48 24 100	NIDD 120 190		(Weak medium density white CHALK with occasional flints and light grey mottling, occasional wispy marl seams and flints. Fractures are horizontal and occasionally vertical closely spaced and locally non-intact (NI/120/190) with slight black speckling on surfaces. (Possibly LEWES NODULAR CHALK FORMATION - Grade A3, locally C3)	50,25 Occasional orange speckling. 50.50 Small nodular flints.		
50.50 - 51.00 50.84 - 51.00 ⁵¹	44 28		C 19 NA NA NA				50.90 10mm thick sheet flint. 51.00-51.23 AZCL —		
51.00 - 52.50 51.84 - 52.00	85 52 39	NIDD 120 190	C 20				51.50 Small nodular flints. 51.85 Zoophycos trace fossil. 51.95 Grey wispy marl seam. 52.00-52.30 NIDD, recovered		
			NDP NDP NDP			Weak to medium strong high density nodular CHALK with occasional marl lenses. (Possible HARDGROUNDS -	as angular gravel and cobbles. 52.65 Small nodular flint	52.50 +46.08	
⁵³ 52.50 - 54.00	100 66 47	NIDD 160 300				LEWES NODULAR CHALK FORMATION - Grade A3) Weak medium density white CHALK with occasional grey mottling, wispy marl seams and flints. Fractures are predominately horizontal occasionally vertical closely to medium spaced and locally non- intact (NI/160/300). (LEWES NODULAR CHALK FORMATION - Grade A2/3, locally C2/3)	surrounded by occasional orange speckling. 52.75 Wispy marl seams.		
53.70 - 53.90 ⁵⁴			C 21 NA				53.60 Medium nodular flints surrounded by orange staining. 53.75 Small nodular flints. 53.90 Small nodular flints. 54.00-54.30 Numerous wispy		
54.23 - 54.45			NA NA C 22				marl seams. 54.20 Small nodular flint.		
54.00 - 55.50	88 61 37						54.55 Zoophy os race fossil 54.70 Small nodular flint. 54.75 Small nodular flint. 54.75 MDD. Medium nodular		
⁵⁵ roundwater Entrie No. Depth Strike		arks		Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks	Fint surrounded by fractured	Hard Boring Depths (m) Durat	tion (mins)Tools used
lotes: For explanatic bbreviations see Ke II depths and reduce lickness given in bra Scale 1:25	y to Explo ed levels i	oratory Ho in metres	Stratum		D60	ersham Tunnel (Chiltern) Area C 77-16 h Speed Two (HS2) Limited		Borehole ML032	-RC014



Drilled PC17 NH .ogged CC/ Checked MM	Start 30/11/ End 07/12/	2016 C H 1	Equipment, Methods and Ren Comacchio 305 Hand dug inspection pit fro I.20m to 20.00m./Rotary co	m GL to 1.2	20m. Op from 20.0	en hole rotary drilling from 0.00 20.00 20.00	to Dlameter Casing Depth (m) (mm) (m) 20.00 200 10.50 64.50 146	Ground Level Coordinates (m) Natjonal Grid	E 5	.58 mOD 01568.53 92113.17
Samples an			1			Strata Description	T			
Depth (m)	TCR SCR RQD	lf	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main	Detail	Depth, Level (m) (mbgl) (Thickness	Legend Water strike	, Backfill
						Weak medium density white CHALK with occasional grey mottling, wispy marf seams and flints. Fractures are predominately horizontal occasionally vertical closely to medium spaced and locally non- intact (NI/160/300), (LEWES NODULAR CHALK FORMATION - Grade A2/3, locally C2/3)	55,10 Small nodular flint. 55.40 Medium nodular flint surrounded by broken chalk.	T T T T T		
55.80 - 56.08		NIDD	C 23				55.70 Medium nodular flint.			
⁵⁶ 55.50 - 57.00	100 61 32	160 300					56.00 Grey wispy marl seams. 56.15 Medium nodular flint.			
57 -			- NA NA				56.70 Small nodular flint. 56.80 Grey marl lens (50mmx20mm). 56.90-57.00 Orange staining throughout (possible sponge bed).			
			NA				57.15 Horizontal fracture infilled with 10mm of comminuted chalk. 57.20.57.30 Highly fractured (probably drilling induced).			
57.00 - 58.50 58	92 47 19						57.65 Large nodular flint. 57.75 Small nodular flint. 57.85 8mm thick sheet flint (horizontal).			
58.35 - 58.50		NIDD 160 300	C 24	06/12/16 10.50	1645 38.44					
59				07/12/16 10.50	0800 Dry		58.80 Medium nodular flint. 58.95 20mm thick moderately weak orange stained seam			
59.18 - 59.35 58.50 - 60.00	100 72 57		C 25				with shell fragments (sponge bed). 59.10 Light grey bioturbate marl. 59.35 Grey wispy mar sent with occasional oran se speckles in surro inding chalk. 59.50-59.55 Numerous grey wispy mar seams. 59.70 Large nodular flint.	59.75 +38.83		
60						Weak medium to high density white CHALK with grey wispy marl seams and bioturbation throughout. Fractures are horizontal very close	pí -			1
roundwater Entrie No. Depth Strike		harks	'	Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks	-	Hard Boring Depths (m) D	Ouration (mins)1	ools used
lotes: For explanatio bbreviations see Ke II depths and reduce nickness given in bra Scale 1:25	y to Explo	oratory He	umn. AGS		D60	ersham Tunnel (Chiltern) Area C 77-16 h Speed Two (HS2) Limited			32-RC0 neet 12 of 13	14



rilled PC17 NH ogged GC/ CM hecked MM pproved MM	Start 30/11/2 End 07/12/2	2016 (H 1	quipment, Methods and Rem Comacchio 305 land dug inspection pit from .20m to 20.00m./Rotary co	n GL to 1.2			Depth from (m) 0.00 20.00	to Dlameter Casing Dept (m) (mm) (m) 20.00 200 10.50 64.50 146	h Ground Level Coordinates (m) National Grid		98.58 mOD E 501568.53 N 192113.17
amples an						Strata Descriptio	n		-		
Depth (m)	TCR SCR RQD	lf	Records/Samples	Date & Casing (mbgl)	Time & Water (m)	Main		Detail	Depth, Level (m) (mbgl) (Thickness	Legend	Water- strike Backfill
60.20 - 60.45			C 26			to medium spaced (50/1: rough and stepped. (LEV NODULAR CHALK FOR Grade A2/3)	NES	60.05 Slight orange staining on horizontal fracture surface. 60.10 Small nodular flint.			
60.00 - 61.50	91 65 59	50 150 300						60,55 10mm thick sheet flint. 60,65 Orange speckling.			
3 1						Weak to medium strong white with light grey mott CHALK. Fractures are h very closely to medium s (NIDD/150/300). (Possib HARDGROUNDS - LEW	tling nodular orizontal spaced le	61.27-61.50 AZCL	61.00 +37.58		
		NA NA NA				NODULAR CHALK FOR Grade A2/3)		61.50 Orange staining and slight black speckling, 61.50-61.70 NIDD, recovered as very high density chalk	-		
61.77 - 62.03			C 27					(Possible HARDGROUNDS). - 62.10-62.25 Grey wispy marl			
61.50 - 63.00	100 88 53	50 150 300						seams.	- - - - - -		
								62.50 Medium nodular flint.			
63		50 150 300						-			
63.00 - 64.50	100 91							63.50 Striated fracture (30mm long) - Possible shear. 63.50-63.60 Very high density chalk (Possible			
⁵⁴ 64.13 - 64.33	35		C 28					HARDGROUNDS). 63.95-64.00 Very high density chalk (Possible HARDGROUNDS).	d hai		
				07/12/16 10.50	1730 37.20	END OF EXPLORATO	ORY HOLE	64.25 Grey wispy mark	- - - - - - - - - - - - - - - - - - -		
65								2.4	- - - - - - -		
roundwater Entrie No. Depth Strike		arks	1	Depth Sea	led (m)	Depth Related Remarks Depths (m) Remarks	,00,0	,	Hard Boring Depths (m)	Duration (n	nins)Tools used
otes: For explanatic breviations see Ke I depths and reduce ckness given in bra Scale 1:25	y to Explo ed levels i ackets in o	oratory H in metres depth col (c) ESG	. Stratum		D60	ersham Tunnel (Chiltern) Are: 77-16 h Speed Two (HS2) Limited	a C			32-R (

barn	E	BORE	HO	LE L	00	3					MI	_03	hole N 5-RC	2016	6
ritchies Project Name: Project No: Dient: ingineer:	Amersham Tunnel to Calvert 1G063-AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd			Survey Gr Co-ordinat Ground Le	id Syste es: evel:			49928 19357	SGB 7.56 m 72.49 m 72.86 m	nE Ch nN Ap nOD So Lo	ble Type lecked proved ale: g Statu	e: By: By: ıs:	<u>et 1 of</u>	A	F B, C PMc 1:25 FINA
Date Started: Date Completed:	23/01/2017 27/01/2017			Orientatior Inclination					de 90 d	•	int Date nal Dep			21/11 55	/20′ 5.50
	Stratum Description	Legend (Thick-	Level (m)	Depth	· ·			and h Si Blows (mins)		ng Test Resu	It Inito			water	W Ba
	oft brown slightly sandy slightly . Gravel is angular to rounded fine to and rare brick fragments.	r- t<0.50)		0.30-0.50	В	(mm))**%*	(mins)	Test	l est Resu			I(MR)		2.Z ;;; ;;; ;;; ;;;
	andy slightly gravelly clayey SILT. rounded fine to coarse of flint and	i ≤ X X t<0.50) X X X t<0.50) X X X t<0.50) X X X X X X X X X X X X X X X X X X X	72.36	0.50-0.70	В										
subangular flint cobb rounded fine to coar Alluvium]	flint GRAVEL - flushed rotary casing		71.86 71.66	1.00 -1.20	В										
subrounded fine to c subangular flint cobl reduced by washing [River Terrace Depo	osits] pre loss. Poor recovery in granular		70.36	2.50-3.00	RC	102						90	- NA -	-	
		tl1.05) r- r- r-		3.00-4.50	RC	102						33 0 0	NR -		
coarse GRAVEL of n	nn slightly clayey subangular fine to nodular flint with high subangular flint o 70mm). Fines content possibly out during coring.	.00 	68.86										NĀ -	-	
Assumed zone of co soils with rotary corin	ore loss. Poor recovery in granular ng.	* .50 50 t<1.00)	68.36											_	
Groundwater levels Explanation of symb	asured along borehole axis. may be subject to seasonal, tidal and bols and abbreviations given in 'Key to n on appended 'Borehole Information :	Exploratory Ho		ould not be	taken a	as con	l			<u> </u>				1	_

Office: BAM Ritchies, Glasgow Road, Kilsy1h, Glasgow G65 9BL

•barn	B	BOR	EHC	DLE L	00	3					M	_03	hole N 5-RC et 2 of	016	
Project Name: Project No:	Amersham Tunnel to Calvert			Survey Gr Co-ordinat	-	em:		49928)SGB 37.56 r 72.49 r	nE Cł	ole Type necked oproved	By:			R B, C PMc
Client: ngineer: Date Started:	High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd 23/01/2017			Ground Le Orientatior				7	72.86 n d	Lo	cale: og Statu rint Date				1:25 FINA /201
Date Completed:	27/01/2017			Inclination					90 c	•	nal Dep		1	55	5.50
	Stratum Description	ne	n) pth lick-Leve (m) (m)	I Depth (m)	Samp Type	1	Rec	and h S Blows (mins)		ing Test Resu	lt Units		If min If ave If max (mm)	Weter	W Ba
Assumed zone of co soils with rotary corir	oreloss.Poorrecovery in granular ng.			4.50-6.00	RC	102							- NR -		
	n slightly sandy clayey subangular /EL of flint with low subangular flint	<>;-	50 67.36	;								33 0	f		
cobble content (up to	o 60mm). Sand is fine to coarse.	11 - 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1										0	_		
coring. River Terrace Depo	oly reduced by washing out during sits] notes flush returns of orange SAND.	<pre><</pre>	50) DO 66.8	5									<u>-</u>	-	
NO RECOVERY. Driner	notes nush returns of orange SAND.	т. т. т. т. т. т. т. т.													
		H1.5	50>	6.00-7.50	RC	102						0 0 0			
lo recovery. Driller i	notes flush returns of CHALK.	7.: 	50 65.36								_		NR -		
		r- r- tf1.(r- f- f- f-	00)	7.50-8.50	RC	102						0 0 0		-	
	K composed of light yellowish white dy SILT. Gravel is very weak, low	r- r- r- r- f-	50 64.3	6											
	white and subrounded to rounded. rounded cobbles of rinded flint (up to)	80.5	50)	8.70-8.80 8.50-9.00	D RC	102						100 0 0	- NI -	-	
assumed zone of co	oreloss.	+C 		5									- NR		
lightly sandy silty su lasts are very weak ght greyish white lo	K composed of light greyish white ubangular to subrounded GRAVEL. < to weak, low to medium density, ically with orangish brown staining	r- - 9. - - - - - - -										73 0 0			
	ubrounded. With rare subangular fine cobbles of flint. (Grade: De) lk Formation]	f-		9.00 - 10.50	RC D	102							-		

ritchies	-	BORE										5-RC et 3 of		_
Project Name:	Amersham Tunnel to Calvert			Survey Gri Co-ordinate		em:		DSGB 37.56 r	πE	Hole Typ Checked			Δ	В,
Project No:	1G063-AAZ.			CO-oruman	55.			72.49 r		Approved				ь, PN
lient:	High Speed 2 (HS2) Ltd			Ground Le	vel:			72.86 r	nOD	Scale:				1:
ngineer: Date Started:	High Speed 2 (HS2) Ltd 23/01/2017			Orientation				d	90	Log Star Print Dat			F 21/11/	FIN /20
Date Completed:	27/01/2017			Inclination:				90 d	•	Final De			55	
		Depth (Thick-	Level		Samp	ling, Corin	ig and In S	Situ Tes	ting		ŢĊŖ	If min		T
	Stratum Description	Legend (THICK- ness) (m)	(m)	Depth (m)	Туре	Dia Re (mm) %	c Blows	Test	Test Re	esult Units			Weter	
slightly sandy silty s Clasts are very wea light greyish white lo and subangular to s to coarse gravel and [Lewes Nodular Ch	-	(11) f- f- 0.50	62.36									NI -		
Assumed zone of co	ore loss.	f- r- t<0.40) f-										- NR -		
lightly sandy silty s Clasts are very wea ight greyish white lo	K composed of light greyish white ubangular to subrounded GRAVEL. k toweak, low to medium density, ceally with orangish brown staining	f- f- f- f- f-	61.96								73 0	f		
	ubrounded. With rare subangular fine d cobbles of flint. (Grade: De) alk Formation]	r- r- f- t:<_1.10) r-		10.50-12.00	RC	102					0 0	NI -		
		t- t- f- f- f-												
Assumed zone of c		2.00	60.86											
	12.00m : Lost flush returns.	f- f- f-												
		f- f- r- f-										- NR		
		tf1.00) ^{F-} F- f-									30	-		
		f- f- r- r-		12.00-13.50	RC	102					0 0			
white CHALK with ra Fracture set 1 : horiz (90/100/110), undul set 2 : one 45 degree	ery weak low density light greyish are flintfragments (up to 70mm). contal to 20 degrees dosely spaced ating slightly rough, no infill. Fracture fracture, planar rough, no infill.	r- f- f- f- f- f- r- r-	59.86											
Lewes Nodular Cha 13.00 - 13.10m:	alk Formation] Flintfragments (up <i>to</i> 70mm), possible flint band.	r. r. f. f. r.								_	_	- NI -		
		f- f- f- f- f- f- f-		13.90-14.00 13.50-14.50	D RC	102					60 0 0			
14.20	0- 14.50m:Assumed zone of core loss.	f- f- f- f-										- NR -		
14.50- 14.58m:	Flintfragments (up <i>to</i> 90mm), possible flint band.	r f- f. t. t. t.		14.50 - 15.00	RC	102					100 0 0	90 100 110		
		;00	57.86											

•barn	E	SOR	E	HO	LE L	00	3							5-RC		
ritchies Project Name:	Amersham Tunnel to Calvert				Survey Gr	id Syste	em:		о	SGB	F	Hole Typ		t 4 of	12	
					Co-ordinat	es:			49928	7.56 n	nE C	Checked	By:		AE	١,
Project No:	1G063-AAZ.				.					'2.49 n		Approved	d By:		F	
lient:	High Speed 2 (HS2) Ltd				Ground Le	evel:			7	'2.86 m		Scale: .og Stat	tue		F	1:
ingineer: Date Started:	High Speed 2 (HS2) Ltd 23/01/2017				Orientatior					d		Print Dat			٦ /21/11	
Date Completed:	27/01/2017				Inclination					90 d	•	Final Dep			55	
•			Depth				ing, C	oring	andh Sit	u Testi	na		TCR	Ifmin		l
	Stratum Description	Legend	(Thick- ness) (m)	Level (m)	Depth (m)	Туре	(^{Dia})		Blows (mins)	Test	Test Res	sult Units	SCR Rଷ୍ଟପ	lfave (mna)x	Weter I	
Assumed zone of co	pre loss.	f.														
		r.	<0.40)													
		r.														
Very weak to weak,	medium density, greyish white		15.40	57.46												
CHALK with occasio	nal thin grey laminations (marl	f.	-													
to 30 degrees closel	ed burrows. Fracture set 1: horizontal y spaced (40/120/380), undulating												73			
slightly rough, with b	black specks and no infill. Fracture				15.00 - 16.50	RC	102						4			
	ees, medium spaced (579/650/3000), bugh, locally with dark yellow												0			
staining, no infill. Fra	acture set 3: three 80 degree ugh, no infill. (Grade: A2/3)															
[Lewes Nodular Cha																
-	-	r. r.														
		F.												NIDO		
		r.	-											130		
		r. r.												150		
		r.														
		f. f.														
					16.50 - 17.50	RC	102						100 31			
					10.00 - 17.00		102						12			
		r.														
		f.														
					17.40 - 17.50	D										
		r	-		17.30	U										
		- r.	In cal													
			le.so)		17.50 - 18.00	RC	102						100 20			
		f.											0			
18.00 -	18.07m : Flint fragments (up to 60mm).															
		f- f-														
		- F-			18.20 - 18.40	c										
		r.														
		r	-													
		f. f.	-										400			
		f-			18.00 - 19.50	RC	102						100 60			
18.78- 18.90	m : Possible void visible on televiewer.												40			
		r.												60 120		
		f. f.	-											400		
		f-														
		r.														
		f f-	-													
		f.														
		r.														
		f-	_													
		[
Stratum depths mea	asured along borehole axis.	• •			,				· · · · · · · ·							1
	may be subject to seasonal, tidal and o	other fluc	tuation	s and sl	hould not be	aken a	is con	stant.								
Groundwater levels																

•barn ritchies	В	BOR	E	HO	LE L	00	3					N	1L03	hole N 5-RC et 5 of	016
Project Name:	Amersham Tunnel to Calvert				Survey Gri Co-ordinate	-	em:			SGB 37.56 1	nE	Hole Ty Checked			AB,
Project No: Client:	1G063-AAZ. High Speed 2 (HS2) Ltd				Ground Le	vel:				72.49 ı 72.86 r		Approve Scale:			PM 1:2
ingineer: Date Started: Date Completed:	High Speed 2 (HS2) Ltd 23/01/2017 27/01/2017				Orientation					c 90 c	•	Log Sta Print Da Final De	te:		FIN 21/11/20 55.5
•	Stratum Description	Legend (Depth Thick-	Level			-	-	andhS	itu Test	ina		TCR	If min	
			ness) (m)	(m)	Depth (m)	Туре	(^{Dia})	Rec %	Blows (mins)	Test	Test F	Result Uni	ts RQU) (mma)k	Weter B
					19.50-21.00	RC	102						100 61 53	60	
21.00-21.40m : Dr	illing disturbed. Recovered non-intact.				21.00 - 22.50	RC	102						100 33 30	120 400	ප්ර පුර පුර පුර පුර පුර
CHALK with occasion wisps). Fracture set spaced (40/170/320), green staining on fra set 2: three 60 degre spaced (240/-/350), infill. Chalk Rock. (G [Lewes Nodular Cha			-	50.96											3080808080808080808080
	illing disturbed. Recovered non-intact. solution features visible on televiewer?		2.10)		22.50 - 24.00 23.70 - 23.90	RC C	102	2					93 40 37	40 200 350	ფ.
frequent marl burrow Fracture set 1: horizo slightly rough, with fr yellow staining. Frac	y, light <u>greyish</u> whiteCH A L Kwi th-l=f'= vs and rare chalk interclasts. ontal medium spaced, undulating equent black specks and dark ture set 2: one 70 degree fracture, th black specks and no infill. (Grade: lk Formation]		₹0 2.00)	48.86	24.00 - 25.50	RC	102						100 43 37		ფიფიფიფიფიფიფიფიფი

•barn	E	BORE	HO	LE L	00	3				I	ML03	hole N 5-RC et 6 of	016
Project Name:	Amersham Tunnel to Calvert			Survey Gri	id Syst	em:	C	DSGB	I	Hole Ty			
Ducia et Nico	10000 447			Co-ordinate	es:			87.56 n		Checke			AB,
Project No: lient:	1G063-AAZ. High Speed 2 (HS2) Ltd			Ground Le	evel:			72.49 n 72.86 m		Approv Scale:	ea By:		PM 1:2
ngineer:	High Speed 2 (HS2) Ltd									Log St	atus:		FIN
ate Started:	23/01/2017			Orientation				d	0	Print D			21/11/20
Date Completed:	27/01/2017	Depth		Inclination:		ling C	oring and h S	90 d	-	Final D	·	If min	55.5
	Stratum Description	Legend (Thick- ness) (m)	Level (m)	Depth (m)	Туре	1	Rec Blows % (mins)	Test	Test Ro	esult Ur	its RØ	lfave Df(rmma)x	Weter Ba
25.50-25.90m:Dr	25.25 - 25.30m : Grey marl seam. illing disturbed. Recovered non-intact.											NI 80 200	ර හිදු හිදු හිදු හිදු හිදු හිදු
with thin grey lamina burrows. Fracture se medium spaced (5/4 with frequent black s infill. Fracture set 2: - (10/1200/1400), und specks dark yellow s degrees to vertical, u	"竹好.暇分gœ.ylst::WhtedALKbc:ailyJ= ations (marl wisps) and frequent marl et 1: horizontal to 20 degrees, 30/600), undulating slighUy rough specks and dark yellow staining, no 45 to 60 degrees, widely spaced ulating slighUy rough, with frequent staining. Fracture set 3: rare 60 undulating slightly rough, with s and no infill. (Grade: A2) nation]	2 oc 2	46.86	25.50 - 27.00 21.00 - 31.50 26.60 26.60 - 26.70	RC D D	102		Falling Head	6.7E	006 m	100 40 37		ადი ფი ფი ფი ფი ფი ფი ფი ფი მი ფი ფი ფი ფი ფი
	27. 10- 27. 17m : Grey marl seam.		45.34										ვიფიფიფიფიფი
Grey marl seam. Po New Pit Chalk Form	ssibly Upper Glynde Marl? nation	27.60	45.26										00
Weak, medium dens with thin grey lamina burrows. Fracture se medium spaced (5/4 with frequent black s infill. Fracture set 2: - (10/1200/1400), und specks dark yellow s degrees to vertical, to frequent black speck [New Pit Chalk Form	sity, light greyish white CHALK locally titions (marl wisps) and frequent marl et 1: horizontal to 20 degrees, 30/600), undulating slighUy rough specks and dark yellow staining, no 45 to 60 degrees, widely spaced ulating slighUy rough, with frequent staining. Fracture set 3: rare 60 undulating slightly rough, with as and no infill. (Grade: A2)			27.00 - 28.50	RC	102					100 53 43	NIDO 40 110	රු හිදු හිදු හිදු හිදු හිදු හිදු හිදු
Grey marl seam. Po New Pit Chalk Form Weak, medium dens with thin grey lamina burrows. Fracture se medium spaced (5/4: with frequent black s infill. Fracture set 2: - (10/1200/1400), und	illing disturbed. Recovered non-intact. ssibly Lower Glynde Marl?		43.61 43.54	28.50 - 30.00 29.45 - 29.70		102					100 60 57		ფიფი ფიფი ფი

•barn	E	BOF	RE	НО	LE L	00	3					N	1L03	ehole N 5-RC et 7 of	016	
Project Name: Project No: Client: Engineer: Date Started: Date Completed:	Amersham Tunnel to Calvert 1G063-AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd 23/01/2017 27/01/2017				Survey Gr Co-ordinat Ground Le Orientation Inclination:	es: evel: n:	em:		49928 1935	OSGB 37.56 r 72.49 r 72.86 n c 90 c	nE nN nOD leg.	Hole Typ Checked Approve Scale: Log Sta Print Da Final De	l By: d By: tus: te:		1: FII 21/11/2	ИсG :25 NAL
	Stratum Description	Legend	Depth (Thick- ness) (m)	Level (m)	Depth (m)	Sampl Type	1	Rec	andh Si Blows (mins)	tu Testi Test	ing Test R	esult Unit	TCR SCR s RØD	lfmin Ifave (mna)x	Weter Ba	Well
	Indulating slightly rough, with is and no infill. (Grade: A2) ation]			+	30.00 - 30.20 30.00 - 31.50		102						83 20 17		یں <u>ج</u> ہ جہ جہ جہ جہ جہ جہ م	
31.50	Flintfragments (upt0 60mm), possible flint band. 31.35 - 31.41m : Grey mart seam. 31.57m : Flint fragments (up to 20mm).		- 	40.46	31.50 -33.00	RC	102						100 9 9	NIDO 40 110	080808	
New Pit Chalk Form Weak, medium dens with thin grey lamina burrows. Fracture se medium spaced (5/43 with frequent black s infill. Fracture set 2: 4 (10/1200/1400), und specks dark yellow s degrees to vertical, to	ity, light greyish white CHALK locally titions (marl wisps) and frequent marl t 1: horizontal to 20 degrees, 30/600), undulating slighUy rough ppecks and dark yellow staining, no 45 to 60 degrees, widely spaced ulating slighUy rough, with frequent staining. Fracture set 3: rare 60 undulating slightly rough, with s and no infill. (Grade: A2)		-32.40 -32.45 	40.46 40.41											_	
					33.00 - 34.50 34.30 - 35.05		102						100 7 0	NIDO 150 300		
Groundwater levels Explanation of symb	asured along borehole axis. may be subject to seasonal, tidal and o bols and abbreviations given in 'Key to n on appended 'Borehole Infonmation S	Explorat			hould not be t	taken a	s con	istant.			<u> </u>					

•barn	E	BOF	RE	HO	LE L	00	G					ſ	ML03	hole N 5-RC et 8 of	016	
Project Name:	Amersham Tunnel to Calvert				Survey Gr	id Syst	em:			SGB		Hole Ty	vpe:			RC
Project No:	1G063-AAZ.				Co-ordinat	es:				37.56 r 72.49 r		Checke Approve				B, CB PMcG
Client:	High Speed 2 (HS2) Ltd				Ground Le	evel:				72.86 r		Scale:	<i></i>			1:25
Engineer:	High Speed 2 (HS2) Ltd 23/01/2017				Orientatior							Log St				FINAL /2017
Date Started: Date Completed:	27/01/2017				Inclination					c 90 c	•	Print Da Final De				5.50m
	Stratum Description	Legen	Depth (Thick	- Level	Depth	Samp	ling, C	oring	andhS	ituTest	ing		TCR SCR			Well
		Logon	ness) (m)	(m)	(m)	Туре	(Ria)	Rec	Blows (mins)	Test	Test F	Result Uni			Weter	
	sity, light greyish white CHALK locally ations (mart wisps) and frequent mart	' ľ	_	t												
burrows. Fracture se	at 1: horizontal to 20 degrees, 30/600), undulating slighUy rough	T. T.			34.50 - 36.00	RC	102									
with frequent black s	specks and dark yellow staining, no	TT	-		04.00 00.00		102							40		
	45 to 60 degrees, widely spaced ulating slighUy rough, with frequent	T T	_										100 73	40 120 450		
specks dark yellow s	staining. Fracture set 3: rare 60 undulating slightly rough, with	T T	_										63	430		
frequent black speck	ks and no infill. (Grade: A2)	TT	-													
[New Pit Chalk Form	nationj	T T	_													
	sity, light greyish white CHALK with	T T	-35.90	36.96												
horizontal to 20 deg	ations (mart wisps). Fracture set 1: rees, medium spaced (40/400/550),	T T	-													
	ough with frequent black specks and , no infill. Fracture set 2: 40 to 60															
degrees, widely space	ced (50/900/2500), undulating requent specks dark yellow staining.	r r	E													
Fracture set 3: rare 8	30 degrees to vertical, undulating		E													
(Grade: A2)	requent black specks and no infill.		_													
[New Pit Chalk Form	nation]				36.00 - 37.50	RC	102						100 37			
		T T	_		00.00 07.00								0			
			_													
			-													
37.15-37.30m:Di	rilling disturbed. Recovered non-intact.	1 T	Ē													
			F											NIDO		
		ГГ	Ē											50 150		
		T T	-											150		
		T T														
		T T	_													
		1,1,1	(5.06)													
		TT														
		T T	F		37.50 - 39.00	RC	102						100 23			
			E										0			
			_													
			-		38.70 - 38.80	D										
		ГГ	E												-	
		T T	E		39.00-39.22	2 C										
	—	L. L	E													
39.29-39.36m	: Tabularffint fragments (up to 20mm). Sheet ffint visible on televiewer.	T T	-										100			
		TT											53			
		L L	-										47			
		T T	E		39.00 - 40.50	RC	102									
		r r	F													
			-													
Stratum depths mea	asured along borehole axis.															L
	may be subject to seasonal, tidal and	other flu	ctuatior	ns and s	hould not be	taken a	as con	istant								
	bols and abbreviations given in 'Key to		tory Ho	oles'												
Further details give	n on appended 'Borehole Information S	Sheer.														
															/-	

•barn ritchies	BO	RE	HO	LE L	00	3					1	L03	hole N 5-RC et 9 of	016	
Project Name: Amersham Tunnel to Ca	lvert			Survey Gr		em:			SGB	- F	Hole Typ				RC
Project No: 1G063-AAZ.				Co-ordinat	es:				37.56 n 72.49 n		Checked Approved				B, CB PMcG
Client: High Speed 2 (HS2) Ltd				Ground Le	evel:			-	72.86 n	nOD	Scale:	-			1:25
Engineer: High Speed 2 (HS2) Ltd Date Started: 23/01/2017				Orientatior	1:				d	ea.	Log Star Print Dat				FINAL /2017
Date Completed: 27/01/2017				Inclination:					90 d	•	Final De				5.50m
Stratum Description	Legend	Depth (Thick- ness) (m)	Level (m)	Depth (m)	Sampl Type	1	Rec	and h Si Blows (mins)		•	Result Units	TCR SCR RØD	lfmin Ifave (mna)x	Weter	Well Backfi
Weak, medium density, light greyish white CHA rare thin grey laminations (mart wisps). Fractur horizontal to 20 degrees, medium spaced (40/- undulating slighUy rough with frequent black sp dark yellow staining, no infill. Fracture set 2: 40	e set 1: 400/550), becks and		-												
degrees, widely spaced (50/900/2500), undula slighUy rough, with frequent specks dark yellow Fracture set 3: rare 80 degrees to vertical, und slighUy rough, with frequent black specks and	ting / staining. ulating														
(Grade: A2) [New Pit Chalk Formation] Grey mart seam. Possibly New Pit Mart 1?		40.96													
New Pit Chalk Formation Weak, medium density, light greyish white CH/ rare thin grey laminations (mart wisps). Fractur horizontal to 20 degrees, medium spaced (40/- undulating slighUy rough with frequent black sp	e set 1: 400/550), becks and	4 1.05	31.81	40.50 - 42.00	RC	102						100 13 10			
dark yellow staining, no infill. Fracture set 2: 40 degrees, widely spaced (50/900/2500), undula slighUy rough, with frequent specks dark yellow Fracture set 3: rare 80 degrees to vertical, und slighUy rough, with frequent black specks and	ting v staining. ulating														
(Grade: A2) [New Pit Chalk Formation] 41.23-42.00m:Drilling disturbed. Recovered in	non-intact.														
42.30 - 42.35m : Orange staining. Sp	bonge bed.														
				42.65 - 42.85 42.00 - 43.50	C RC	102						100 60 60			
		(7.61)													
				43.50 - 45.00	RC	102						100 35 30			
Stratum depths measured along borehole axis	•														
Groundwater levels may be subject to season: Explanation of symbols and abbreviations give Further details given on appended 'Borehole Ir	al, tidal and other fleen in 'Key to Explor			hould not be t	taken a	as cor	nstant.								

•barn ritchies	BORE	HO	LE L	00	3					1L03	hole N 5-RC t 10 of	016	
Project Name: Amersham Tunnel to Calvert Project No: 1G063 -AAZ. Client: High Speed 2 (HS2) Ltd			Survey Gr Co-ordinat Ground Le	es:	em:		OSGB 9287.56 3572.49 72.86	mN	Hole Typ Checked Approve Scale:	l By: d By:		1	Mc(:25
Engineer: High Speed 2 (HS2) Ltd Date Started: 23/01/2017 Date Completed: 27/01/2017			Orientation Inclination					deg. deg.	Log Sta Print Da Final De	te:		FI 21/11/2 55.1	
Stratum Description	Legend Depth (Thick- ness) (m)	Level (m)	Depth (m)	Sampl Type	1	oring and h Rec Blov % (mir		ting Test I	Result Unit	TCR SCR s RØD	lfmin lfave (mma)x	Weter Ba	We ack
45.70- 46.35m : Drilling disturbed. Recovered non-ir	ntact.		45.00 - 46.50	RC	102					100 50 43			
			46.50 - 46.68	с									
			46.50 - 48.00	RC	102					100 70 53	NIDO 150 340		
Drilling disturbed. Recovered as weak, low density, greyish white CHALK. With abundant randomly orientated fractures, closely spaced, infilled (<3mm) soft brown clay. (Grade: B3) [New PitChalk Formation]		24_20	48.65 - 48.75 48.00 - 49.50		102					100 17 10			
Stratum depths measured along borehole axis. Groundwater levels may be subject to seasonal, tid Explanation of symbols and abbreviations given in ' Further details given on appended 'Borehole Inform	Key to Exploratory Ho		hould not be	taken a	as con:	stant.		<u> </u>			<u> </u>		
Office: BAM Ritchies, Glasgow Road, Kilsyth, Glasgow	G65 9BL								BAN	I R Boi	ehole Lo	og 06/04 [.]	12

•barn	E	BORE	HO	LE L	00	3							5-RC(t 11 of	
roject Name:	Amersham Tunnel to Calvert			Survey Gr	id Svst	em:		OSGE		Ho	le Type		1101	12
,				Co-ordinat			49	9287.56			ecked			AB
Project No:	1G063-AAZ.						19	3572.49	mN	App	proved	By:		Р
lient:	High Speed 2 (HS2) Ltd			Ground Le	evel:			72.86	mOD	Sca	ale:			1
ngineer:	High Speed 2 (HS2) Ltd									Loç	g Stat	us:		FI
ate Started:	23/01/2017			Orientation	1:			-	deg.	Pri	nt Date	э:	1	21/11/2
Date Completed:	27/01/2017			Inclination				90) deg.	Fin	nal Dep	oth:		55.
	Stratum Description	Legend (Thick ness)	- Level (m)	Depth (m)	Sampl Type		oring and		Тоо	t Resul	t Units	TCR SCR RØ4D	lfmin lfave l(mma)x \	Veter E
greyish white CHAL	ecovered as weak, low density, light K. With abundant randomly closely spaced, infilled (<3mm) with	(m)		(11)	Type	((11111)								
soft brown clay. (Gra [New Pit Chalk Form	ade: B3)			49.50 - 51.00	RC	102						100	NIDO	
												0 0	150 340	
				51.00 - 52.50	RC	102						100 7 7		
				54 00 50 05	-								1	
				51.90-52.05	D								1	
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		(6.84)											1	
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		1 II -											1	
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													NIDO	
													50 90	
												100	l	
				52.50 - 54.00	RC	102						6	1	
												0	1	
													1	
				54.10-54.20	D								l	
												100		
												10 0		
				54.00 - 55.50	RC	102								
		+												
Stratum depths may	asured along borehole axis.													

•barn ritchies	E	BOF	RE	HOL	E L	.00	6						MLC	rehole I 035-RC eet 12 o	016	
Project Name:	Amersham Tunnel to Calvert				Survey G Co-ordina	-	em:			SGB 37.56 r			Type: ked By			R B, C
Project No: lient:	1G063-AAZ. High Speed 2 (HS2) Ltd				Ground L	evel:				72.49 r 72.86 n	nN nOD	Appro Scale	oved B	y:		PM0 1:2
ngineer: ate Started: bate Completed:	High Speed 2 (HS2) Ltd 23/01/2017 27/01/2017				Orientatio Inclination					d 90 d	eg.	Print	Status: Date: Depth		21/11	FIN 1/20 5.50
-	Stratum Description	Legend	Depth (Thick ness)	- Level (m)	Depth	Sampl	-	-	and h Si Blows	tuTest	ng		Т	CR Ifmin CR Ifave 3D Ifmmax		Τ
greyish white CHALI orientated fractures, soft brown clay. (Gra			(m)		(m)	Туре	(mm)	%	Blows (mins)					NIDO 50 90		
[New PitChalk Form Boreho1e∓	ation] lerminated at55.50 mJ ⊫	=1-55	.50	17.36										90	-	
			f- f-													
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			f- f-													
	asured along borehole axis. may be subject to seasonal, tidal and pols and abbreviations given in 'Key to	other flue	ctuation	ns and she	ould not be	taken a	s cons	stant.								

,,.b	a ri			BO	REH	OLE	IN	FOR	MA	T	ION	SH	IEE1	Γ		ML	orehole N 035-RC Sheet 1 of	016
Project N Project N Client: Engineer:	0:		1G063 · High Spe	am Tunnel -AAZ eed 2 (HS2 eed 2 (HS2	2) Ltd				Surve Co-oro Grour	dinate			OSG 499287.5 193572.4 72.8	6 mE	Che App Log	le Type: ecked E proved g Statu	By: By:	RC AB, CB PMcG FINAL
Date Star Date Con			23/01/20						Orient		:			deg.		ate: al Dept	h.	21/11/2017
Date Con	iipieteu.		27/01/20	117		D	epth Re	elated Explora			mation			0 deg.	FIN	ai Depi	11.	55.50m
From <ml 0.00</ml 	To rr 1.20		Tvoe IP	Start 23/01/2017	End 23/01/2017	Plant Insulated digging	g tools	Barrel	Drill		L. Ro	Driller berts		Loaaer I. Soley			Remar	ks
1.20 4.50	4.50 55.50		RC RC	23/01/2017 24/01/2017	23/01/2017 26/01/2017	Cornacchio 305		Geobor-S (146) Geobor-S (146)	PCI			oberts		C. Elenwa C. Elenwa				
				11-Drillina Pro							er bv Deoth		_			Diameter	bv Deoth	
Date 23/01/2017	07:30)	Deoth <ml 0.00</ml 	Casinanl 0.00	Depth Water (m) Dry 1.90	start of shift	S	Deoth <ml 2.50 55.50</ml 	Dia.Im 168 146		Rem	narks	Deoth < 2.50 55.50		.rmml 168 146		Remar	KS
23/01/2017 24/01/2017 25/01/2017 25/01/2017 25/01/2017 26/01/2017 26/01/2017 27/01/2017	18:00 07:30 07:30 17:00 07:30 07:30 18:00 07:30		4.50 4.50 27.00 55.50 55.50 55.50 55.50 55.50	4.50 4.50 27.00 55.50 55.50 0.00 0.00	1.90 1.90 9.20 9.70 8.30 9.80	End of shill start of shift End of shill start of shift End of shill start of shift End of shill start of shift		55.50	146	6			55.50 ater Added F		146			
27/01/2017	15:0		55.50	0.00		End of shill		From (m)	To (r	m)	Volume (Iltres)		alei Audeu i	Cecorus	Rema	arks		
			Dept	Related Rer	narks				Chi	isellini	Details				Drilli	no Flush	Details	
From (m)	To (m)	Elush			Remarks	-		From (m)	To (r		Duration (hh:mm)	Tool	From (m		n) Retu	rns (%)	Flush	Colour
1.20 3.00	2.50 7.50	Poorr	ecovery - ro	tary coring uns	commence corin suitable for groun	g. Id conditions (sand	dand						2.50	3.00		0-100	Polymer- Purebore	Brown
7.50	8.50	grave Driller	s note: poor	recovery in p	por quality chalk.								3.00	4.50		0- 50	Polymer- Purebore	Brown
7.50 21.00	31.50			umed top of ch carried out in st		changed to white.							4.50	6.00	60	0- 80	Polymer- Purebore	Orange
			,										6.00	7.50	50	0- 50	Polymer-	Orange
													7.50	8.50	70)- 70	Purebore Polymer-	White
																	Purebore	
Dale	Strike(m)	caalrci(er Strikes Depth (m) Seal	ed(m) R	emarks	Type F	Monito Pipe ID From(m			Pioe Work	Remark	s From (m	n) To (m		ackfill De gend		aiption
			/ ()				SP SP	1 0.00 1 21.50	21.50 31.50	50 50	Plain Slotted		0.00 0.05	0.05	9	910 F	lush cover concrete	1 -
													0.50 19.00 21.00 31.50 33.50	19.00 21.00 31.50 33.50 55.50		904 G 903 B 902 G 903 B	Grout Sentonite Gravel Sentonite Grout	
Depth (ml	Туре	N Vslue	e Casina (m otor (ml	SW/Pon/mm Blo	ws1 Pen1(mml		ndard Penetra			ts nml Blows4	Bon4/mm		onE/mml	Ployee	Pen6(mr	ml Hamme	r E. Ratio%
Deput(ini	турс	IN VSIUC	e Casina (i	in ater (in	Bio	war reni(iiiiii	DIOW32	renz(iiiiii	DIOW35	6113(1	IIIII DIOW34	r en4(iiii	II DIOW35 P	eno(inini	DIOWSO	reno(iiii	III Hamme	L. Ratio /6
						Reason for Ho	oleTer	mination: I	Reache	d sch	eduled de	pth						
0																		
Ground	water le	vels c	an be sul	oject to sea	asonal, tidal a	and other fluct	uatior	is and sho	uid not l	pe tal	ken as cor	nstant.						
DAM D					accow CEE											_		06/04/2017

BAM Ritchies, Glasgow Road, Kilsyth, Glasgow G65 9BL

".b	a r	n		BC	REH	OLE	IN	FOF	RM	ΑΤ	ION	SH	EET			Borehole	
r Project Na Project Na Client: Engineer:	0:	;	1G063 - High Spe						Co-	vey Gr ordinat und Le			OSGB 499287.56 193572.49 72.86	mN	Hole Ty Checker Approve Log St Date:	<u>Sheet 2</u> pe: d By: ed By:	
Date Star Date Com			23/01/20 27/01/20							ntatior nation				deg. deg.	Final D	epth:	55.50m
From <ml< td=""><td>Tor</td><td></td><td>Туое</td><td>Start</td><td>End</td><td>Plan</td><td></td><td>elated Explo Barrel</td><td>oratory H</td><td></td><td>ormation</td><td>dDriller</td><td></td><td>oaaer</td><td></td><td></td><td>marks</td></ml<>	Tor		Туое	Start	End	Plan		elated Explo Barrel	oratory H		ormation	dDriller		oaaer			marks
			Bolin	11-Drillina Pr	iress				Hole	Diame	ter by Deoth			Ci	asina Diam	eter bv Deatt	h
Date	Tim	e	Deoth <ml< td=""><td>Casinanl</td><td>Depth Water (m)</td><td>Remar</td><td>ks</td><td>Deoth <r 2.50</r </td><td>nl Dia</td><td>.lmml 168</td><td></td><td>marks</td><td>Deoth <ml 2.50</ml </td><td>Dia.rr</td><td>mml 8</td><td></td><td>marks</td></ml<>	Casinanl	Depth Water (m)	Remar	ks	Deoth <r 2.50</r 	nl Dia	.lmml 168		marks	Deoth <ml 2.50</ml 	Dia.rr	mml 8		marks
								55.50		146			55.50	140	6		
								From (m) To) (m)	Volume (Iltres		ter Added Rec		Remarks		
			Donti	Related Re	marka					Chicollin	iDetails				Drilling El	ush Details	
From (m)	To (m)	_	Depti	Related Re	Remarks			From (m		o (m)	Duration (hh:mm	i) Tool	From (m) 8.50	To (m) 12.00	Returns (%		
							1			- 16 - 11			12.00	55.50	0	Purebore Polymer Purebore	 No returns
Dale	Strike(m)) caalrc		er Strikes Depth (m) Sea	led(m) R	emarks	Type P				n Pioe Work	Remarks	From (m)	To (m)	Legend	Details	Desaiption
								ndard Pene									
Depth (ml	Туре	N Vslu	ue Casino C	m V ater (m)	SWPen(mm Blo	ws1 PenHmm) Blows2	Pen2(mm) Blows3	Pen3(mm) Blows4	Pen4(mm)	Blows5 Pent	5(mm) Blo	ows6 Pen6	(mm) Han	mmer E. Ratio%
						Reason for H	loleTer	mination	React	ned sc	heduled d	epth					
					asonal, tidal a lasgow G65 s		ctuation	ns and sh	ould no	ot be ta	aken as co	nstant.				BAM R	Info 06/04/2017

bar							[DISCONTINU	ITY SHEET			Borehole No ML035-RC016 Sheet 1 of 1
Project Name: Project No: Client: Engineer: Date started:		1G06 High S	sham Tunnel to C 3-AAZ Speed 2 (HS2) Lt Speed 2 (HS2) Lt	d					Survey Grid System: Co-ordinates: Ground Level: Orientation:	OSGB 499287.56 mE 499287.56 mN 72.86 mOD	Hole Type: Checl <ed by:<br="">Approved By: Log Status: Date:</ed>	RC AB,CB PMcG FINAL 21/1112017
Date Completed:		23101						Discontinu	Inclination:	deg. 90 deg.	Final Depth:	55.50m
Top(m) 15.576 15.87 15.87 15.92 HI.M	Bilse(m) Is.ec Is.n **** 16.00 ****	Type RackJoi1t Rocfyom RockJc*II Rock.Ic*II	10 90 10 10 30	SSR(mm) S ht IOU h S ht IOU h S ht IOU h S ht IOU h S ht IOU h	MSR (cm) Undiha Unditn: Undia.thq Undia.lh	JRC 1 10 1 12	JCS	Aperture Observation I Noinlil I Noinlil Noinlil	rrilling/Materiil			
TL.M		Rock.k*d		s 11T			11	Notaili		•		_
18.15		Roi*Joi'lt	;=	S ht KOU h	Und•tn1							
17.05	17.011	Rock Jam	0 #1	S hi IOU h	Und•tilq							
17.64 111.15	11.n 18.26	RockJoi1t Roi®Joi1t	0	S ht IOU h S ht IOU h	Und1Mti11 Und1Mti11							
18.50	j0.87	RockJoi1t RockJoi1t	"	S ht iou h S hi iou h	Undia.tn1 Undu							
111.78 111.87	18.81	Rollk-InInI Rock.Joni:	10 10	Ro h S hi ıou h	atng			mfil				
111.05 18.12 19.37 19.53 19.159	18.20 18.20	Roi*.k*d Roi*.k*d Rock.Jom RockJoi1t	88°	Shi IOUh Sht IOUh Sht IOUh Sht Iouh		10						
19.87	10.53 19.7(1 20.1(1 20.!S	RoteJoilt RockJoill RockJMll		Shtiouh Shtiouh Shtiouh Shtiouh		M						
20.77 29.37 21.73 21.98	20:::S 79:71 79:00	Rock.k*rt Rock.k*rt Roc*Joi1t	80 0	Shi Kevin Shi Kevin Shi Kevin		10 14						
		Roefl:Joilt RockJoi1t	0	S ht IOU h S				1 :::::				
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3x7 Image: Mail 0' S hi ligh h 12 I Notali 351 71.0' Rode: A' 0 S hi rou h 14 Notali 71.1' Rode: A' 0 S hi rou h 14 Notali 71.1' Rode: A' 0 S hi rou h 1 Notali 71.1' Rode: A' 0 S hi rou h 1 Notali 71.1' Rode: A' 0 S hi rou h 1 Notali 71.1' Rode: A' 0 S hi rou h 1 Notali 71.3' 73.6' Rode: A' 0 S hi rou h Notali 77.4' 73.5' Rode: A' 0 S hi rou h Urdin.h 12 73.7' 73.75' Rode: A' 10 S hi rou h Urdin.h 12 Notali 73.7' 73.75' Rode: A' 0 S hi rou h Urdin.h 12 Notali 80.4' 80.5' Rode: A'' 0' S hi rou h Urdi.	35.77	38.74 38.98	Rocte:Joi11 Rocte:Joi11 Rocte:JMll	20 0	S		15 15 14	Noinlil Noinlil Noinlil		
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Groundwater Evels can besubject to seasonal, tidal and dther nuctuations and should not betaken as constant. Reason for Hole Termination: Reached scheduled depth	38.51 38.00 38.77	38.80 38.70 87	Rocte-Inini	0 0 111	S hi 100 h			=.		
Groundwater evels can besubject to seasonal, tidal and other nuctuations and should not be taken as constant.	38.81	-,,	Rocte: Joil 1	þ	Sighily10ugh	Planar	10	Noinlil		
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Project Name: Project No: Client: Engineer: Date Started: Date Completed:	Amersham Tunnel to Calvert 1G063-AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd 24/01/2017 27/01/2017			Survey Gr Co-ordinat Ground Le Orientation Inclination	evel: n:			49917 19364 7	1.03 n 0.95 n d 90 c	nE Cl nN Ap nOD Si La eg. P deg. Fi	ole Type: hecked E oproved cale: og Statu: rint Date: nal Dept	: By: By: s:	et 1 of	F PMcG, C PMc 1:2: FIN/ 21/11/20 ⁻ 25.00
	Stratum Description	Legend Legend		Depth		-		and h Sit Blows		1	_		If min If ave	Weter W Ba
subangular and sub [Alluvium] Stiff orangish browi	/ sandy gravelly clayey SILT. Gravel is prounded fine to coarse of flint. n very gravelly CLAY with medium bble content. Gravel is subangular to	$\begin{array}{c c c c c c c c c c c c c c c c c c c $)	(m) 0.50 1.00	В	(mm)	%	(mins)		Test Resu		%	(mm)	•.z ;: •.z !''/ tti- ;;z
subrounded fine to <u>Alluvium</u>] No recovery. Driller GRAVEL. [Alluvium]	coarse of flint.		69.75	1.20-2.20 2.20-2.50	RC	102			S	50/150		ο ο ο		
		Γ. Γ. Γ. Γ. Γ. Γ. Γ. Γ. Γ. Γ. Γ. Γ. Γ. Γ	~	2.20 - 2.95 2.95 - 3.70	RC	102					_	0 0 0 0	NR -	
				3.70-4.00 3.70-4.20	RC	102			S	50/150)	000 0		
		с		4.20-4.70	RC	102					-	<u>aaa</u> <u>a</u> aa		

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roject Name:	Amersham Tunnel to Calvert				Survey Gr Co-ordinat	-	em:	4991	DSGB 79.42 i			ed By:		PMcG
roject No: lient: ngineer:	1G063-AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd				Ground Le	evel:			41.03 r 70.95 ı		Appro Scale: Log S			P F
ate Started: ate Completed:	24/01/2017 27/01/2017				Orientation Inclination	:			d 90 (deg.	Print [Final	Depth:		21/11/2 25
	Stratum Description	Legend	Depth (Thick- ness) (m)	Level (m)	Depth (m)	Samp Type	Dia R	<u>ingand In S</u> ec Blows % (mins)			esult Ur	TCR SCR hits RQD %	If min If ave If max (mm)	Weter
No recovery. Driller GRAVEL. Alluvium]	notes flush returns of SAND and	f- f- r.	-									— NR	-	
No recovery. Driller	notes flush returns of CHALK with	r. r. f.	5.40	65.55	5.20 -5.65				s	N=	50	0 0		
ints.		f r r			5.20-5.70	RC	102					° 		
		r. r. f. f.	-		5.70-6.20	RC	102					0		
		f r r	<1.30) -									0	NR -	· ·
		r. r. ř:	- - -		6.20-6.70	RC	102					8		, ,
rilling disturbed R	ecovered as: dark grav slightly	r r 	 	64.25								0		
ubrounded coarse		f	10.30) -	01.20									NA -	
ewes Nodular, Ch orecovery. Briten ints.	nalk Formation of OHALK with		.00	63.95										,
		r. f. f.	-									20		,
		r. r r	-		6.70-8.20	RC	102					0		
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		t: r. r	= <2.70) 										NR	1
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		r. 1.	-		8.20-9.70	RC	102					8		j
		r F F										0		
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		r. f. f. r.	-											1 1
No recovery. No flus	h returns at surface.	r. r	-9.70 - -	61.25										ļ
		f.	-											
Stratum denths may	asured along borehole axis.	I												

•barn	E	BO	RE	HO	LE L	00	3							5-R0	
roject Name:	Amersham Tunnel to Calvert				Survey Gri	d Syste	əm.		0	SGB	Ho	Іе Турє		et3of	5
rojoot nume.					Co-ordinat					'9.42 m		ecked			PMc
roject No:	1G063 -AAZ.									41.03 m		proved	By:		F
lient:	High Speed 2 (HS2) Ltd				Ground Le	vel:			7	0.95 m		ale:			_
ngineer: ate Started:	High Speed 2 (HS2) Ltd 24/01/2017				Orientatior	ŀ				de		g Statu nt Date			F 21/11
ate Completed:	27/01/2017				Inclination					90 d	-	al Dep			25
			Depth (Thick-	1		Sampli	ing, C	oring a	andh Si	tu Testi	ng		ICR SCR	If min If ave	
	Stratum Description	Legend	(Thick- ness) (m)	Level (m)	Depth (m)	Туре	Dia (mm)		Blows (mins)	Test	Test Result	Units	SCR RQD %	If ave If max (mm)	Weter
No recovery. No flus	sh returns at surface.		1- 1- 1-		9.70 - 10.45	RC	102						0		
			r										6		
			r- f- f-		10.43	EW							+		
			f- r-												
			r- r-										0		
			F=		10.45 - 11.20	RC	102						8		
			f- f- f		6.00-16.00					Falling		m/s			
			r- r-		0.00-10.00					Head		11/3			
			r- r-									-			
			r f-										0		
			f- f- r-		11.20 - 11.70	RC	102						0 0 0		
			r- r-										0		
			83.70)										N	۶ -	
			f- f-											-	
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			r- r-	F7 FF									- 2		
Structureless CHAL	K composed of off-white clayey		13.40	57.55									53		
gravelly SILT, Grave	elisweak low denaity off-white with		r- r-		12.70-14.20	RC	102						0		
nodular flint cobbles			f= f-												
[Lewes Nodular Cha			f- r-		13.70 - 13.BO	D									
			r- r-												
			r- H1.30)											-	
			f- f-											NA -	
			r- r-									-	-		
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No recovery. No flue	sh returns at surface.		14.70	56.25									0	_	
			r- r-												
			f-		14.20-15.70	RC	102								

•barn ritchies	E	BORE	НО	LE L	00	3					_035	hole N 5-R0(et 4 of	002a	ı
Project Name: Project No: Client: Engineer: Date Started: Date Completed:	Amersham Tunnel to Calvert 1G063-AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd 24/01/2017 27/01/2017			Survey Gr Co-ordinat Ground Le Orientation Inclination	es: evel: n:	em:	4991 1936	DSGB 79.42 n 41.03 n 70.95 n d 90 d	nE nN nOD eg.	Hole Typ Checked Approved Scale: Log Sta Print Dat Final De	e: By: I By: tus: e:		PMcG F F 21/11/	PMcG 1:25 FINAL
	Stratum Description	Legend Depti (Thick ness)	k- Level	Depth (m)	Samp Type		oring and h S Rec Blows % (mins)	itu Testi Test	ng Test Re	esult Unit	TCR SCR s RØ&L	lfmin Ifave Dfmmaak	Weter E	Well 3ackfil
No recovery. No flus	h returns at surface.	(m))									NR		<u>ං නිං නිං නිං නිං නිං</u> <u>කර්කාරකාරකාරකා</u>
Assumed zone of co	pre loss.											NR	-	0 890 890 99
white CHALK. Fraction orientated fractures, spaced (10/20/40), p occasionally infilled to 80 degrees, dose	weak, low density, light brownish ure set 1: abundant randomly extremely dosely to very dosely blanar slightly rough, open and (<2mm) with day. Fracture set 2: 65 ly spaced (70/100/120), planar ugh, open, with no infill. (Grade: B4) lk Fonmation]		54.75	15.70-17.20 16.67-16.77	RC	102					67 0 0			
				17.20-18.70	RC	102					100 0 0	10 20 40		
Assumed zone of co	ore loss.										53	NR	-	
CHALK. No discerni randomly orientated closely spaced (NI/2	weak, low density, light greyish white ble fracture sets. With abundant fractures, extremely dosely to very 20/40), planar slightly rough, open n) with clay. {Grade: B4) lk Fonmation]	19.40		18.70-20.20 19.70-19.80	D RC	102					777	NI 20 40		
Groundwater levels Explanation of symi Further details given	asured along borehole axis. may be subject to seasonal, tidal and bols and abbreviations given in 'Key to n on appended 'Borehole Infonmation S as Glasoow Road Kilsyth Glasoow G65 9B	Exploratory H Sheer.		hould not be	taken a	I as con	Istant.	I	<u> </u>				00.06/04	4400

Co-ordinates: 499179.42 mE Che Project No: 1G063-AAZ. 193641.03 mN Appr Client: High Speed 2 (HS2) Ltd Ground Level: 70.95 mOD Scal Engineer: High Speed 2 (HS2) Ltd Drientation: deg. Prince		-R0002a et 5 of 5
Project No: 10983-AAZ. 193841.03 mM App. Client: High Speed 2 (HS2) Ltd Ground Level: 70.95 mOD Scale Date Stantation: 2401/2017 Orientation:	Hole Type: Checked By:	R(PMcG, CI
Engineer: High Speed 2 (H52) Ltd Log Date Scanpleted: 2401/2017 Orientation: 9-0 dg. Pin Date Completed: 2701/2017 Inclination: 90 dg. Pin Extremely weak to weak, low density, light greyish while CHALK. No discernible fractures extremely dosely to very closely spaced (N02400), planar sight/ rough, one Lawes. Noclular Chalk Formation 50.75 Stratum Description Type Rows Test Brows Test Brows Test Brows Dolling disturbed, recovered non-intact. Stratum of contacters by derestly, light greyish while CHALK. Not discernition of contacters by derestly, light greyish while CHALK. Recovered restly light greyish while CHALK while frequencies (2 00 45) degrees, dosely spaced (N8000100), planar sightly rough, open with orients and the green (2000). 49.45 20.95 · 21.70 RC 102 I I I I I I I I I I I I I I I I I	Approved By:	PMcC
Date Starter: 24/01/2017 Orientation: deg. Print Inclination:	Scale: Log Status:	1:25 FINA
Stratum Description Lagent Messal Lagent Messal Lagent Messal Lagent Messal Lagent Messal Sampling, Coring andh Situ Testing Extremely weak to weak, low density, light greyish white CHALK. No discribule fractures est. With abundant randomly orientated fractures, extensely dosely to very closely spaced (MI20/du), planet sightly rough, open locally inflied (-2mm) with clay, (Grade: B4) 20.20 50.75 50.00 50.00 Drilling disturbed, recovered non-intact. Leves Notdar Chalk Formation 20.05 50.00 20.20 - 20.26 RC 102 Veak to medium strong, low to medium density, light greyish white CHALK with frequent thing rey laminations (martwisp.) Fractures et : 14 to 0.45 degrees, dosely spaced (NI80/130), planet sightly rough, open with origing infractures et : 40.40.45 degrees, dosely spaced (NI80/130), planet sightly rough, open with origing infractures : 22.10m: Trnc.creamisting on fracture : 22.10m: Trnc.creamisting white Shell/ragment (20nm). 49.45 20.95 - 21.70 RC 102	Print Date:	21/11/2017
Stratum Description Level (mes) (m) (m) (m) (m) (m) (m) (m) (m) (m) (m	Final Depth:	25.00n
CHALK. No discernible fracture sets. With abundant randomy orientated fractures, estremely dosely to very closely spaced (MIZ040), planar slightly rough, open lcelwes Nodular Chalk Formation Assumed zone of core loss. Drilling disturbed, recovered non-intact. Strong, high density, light greyish white CHALK. Recovered as: sandy fine to coarse GRAVEL of chalk. Possibly Chalk Rock? [Lewes Nodular Chalk Formation] Weak to medium strong, low to medium density, light greyish white CHALK with frequent thin grey taminations find visps), Focture set 1: 10 6 degrees. Asternely closely spaced (60/80/120), planar slightly rough, open with orange iron staining on fracture surfaces. (Grade: B3) [Lewes Nodular Chalk Formation] 21.50-21.90m:Drilling disturbed. Recovered non-intact. 22.10m: 1 no. creamish white shell fragment (20mn). (a.50) (a.50) (a.50)	TCR SCR Result Units ROAD	Ifmin Ifave (mma)x Weter Backt
locative infilied (<2mm) with clay. (Grade: B4)		NI 20 40
Drilling disturbed, recovered non-intact. Strong, high density, light greyish white CHALK. Recovered as: sandy line to carse GRAVEL of chalk. Recovered as: sandy line to carse GRAVEL of chalk. Recovered as: sandy line to carse settle set		
Drilling disturbed, recovered non-intact. strong, night densiy, light greyish white CHALK. Recovered as: sandy [Lewes Nodular Chalk Formation] Weak to medium strong, low to medium density, light greyish white CHALK with frequent thin grey laminations (mari wisps). Fracture set 1: 10 6 degrees, extremely closely to dosely spaced (NU80/130). planar slightly rough, open with on sinil. Fracture set 2: 40 to 45 degrees, dosely spaced (60/80/120). planar slightly rough, open with orange ion staining on fracture sufficiences. (Grade: B3) [Lewes Nodular Chalk Formation] 21.50-21.90m: 1no. creamish white shell fragment (20mm).	0 0 0	NR
density, light greyish white CHALK. Recovered as: sandy fine to coarse GRAVEL of chalk. Possibly Chalk Rock? [Lewes Nodular Chalk Formation] 21.50 49.45 Weak to medium strong, low to medium density, light greyish white CHALK with frequent thin grey laminations (mart wisps). Fracture set 1: 1to 6 degrees, extremely closely to dosely spaced (0/80/120), planar slightly rough, open with onage inon staining on fracture surfaces. (Grade: B3) [Lewes Nodular Chalk Formation] 49.45 20.95 - 21.70 RC 102 [Lewes Nodular Chalk Formation] 21.50-21.90m: Drilling disturbed. Recovered non-intact. 22.10m: 1 no. creamish white shell fragment (20mm). 49.45 20.95 - 21.70 RC 102		
Weak to medium strong, low to medium density, light greyish white CHALK with frequent thin grey laminations (mari wisps). Fracture set 1: 10 6 degrees, extremely closely to dosely spaced (Ni/80/130), planar slightly rough, open with no inflit. Fracture set 2: 40 to 45 degrees, dosely spaced (60/80/120), planar slightly rough, open with no inflit fragment (20mm). 49.45 20.95 - 21.70 RC 102 ILewes Nodular Chalk Formation] 21.50 49.45 20.95 - 21.70 RC 102 21.50 21.50 49.45 20.95 - 21.70 RC 102 ILewes Nodular Chalk Formation] 22.09 - 22.23 C 21.00 - 23.20 RC 102 21.50 49.45 49.45 49.45 49.45 49.45 49.45 ILewes Nodular Chalk Formation] 21.50 - 21.00m: 11no. creamish white shell fragment (20mm). 21.70 - 23.20 RC 102 (3.50) 100 101 101 101 101 101		NIDO
Weak to medium strong, low to medium density, light grey/sh white CHALK with frequent thin grey laminations (marl wisps). Fracture set 1: 10 6 degrees, extremely closely to dosely spaced (NI/80/130), planar slightly rough, open with origin iton staining on fracture surfaces. (Grade: B3) [Lewes Nodular Chalk Formation] 21.00 - 22.23 C 21.50 - 12.90m: Drilling disturbed. Recovered non-intact. 22.10m: 1 no. creamish white shell fragment (20mm). 21.70 - 23.20 RC 102	100 20 13	
rough, open with no infill. Fracture set 2: 40 to 45 degrees, dosely spaced (60/80/120), planar slightly surfaces. (Grade: B3) [Lewes Nodular Chalk Formation] 21.50-21.90m: Difling disturbed. Recovered non-intact. 22.10m: 1 no. creamish white shell fragment (20mm). 21.70-23.20 RC 102 11.70-23.20 RC 102 11.70-23.20 RC 102		
surfaces. (Grade: B3) [Lewes Nodular Chalk Formation] 21.50-21.90m: Drilling disturbed. Recovered non-intact. 22.10m: 1 no. creamish white shell fragment (20mm). 21.70-23.20 RC 102 102 102 102 102 102 102 102		
21.70-23.20 RC 102		
	100 35	
	30	
		NI 80
23.20 - 24.70 RC 102		130
23.20 - 24.70 RC 102		
	100 30	
	0	
24.60-24.65m : Soft light greenish grey marl seam. 24.70-24.75m : Drilling disturbed. Recovered non-intact.		
24.70 - 25.00 RC 102 24.80 - 24.93 C	100 24 0	
Borehole Terminated at 25.00m 25.00 45.95		

-barn ritchies	B	BOR	RE	HOI	E L	.00	3						_035	ehole N 5-R00 et 1 of)03a	3
roject Name: roject No:	Amersham Tunnel to Calvert				Survey G Co-ordina	-	em:		49919	9SGB 96.52 n 33.70 n	ηE	Hole Typ Checked Approved	By:		PMc0 F	F G, C PMc
lient: ngineer:	High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd				Ground L	evel:			7	70.69 m		Scale: Log Sta	tus:			1:2: FIN/
ate Started: ate Completed:	20/01/2017 24/01/2017				Orientatio Inclination	1:				d 90 d	eg.	Print Dat Final De			20/11/ 10	/20 0.00
	Stratum Description	Legend	Depth (Thick- ness) (m)	Level (m)	Depth (m)	Sampl	-	-	and h Si Blows (mins)	tu Testi Test	ng Test Re	sult Units	TCR SCR RØD	lfmin Ifave I(mma)x	water	
ntermediate plastic ounded fine to coa	sandy gravelly silty low to ity CLAY. Gravel is angular to arse of flint. With occasional bands of angular to rounded fine to coarse	t I:I-	-													
		y }f1 t	.00)		0.50	В										1.
-	lightely sandy-siltyangulatorounde d–P.• VEL offlint. Sand isfine to coarse.	Z:- ,1.0	00	69.69	1.1	В										
IUV: ju m1.c	Clayey GRAVEL of flint. (Rotary	- <u>ð(• ' •)</u> r '	1.20	69.49												
		<	:2.30)													
		r	_													
riillers description: ole)	SAND and GRAVEL. (Rotary open		-3.50	67.19												
		[<	-													
			_													

Groundwater levels may be subject to seasonal, tidal and other fluctuations and should not be taken as constant.

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

barn	E	BOF	RE	HOI	LE L	.00	3					N	1L03	ehole N 5-R00 eet 2 of)03a	à
Project Name: Project No: Client:	Amersham Tunnel to Calvert 1G063 -AAZ. High Speed 2 (HS2) Ltd				Survey G Co-ordina Ground L	tes:	em:		49919 19363	SGB 6.52 n 3.70 n 0.69 m	ηN	Hole Ty Checke Approv Scale:	ed By:		F	RO G, CB PMcG 1:25
Engineer: Date Started: Date Completed:	High Speed 2 (HS2) Ltd 20/01/2017 24/01/2017				Orientatio					d 90 d	-	Log Si Print D Final D	ate:		20/11/	=INAL /2017 0.00m
	Stratum Description	Legend	Depth (Thick- ness) (m)	Level (m)	Depth (m)	Sampli Type	1	-	andh Si Blows (mins)	tu Testi Test	ng Test F	Result Un	TCF SCF RQU	R Ifmin R Ifave C (mma)x	water	Well/ Backfill
Drillers description: \$	SAND and GRAVEL. (Rotary open		_													0000
Drillers description: 0	CHALK. (Rotary open hole)		- 5.20	65.49												영국 가장 가장 가장 가장 가장 가장 가
r Boreho	ofe∓lerminated at10.00m+-	-+-4u.	00	60.69												
Groundwater levels Explanation of symb	asured along borehole axis. may be subject to seasonal, tidal and bols and abbreviations given in 'Key to n on appended 'Borehole Infonmation	Explorat			ould not be	taken a	s con	nstant.			<u> </u>		_	<u> </u>	L	1

•barn ritchies		BOF	REI	HO	LE L	00	3					Μ	L03	hole N 5-CR et 1 of	003
Project Name: Project No:	Amersham Tunnel to Calvert 1G063-AAZ.				Survey Gr Co-ordinat	-	em:		49903	9SGB 35.82 n 21.10 m	nE Cł	ole Typ necked oproved	e: By:		CP+ PMcG, PM
Client: ingineer:	High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd				Ground Le	evel:			7	71.34 m		cale: og Stat	tus:		1: FII
Date Started: Date Completed:	10/10/2016 26/10/2016				Orientatior Inclination	:				de 90 d	leg. Fi	int Dat nal De			20/11/2 55.0
	Stratum Description	Legend	Depth (Thick ness) (m)	- Level (m)	Depth (m)	Sampl Type	Dia	Rec	andh Si Blows (mins)	Test	ng Test Resu	It Units	TCR SCR RQD %		Weter E
	brown slightly sandy gravelly CLAY Ir to angular fine to coarse of flint.		- -(0.30) - - 0.30	71.04		В	mm		(((((((((((((((((((((((((((((((((((((((** 9* 9*
Finm light greyish br sandy gravelly CLA' fine to coarse of flint [Alluvium]	rown mottled reddish brown slightly Y. Gravel is subangular to angular t. Sand is fine.			71.04	0.50										
			(1.20)		1.00	в									
	wn very sandy angular to coarse GRAVEL of flint. Sand is fine		1.50 	69.84	1.20-1.65	u	100	40	127						
					1.65-2.10 1.65-2.20	В				S	N=33				
					2.20-2.65	u	100	100	109						
					2.65	D									
					2.65 -3.10 2.65 -3.20	В				с	N=35				
					3.20 -3.20					с	50/0				
					3.65-4.20	В									
			1 1 1 1 1 1 1 1 1 1		4.20-4.65					c	N=30				
					4.65 -5.20	в									

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Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

•barn ritchies	E	BOF	RE	HO	LE L	00	3						ML03	hole N 5-CR et 2 of	003
Project Name:	Amersham Tunnel to Calvert				Survey Gr Co-ordinat	-	em:			9SGB 85.82 n		Hole T <u>y</u> Checke	/pe:		CP+ PMcG,
Project No:	1G063-AAZ.									21.10 n			ed By:		PN
Client:	High Speed 2 (HS2) Ltd				Ground Le	evel:			7	71.34 n	nOD	Scale:			1:
Engineer:	High Speed 2 (HS2) Ltd											Log St	atus:		۶I
Date Started:	10/10/2016				Orientation	n:				d	•	Print D	ate:		20/11/20
Date Completed:	26/10/2016				Inclination	:				90 d	leg.	Final D	epth:		55.0
	Stratum Description	Legend	Depth (Thick- ness) (m)	Level (m)	Depth (m)	Sampl Type		-	and h Si Blows	tu Testi Test	ng Test Re	sult Ur	TCR SCR its RQ2	Ifave	Weter E
	wn very sandy angular to coarse GRAVEL of flint. Sand is fine														
to coarse.	COAISE GRAVEL OF MILL SAND IS MILE		r₋ >-5.20	66.14											
[Beaconsfield Grave		/	r- r-												
composed of light gr SILT. Gravel is very white with occasiona subangular fine to c	tecovered as: Structureless CHALK reyish white motHed brown gravelly weak, medium density, light greyish al black specks, angular to coarse of chalk. With occasional coarse gravel of flint fragments. alk Fonmation?]		r- f- f- f- t- t- t- t- t-		5.20 -5.65					S	N=14	1			
			- f- f- f- t- t- t- t-		5.65 -6.50	в									
			f- f- r- r- t<2.BO) r-		6.50 -6.95	u	100	100	24						
			r- f- f- r-		6.95	D	100	100	24						
			f f f f		6.95 -7.40					s	N=1	7			
			f- f- f- r-			в									
			r- r- r- f- f- f-		6.95 -8.00	B									
	ecovered as: Structureless CHALK reyish white slightly sandy silty		r- r- - ::.00 r-	63.34	7.97										.SZ
weak, medium dens occasional subangul	ar fine to coarse GRAVEL. Clasts are ity, white with black specks. With lar fine to coarse gravel of flint, and bles of flint and chalk. (Grade alk Fonmation?)		r- r- f- f- f- r-		8.00 - 8.45	U-NR	100		21						
			r- r f- f- f-		8.45 -8.90					S	N=6				
			r- r- r- r-		8.45 -9.50	в									
			f= f= f= f=												
			r- r- f- f- f-												
			f f f f		9.50 -9.95	U-NR	100		27						
			r-		10.00	w					1				I 1

Groundwater levels may be subject to seasonal, tidal and other fluctuations and should not be taken as constant.

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

•barn	E	BORE	10	LE L	00	3					ML	orehole 035-CI heet 3 c	R003
Project Name:	Amersham Tunnel to Calvert			Survey Gri Co-ordinat		em:			SGB 5.82 n		le Type: ecked E		CP+F PMcG, 0
Project No: lient:	1G063 -AAZ. High Speed 2 (HS2) Ltd			Ground Le	evel:				21.10 n 71.34 m	nOD Sc			PM0 1:2
ngineer: ate Started: Date Completed:	High Speed 2 (HS2) Ltd 10/10/2016 26/10/2016			Orientation					d 90 d	eg. Pri	g Status int Date: nal Depth		FIN 20/11/20 55.00
	Stratum Description	Legend (Thick- ness) (m)	Level (m)	Depth (m)	Sampl Type	- ⁻	-	and h Sit Blows (mins)	tu Testi Test	ng Test Resu	It Units	CR Ifmi SCR Ifave ⊠2D (mnna)∢	
				9.95 - 10.40					s	N=22			
10. 45 m : Wii	th occasional subangular chalk cobbles.			10.43 10.44 9.95 - 11.00	EW EW B								
				11.00-11.45					S	N=20			
				11.45 - 12.50	В								
13.00 <i>m</i> : V	With occasional subangular ffint cobbles.			12.50 - 12.95					S	N=18			
				12.95 - 14.00	В								<u> </u>
14.45m: Gravelan	d cobbles become predominantly white			14.00 - 14.45	U-NR	100		25					හිද හිද හිද හිද හිද
chalk, with ra	re subangular fine to coarse ffint gravel.			14.45 - 14.90					S	N=7			. ඉදිං ඉදිං
				14.45 - 15.50	в								000

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Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

•barn ritchies	E	BOF	RE	HO	LE L	00	3					N	IL03	hole N 5-CR(et 4 of	003	
Project Name:	Amersham Tunnel to Calvert				Survey Gr Co-ordinat		em:			SGB 5.82 m		ole Typ hecked			CF PMc0	P+R G, (
Project No:	1G063-AAZ.								19372	1.10 m	nN A	pprove	d By:		F	PM
lient:	High Speed 2 (HS2) Ltd				Ground Le	evel:			7	1.34 m		cale:				1:2
ngineer:	High Speed 2 (HS2) Ltd											og Sta				FIN
Date Started:	10/10/2016				Orientation					d	-	rint Dat		2	20/11	
Date Completed:	26/10/2016				Inclination					90 d	· ·	inal De			55	5.0 T
	Stratum Description	Legen	Depth (Thick ness) (m)	- Level (m)	Depth (m)	Type	(Dia)	-	andh Sit Blows (mins)	u Testi Test	ng Test Res	ult Units	TCR SCR RØD	lfmin Ifave (mnna)k V	/eter	۱ Ba
composed of light g angular to subangu weak, medium den	Recovered as: Structureless CHALK greyish white slightly sandy silty alar fine to coarse GRAVEL. Clasts are sity, white with black specks. With															20 300 300
rare subangular col undetermined)	ular fine to coarse gravel of flint, and obles of flint and chalk. (Grade		-													0 000 0
[Lewes Nodular Ch	alk Formation?]		-		15.50 - 15.95					s	N=5					00000
					13.30 - 13.35					5	11-0					So So So
																808080
					15.95 - 17.00	В										080808
					17.00 - 17.45					S	N=5					30,80,80,80,80
					17.45 - 18.50	в										80 80 80 80 80 80 80 80 80 80 8
					18.50 - 18.95					s	N=9					80 80 80 80 80 80 80 9
					18.95 - 20.00	В										30 30 80 80 80 80 80 80 80
																80.808080

Groundwater levels may be subject to seasonal, tidal and other fluctuations and should not be taken as constant.

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

•barn	E	BORE	HO	LE L	00	3				N	/L03	ehole N 85-CR et 5 of	2003	
Project Name:	Amersham Tunnel to Calvert			Survey Gr	-	em:		SGB		Hole Ty	pe:		C	P+R
Drain at Nav				Co-ordinat	es:			35.82 n		Checke			PMc	,
Project No: Client:	1G063-AAZ. High Speed 2 (HS2) Ltd			Ground Le	vel.			21.10 n 71.34 m		Approve Scale:	а ву:		I	PMc 1:2
Engineer:	High Speed 2 (HS2) Ltd								.02	Log Sta	atus:		I	FINA
Date Started:	10/10/2016			Orientation	n:			d	eg.	Print Da	ite:		20/11	/201
Date Completed:	26/10/2016			Inclination				90 d	<u> </u>	Final De	·		_	5.00
	Stratum Description	Legend Depth (Thick- ness) (m)	Level (m)	Depth (m)	Samp Type		oring and h S Rec Blows % (mins)	itu Testi Test	ng Test R	esult Un	TCR SCF its RØ	lfmin ₹lfave ↓Df(mma)k	Weter	W Bacł
composed of light gr angular to subangula weak, medium densi occasional subangul rare subangular cobt undetermined) [Lewes Nodular Cha			49.34	20.00-20.45 20.45-21.50 21.50-21.95	В			S	N=*					ਉਹ ਉ
medium strong, high occasional black spe coarse gravel sized with thin grey lamina very thinly bedded ve Recovered as: slight subangular gravel. C Undetermined) [Lewes Nodular Cha 22.70-22.90m CHALK with thin	covered non-intact. Weak locally density, greyish white CHALK with acks, occasional angular fine to rinded flint fragments, and locally ations (marl wisps). With frequent ery weak, low density horizons. dy sandy slightly silt fine to coarse thalk Rock Member. (Grade lik Formation] : Weak, medium density, greyish white grey laminations (marl wisps). Fracture grees, undulating rough, clean. (Grade: A4)			22.00 - 23.20 22.70 - 22.82	RC c	102					100 35 9	NIDO 10 110		් පති
Lewes Nodular Cha Weak, high density, thin grey laminations horizontal to 15 deg undulating rough, pa Member. (Grade: A3) [Lewes Nodular Cha	light greyish white CHALK with rare (marl wisps). Fracture set 1: rees closely spaced (25/90/200mm), rtly open, clean. Chalk Rock)		48.14 48.09 46.39	23.20 - 24.70 13.50 - 34.50	RC	102		Falling Head	2.3E-	-005 mi	100 59 7	NIDO 80 110		알 알 알 알 알 알 알 알 알 알 알 알 알 알 알 알 알 알 알

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

•barn	E	BORE	HO	LE L	00	3					ML03	hole N 5-CR et 6 of	003
Project Name:	Amersham Tunnel to Calvert			Survey Gr Co-ordinat		em:		DSGB 35.82 r	nF	Hole 1	Type: ad By:		CP+R PMcG, C
Project No:	1G063-AAZ.						1937	21.10 r	nΝ	Appro	ved By:		PMc
Client: Engineer:	High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd			Ground Le	vel:			71.34 r	nOD	Scale: Log S	Status:		1:2 FINA
Date Started: Date Completed:	10/10/2016 26/10/2016			Orientatior Inclination:				c 90 c	0	Print [Date: Depth:		20/11/20 ² 55.00
•		Depth				ing, C	oring and h S		•			If min	
	Stratum Description	Legend (Thick- ness) (m)	Level (m)	Depth (m)	Туре	(Dia)	Rec Blows % (mins)	Test	Test F	Result L	Inits ROL	lfave)(mna)(W Weter Bac
frequent black specks orientated, very dose	ity, light greyish white CHALK with s. Fractures are randomly ly spaced (B/30/60mm), undulating ight orangish brown staining, no lk Formation]		-	24.70-26.20	RC	102					100 53 16	10 30 50	තේ ප්ර ප්ර ප්ර ප්ර ප්ර
New Pit Chalk Form Weak, medium to hig with frequent thin gre set 1: horizontal to 1: (110/200/300mm), ur partly open, with freq	the gray mark JJ" pperQyrode" "M"" a rk- ation yh density, creamish white CHALK y laminations (marl wisps). Fracture 5 degrees, dosely spaced ndulating to planar slightly rough, uent black specks, slight orangish g, no infill. (Grade: A3)	*	45.47 45.43										ති බති බති බති බති බති
[New Pit Chalk Form				26.51-26.71 26.20-27.70	C RC	102					100 87 63	110 200 300	්ජි ්ජි ්ජි ්ජි ්
	re incipient fracture 45 <i>10 75 degrees,</i> very tight, with frequent black specks.												
Marl? New Pit Chalk Form Very weak locally we CHALK with occasion wisps). Fracture set spaced (30/150/320n	oft grey marl. Possibly Lower Glynde ation ak, medium density, greyish white hal thin grey laminations (marl 1: horizontal to 10 degrees dosely m), undulating slightly rough, partly equent black specks, slight orangish	27.75 27.81	43.59 43.53	28.12-28.30	с							100 300 500	ංසු දෙයි දෙයි. මේ දේ දේ දේ දේ දේ
Fracture set 2: 45 to	y infilled with soft grey marl (>3mm). 60 degrees, closely spaced, tight to uent black specks, no infill. (Grade: ation)	28.64	42.70	27.70-29.20	RC	102					100 97 31		990 990 990
28.45 - 28. Very weak, medium o occasional thin grey subrounded fine to m fragments. Fracture s medium to widely spa undulating slightly roi specks and slight ora 2: 45 to 65 degrees of	48m : Thick/ laminated soft_re, marl. j density, creamish white CHALK with laminations (marl wisps) and rare needium gravel sized rinded flint set 1: horizontal to 10 degrees ced (546/1090/1BOOmm), ugh, partly open, with frequent black ungish brown staining. Fracture set Josely spaced tight to partly open, k specks. (Grade A2/3)												් දේ දීම දේ දීම දේ දීම දේ දීම දේ ද
29.45-29.70m extremely closely sp	auon Twoparallel 60 degreejoint fractures paced, undulating slightly rough, partly pen, with frequent black specks, clean.										100 98 48		<u> 0 000 000 000 000 000</u>
		The second se		29.20 - 30.70	RC	102			1				Lon I

Groundwater levels may be subject to seasonal, tidal and other fluctuations and should not be taken as constant.

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

•barn ritchies	E	BORI	EHO	LE L	00	3						IL03	hole N 5-CR et 7 of	003
Project No:	Amersham Tunnel to Calvert 1G063-AAZ. High Speed 2 (HS2) Ltd			Survey Gr Co-ordinat Ground Le	es:	em:		49903 19372	SGB 5.82 m 1.10 m 1.34 m	nE (nN A	Hole Typ Checked Approved Scale:	By:		CP- PMcG, PI 1
Date Started:	High Speed 2 (HS2) Ltd 10/10/2016 26/10/2016			Orientation					d 90 d	eg. F	Log Sta Print Dat Final De	e:		FI 20/11/2 55.
St	tratum Description	Legend (Th	epth nick- ss) (m)	Depth (m)	Sampl Type	1	Coring a Rec E % (I		tu Testi Test	ng Test Re	sult Unit	TCR SCR s Rପ୍ରଧ	lfmin Ifave D(mna)x	Weter Ba
	2m : Thickly laminated son grey marl. Rinded nodular flint fragments (up to 20mm), possible flint band.		n) 76)	(m) 30.78-31.09 30.70-32.20	с	102		mins)				100 99 66	60 310 750	ם אים מים מים מים מים מים מים מים מים מים מ
	illing disturbed, recovered non-intact. illing disturbed, recovered non-intact.			32.20 - 33.70) RC	102	2					93 71 25		დი
45/30/15mm), possible [New Pit Chalk Format 34.49 - 34.57m : Dr	led rinded flint fragments (up to e flint band (Glyndebourne Flints?). tion] <i>rillin disturbed recovered non-intact.</i> y, creamish white CHALK with ssil fragments, and rare subrounded ivel sized rinded flint fragments.	·	.40 36.94 .50 36.84	33.70 -35.20 34.55 - 34.70		102						97 77 10		<u> </u>

•barn	E	BOF	RE	HO	LE L	00	3					N	1L03	hole N 5-CR et 8 of	003	
Project Name: Project No: Client: Engineer: Date Started: Date Completed:	Amersham Tunnel to Calvert 1G063-AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd 10/10/2016 26/10/2016				Survey Gr Co-ordinat Ground Le Orientation Inclination:	es: evel:	em:		49903 19372	9SGB 35.82 n 21.10 n 71.34 n d 90 d	nN nOD leg.	Hole Typ Checked Approved Scale: Log Sta Print Dat Final De	l By: d By: tus: te:		PMcG F F 20/11/	P+RC G, CB PMcG 1:25 FINAL /2017 5.00m
	Stratum Description	Legend	Depth (Thick- ness) (m)	Level (m)	Depth (m)	Sampl Type	Dia		andh Si Blows	tu Testi Test	•	esult Unit	TCR SCR s RØD	lfave	Weter I	Well/ Backfill
with black specks. medium spaced, pl partly open, with bl no infill. (Grade: B4 [New Pit Chalk For 35.20 - 35.25m 35.55 - 35.700			() 	-										NIDO 430 950		
Drilling disturbed.	: With rare bivalve shell fragments (up to 35x20x12mm). Extremely weak to very weak, low		 	35.19	35.20 - 36.70	RC	102						97 58 40			
orientated fractures undulating slighUy specks, slight yello undetermined) <u>New Pit Chalk For</u> Weak, medium der set 2: 25 to 35 deg	white CHALK. Abundant randomly , extremely closely spaced, rough, partly open, with frequent black wish orange staining, no infill. (Grade <u>rmation</u> isity, creamish white CHALK. Fracture rees medium spaced, undulating with occasional black specks, slight		(0.45) 	34.74										NIDO		
yellow staining, no [New Pit Chalk For	infill. (Grade: A3)		(0.85)		37.04-37.26								100	80 100 350		
white locally gritty thin grey lamination fragments. Fracture smooth to striated,	, low to medium density, creamish CHALK with rare inclined (45 degree) as (marl wisps), and rare fossil e set 2: (2 no.) 60 degrees, planar partly open, with frequent black gish brown staining, no infill. (Grade: mation]		-37.45	33.89	36.70 - 38.20	RC	102						68 21	NIDO 50 90		
with occasional thir Fracture set 1: (2 n undulating slighUy				32.84	38.20 - 39.70	RC	102						96 85 31	NIDO 440		
degrees to vertica	m : Drilling disturbed. Possibly (1 no.) 80 al fracture. undulating slightly rough, with ecks, slight orangish brown staining, no infill.													680		
Groundwater levels Explanation of sym	easured along borehole axis. s may be subject to seasonal, tidal and on hools and abbreviations given in 'Key to en on appended 'Borehole Infonmation S	Explora			hould not be t	aken a	as con	nstant		L	<u>.</u>	I	1	<u>.</u>	<u> </u>	
_	ies, Glasgow Road, Kilsyth, Glasgow G65 9Bl											BAN	/IR Bor	ehole La	og0610	412017

•barn	E	BOR	E	HO	LE L	00	3						Μ	L03	hole N 5-CR et 9 of	003	
Project Name:	Amersham Tunnel to Calvert				Survey Gr Co-ordinat		em:)SGB 35.82 r	nF		e Type cked				P+RC G, CB
Project No:	1G063-AAZ.					.00.				21.10 r			roved	•			PMcG
Client:	High Speed 2 (HS2) Ltd				Ground Le	evel:			-	71.34 n	nOD	Sca					1:25
-	High Speed 2 (HS2) Ltd				Orientetier								Stat				
	10/10/2016 26/10/2016				Orientation Inclination					c 90 c	•		it Date al Dep				/2017 5.00m
Date Completed.	20,10,2010		Depth				ina. C	Corina	andh Si		0	1 1110	1000	TCR	lf min		
Sti	ratum Description	Legend	(Thick ness) (m)	- Level (m)	Depth (m)	Туре	1	Ŭ	Blows (mins)		Test F	esult	Units	SCR RØD	Ifave	Weter	Well Backf
	density, creamish white CHALK ey laminations (mart wisps).	<u>fr</u> tr													NIDO 440		
Fracture set 1: (2 no.)	horizontal to 15 degrees,	H	1 0.20	31.14											680		
2: (1 no.) 45 degrees,	gh, very tight, no infill. Fracture set planar slightly rough, with black	fr r															
specks. (Grade: A2) New Pit Chalk Format	tion	╔┲╧┲╞			39.70 - 41.20	RC	102										
	g, medium density, creamish white		0.70)			-								100	30		
	I: horizontal to 10 degrees medium													90 90	130 160		
2: 45 to 60 degrees clo	sely spaced, undulating slighUy	HT THE													100		
rough, tight to partly op Pit Chalk Formation]	pen, no infill. (Grade: B4/5) [New		48:99	30.44													
40.32 - 40.34r	m:Ve thin/ bedded soft_re marl.		+0:92 	30.42													
Very thinly bedded soft 1?	t grey mart. Possibly New Pit Mart																
New Pit Chalk Format																	
	k, medium to high density, K with occasional interwoven thin																
grey laminations (mart	wisps), rare bivalve fossil	Frit-															
	avities (up to 20x30mm). Fracture degrees widely spaced, undulating																
slighUy rough, tight to	partly open, with occasional																
	g, no infill. Fracture set 2: 40 to 60 ced, planar to undulating smooth to	TTE															
slighUy rough, with free	quent black specks, occasional	r r			41.80 - 42.02	с								100			
New Pit Chalk Format	staining, no infill. (Grade: A2) tion]		_		41.20 - 42.70	RC	102							82 26			
	lling disturbed, recovered non-intact. lling disturbed, recovered non-intact.	Fr Fr												20			
	inng ustabled, recovered norrinaet.																
			-												NIDO		
	lling disturbed, recovered non-intact.		3.15)												390 1040		
42.70 - 42.90m : Dril	lling disturbed, recovered non-intact.																
			-														
														100			
43.40 - 43.41m : /	Asymmetrical cavity (15x30mm) with	T T			42.70 - 44.20	RC	102							BO			
	brownish orange staining.	TTTT-												18			
		IT TE															
		T T	-		43.90 - 44.10	c											
	lling disturbed, recovered non-intact.	TT TT															
	to <u>nelium density</u> cr <u>ea</u> mish_µ1'+	. <u>d,4 20</u> 4	14.20	14													
	h rare thin grey laminations (mart 15 to 30 degrees closely spaced,	r r															
	gh, partly open to open, with	Fr Fr												400			
	occasional orangish brown ture set 2: (6 no.) 45 to 60	FT TH	1.50)											100 77	NIDO 200		
degrees, medium spac infill. (Grade: A3)	ed, undulating slighUy rough, no		-											18	400		
[New Pit Chalk Format		F															
44.20 - 44.95n	n : Drilling disturbed. Possibly due to conjugate fracturing.				44.20 - 45.70	RC	102										
	galo naolanigi	+	-	I		-											
Stratum depths measure	ured along borehole axis.				1	I	I	I	I		I					I	L
	ay be subject to seasonal, tidal and	other fluct	uation	is and s	hould not be	taken a	as cor	nstant									
Explanation of symbol	Is and abbreviations given in 'Key to	Explorato	ry Ho	les'													
Further details given of	on appended 'Borehole Infonnation \$	Sheer.															
	Glasdow Road Kilsyth Glasdow G6598														ehole I		

•barn ritchies	BORE	EHO	LE L	00	3						ML03	hole N 5-CR t 10 o	003	
Project Name: Amersham Tunnel to Calvert Project No: 1G063-AAZ. Client: High Speed 2 (HS2) Ltd Engineer: High Speed 2 (HS2) Ltd			Survey Gr Co-ordinat Ground Le	es:	em:		49903 19372	0SGB 35.82 n 21.10 n 71.34 n	nN	Hole Ty Checke Approve Scale: Log St	d By: ed By:		1::	
Date Started: 10/10/2016 Date Completed: 26/10/2016			Orientatior Inclination:					d 90 d	•	Print Da Final D			20/11/20 55.0	
Stratum Description	Legend Dep (Thio nes (m	s) (m)	Depth (m)	Samp Type	1	-	and h S Blows (mins)	itu Testi Test	ing Test R	esult Ur	TCR SCF hits RØ	lfmin lfave D(mna)k	Weter Ba	Nell/ ckfill
45.25-45.33m : Drilling disturt.Jed, recovered non-intact.												NIDO 200 400		
45.55-45.70m: Drilling disturtJed, recovered non-intact.	45.7	0 25.64												
Weak, medium to high density, creamish white CHALK with occasional thin grey laminations (marl wisps). Fracture set 1: horizontal to 15 degrees widely spaced, undulating slighUy rough, tight to parUy open, with frequent black specks, no infill. Fracture set 2: (2 no.) 45 to 60 degrees, planar smooth to polished, tight to parUy open, with frequent black specks, occasional heavy orange and blackish brown staining, no infill. (Grade: A2) [New Pit Chalk Formation]		U 25.64	45.70 - 47.20 46.39 - 46.79		102						100 91 58			
47.10-47.20m : Drilling disturtJed, recovered non-intact.) (0									100	NIDD 270 700		
48.10-48.18m:Drilling disturt.Jed, recovered non-intact.			47.20-48.70	RC	102						87 23			
48.35-48.40m : Drilling disturtJed, recovered non-intact. 48.50-48.60m : Asymmetrical cylindrical vug (25x100mm) with brownish orange staining.														
Drilling disturbed, recovered non-intact. Weak, low to medium density, greyish white CHALK. (Grade undetermined) [New Pit Chalk Formation] <i>48.70-49.30m: Drilling disturtJed, recovered non-intact.</i>												NIDO 50		
Weak locally medium strong, medium to high density, creamish white CHALK with occasional interwoven thin grey laminations (marl wisps). Fracture set 1: (2 no.) 10 to 30 degrees very widely spaced, undulating slightly rough, parUy open, with frequent black specks, slight yellow staining, no infill. Fracture set 2: (4 no.) 45 to 65 degrees medium to very widely spaced, undulating slightly rough, partly open, with rare orangish brown staining, no infill. (Grade: A1)		0 22.04	48.70 -50.20 49.60 - 49.78		102						100 69 17			
Stratum depths measured along borehole axis. Groundwater levels may be subject to seasonal, tidal and Explanation of symbols and abbreviations given in 'Key to Further details given on appended 'Borehole Information Office: BAM Ritchies, Glasgow Road, Kilsyth, Glasgow G65 9B	Exploratory Sheer.		hould not be t	aken a	as cor	nstant				RA	MRRo	rehole	og 06/041:	2017

ritchies												Shee	et 11 of	
oject Name:	Amersham Tunnel to Calvert				Survey Gri Co-ordinate	-	em:		DSGB 35.82 n	٥F	Hole T			CP- PMcG
oject No:	1G063-AAZ.				CO-Ordinat				21.10 n		Approv	-		PI
ent:	High Speed 2 (HS2) Ltd				Ground Le	vel:			71.34 m	nOD	Scale:			1
gineer:	High Speed 2 (HS2) Ltd										Log St			FI
te Started: ate Completed:	10/10/2016 26/10/2016				Orientation Inclination:				d 90 d	•	Print D Final D		:	20/11/2 55.
			Depth				ing, Co	oring and h S	itu Testi	na		TCR	Ifmin	
	Stratum Description	Legend (Thick- ness) (m)	Level (m)	Depth (m)	Туре	(Dia)	Rec Blows % (mins)	Test	Test F	Result Ur	its ROAD	lfave (mnna)x	Weter B
New Pit Chalk Form			(,											
49.90 - 49.99m : L	Drilling disturbed, recovered non-intact. Drilling disturbed, recovered non-intact.													
50.10 - 50.20m : L	Drilling disturbed, recovered non-intact.													
			.											
		Frit												
					50.20 -51.70	RC	102					97 97		
		fr r -	-		30.20 01.70							97		
		T T												
		ртт Е												
		,r,r	.											
		FT-T												
			-											
		HT I			52.23 - 52.46	с								
					51.70 -53.20	RC	102					93 91	NIDO	
		FFF	5.70)									91	1050 1995	
		jr jr E												
		TTT-												
			-											
		T T			53.20-53.31	C								
		ır ¦ır [-			53.20-53.3	с								
		HT.E												
												100		
			_		53.20 - 54.70	RC	102					73 73		
												/3		
54.20-54.40m:	Patchy orange brown staining (sponge	FFFF												
	bed)?													
		ÉT TE												
												77		
		ır‡r€			54.70 -55.00	RC	102					33		
Boreh	ole Terminated at 55,00m	╞┲╧┲╪	55.00	16.34									──	
			I										<u> </u>	
	asured along borehole axis. may be subject to seasonal, tidal and			ام ام م	haved not had	akan a		atant						

,,.b	a I			BC	REH	OLE	IN	IF	OR	MA	٩T	ION	SH	EE.	Г		ML	Borehole _035-CF Sheet 1 c	R003
Project N Project N Client: Engineer	lo:		1G063 High Sp	am Tunnel -AAZ beed 2 (HS beed 2 (HS	2) Ltd					Co-oi	ey Gri rdinate nd Le			OSC 499035.4 193721.7 71.	82 mE	C A	Hole Typ Checked Approvec Log Stat	By: I By:	CP+RC PMcG, CB PMcG FINAL
Date Star	rted:		10/10/2	016						Orien	itation	:			deg		Date:		20/11/2017
Date Cor			26/10/2						d Explora		ole Info				90 deg		-inal Dep		55.00m
From <ml 0:00 1.20 5.20 22.00</ml 	5	o rml .20 5.20 2.00 5.00	IVoe IP CP CP RC	Start 10/10/2016 10/10/2016 20/10/2016 24/10/2016	10/10/2016	Plar Insulated digg T830-047 T830-047 T830-047 P450		Ge	eobor-S (146)	TC C		S. Kiczyns S. Kiczyns S. Kiczyns	Crew ki /J. Adam ki /J. Adam ki /J. Adam e /T. Devlin		Loaaer J. Manas J. Manas A. Mccas	s s W		Rema	rks
			Bolii	11-Drillina P						Hole I	Diamete	er by Deoth						er by Deoth	
Date 10/10/2016 19/10/2016 19/10/2016 19/10/2016 20/10/2016 21/10/2016 21/10/2016 21/10/2016	0 1 1 1 0 1 1 0	ime 7:30 8:00 1:00 7:45 7:30 7:45 8:30 2:30	Deoth <ml 0.00 5.65 5.65 12.95 12.95 22.00 21.50 21.50</ml 	Casinani Di 0.00 4.70 5.20 12.50 12.50 22.00 21.50 21.50	th Water (m) Dry Dry B.00 B.70 13.50 Dry	Rema start of shift End of shill start of shift End of shift End of shift start of shift start of shift End of shift	rks		eoth <ml 22.00 55.00</ml 	Dia. 20 14	0	Ren	narks	Deoth 21.5 21.5 55.0	0	Dia.rmm 200 168 146		Rema ble percussive	
24/10/2016 24/10/2016 25/10/2016	1	2:30 2:30 6:45 9:15	21.50 21.50 24.70 24.70	21.50 21.50 24.70 24.70	Dry 1.20 5.75 5.82	start of shift End of shift start of shift		Fr	rom (m)	To ((m) V	olume (litres)	wat	er Added	Re co rds	Re	marks		
25/10/2016 25/10/2016 26/10/2016 26/10/2016	1	9:15 7:00 9:15 8:00	50.20 50.20 55.00	50.20 50.20 55.00	5.20 5.80 5.82	End of shill start of shill Hole complete	e			Cr	nisellin	iDetails				D	rillino Flusi	Details	
-From (m) 13.50	To (m 34.50			earned out ins	Remarks standpipe			Fr	rom (m)			ation(hh:mm)	Tool	From (n 22.00 24.70 33.70 38.20 41.20 42.70 44.20 45.70 47.20 48.70	24 33 38 41 42 44 44 45 45 47 48	m) Re .70 .20 .20 .20 .70 .20 .70 .20 .70 .20 .70 .20	Eturns (%) 90- 90 70- 70 60- 60 50- 50 40- 40 50- 50 40- 40 30- 30 20- 20 10-10 Backfill D	Flush Water Water Waler Water Water Water Water Water Water Water	Colour
Dale 	8.0) 8. 0	(m) lime (mine 10 5	Depth (m) Sea	led(m) R	emarks	SP	1	From(m)) To (m) 14.00) Da(m 80	Pipe Type Plain	Remarks	0.00	0.	10	legend 909	Des Upstanding c	aiption over
19/10/2016 19/10/2016 19/10/2016	8.0) B.0	0 15	7.25 7.05 6.90			SP	1	14.00	34.00	₿O 	Slotted		0.10 0.50 13.50 34.50	13. 34.	.50 .50	903 902	Concrete Bentonite Gravel Bentonite	
Donth (m)	Tret		ud Casino	/m Water (m	LISW/Bon/mm IB	lound Ront/m			Penetra				Ron4/mml	Playar D	nE/mml	Ployes	Donfilmm	Usemaa	
Depth (m) 1.66 3.26 3.20 6.95 8.45 9.95 11.00 12.50 14.45 15.50 20.00 21.50	Type S C C C S S S S S S S S S S S S S S S	N VS N=3 50// N=3 N=1 N=1 N=2 N=2 N=2 N=1 N=7 N=4	33 1.22 5 2.20 0 3.20 0 4.20 4 4.70 4 4.70 5 8.00 2 9.50 0 11.00 6 12.55 1 15.56 1 17.00 1 18.55 8 20.000	Dry Dry Dry Base Dot 12.00 D 12.80		Iows1 Penting 5 75 5 75 55 5 4 75 3 75 2 75 2 75 2 75 3 75 1 75 1 75 1 75 1 75 6 75 6 75 8 75 6 75	mi Bow B 4 4 3 1 2 2 2 2 1 1 3 2 2 2 1 1 8	<u>s2</u> Pe	n2(mml) 76 75 75 75 75 75 75 75 75 75 75 75 75 75	Biows3 111 500 6 3 4 2 6 6 3 3 1 1 3 9 111	Pensim 76	Imil Blows4 6 8 3 4 2 6 6 1 2 1 2 1 1 2 1 2 3 12	75 75 75 75 75 75 75 75 75 75 75 75 75 7	Blows5 Pa 9 8 4 4 1 6 6 6 1 1 2 2 3 14	n5(mm) 75 75 75 75 75 75 75 75 75 75 75 75 75	Blows6 9 8 4 5 1 1 4 7 8 2 2 1 1 2 3 3 12	76 75 75 75 75 75 75 75 75 75 75 75 75 75	I Hammel BRK3 BRK3 BRK3 BRK3 BRK3 BRK3 BRK3 BRK3	3 70 70 70 70 70 70 70 70 70 70 70 70 70 70 70 70 70 70 70 70 70 70 70 70 70 70 70 70 70 70 70
						Reasonforl	HoleTe	ermin	ation: F	Reache	ed sch	eduled de	epth						
Ground	water	levels	can be su	bject to se	asonal, tidal a														

BAM Ritchies, Glasgow Road, Kilsyth, Glasgow G65 9BL

-barn	E	BORE	HO	LE L	00	3					N	IL03	hole N 5-CR et 1 of	004
Project Name:	Amersham Tunnel to Calvert			Survey Gr Co-ordinat	-	em:		49891	SGB 3.63 n	nE C	lole Typ Checked	e: By:		CP+ JMe,
Project No: lient:	1G063 -AAZ High Speed 2 (HS2) Ltd			Ground Le	evel:				19.98 n 72.15 n	nOD S	pproved			PN 1:
ngineer: ate Started: Date Completed:	High Speed 2 (HS2) Ltd 24/10/2016 26/10/2016			Orientation Inclination					d 90 d	leg. F	og Sta Print Dat Final De	te:		FII 20/11/2 55.0
		Depth			Sampl	ing, C	oring	andh Si	tu Testi	na		TCR	lfmin	
	Stratum Description	Legend (Thick- ness) (m)	(m)	Depth (m)	Туре	(^{Dia})	Rec %	Blows (mins)	Test	Test Res	sult Units	SCR RØJD	lfave (mnna)x	water Ba
	brown slightly gravelly SILT with Gravel is subrounded to subangular	X X X X X X X X X X X X X X X X X X (X X X (0.70) X X X (X X X X (X X X (X X X (X X X (X X X X X X (X X X X X X X (X X X X X X X X X X X X X X X X X X X		0.50	в									
ine to coarse GRAV cobbles. Sand is fine Alluvium]		0.70	71.45	1.1	В									
	oming slightly darker in colour and veiy clayey. oming dark orangish brown and slightly clayey.	(0.80)		1.20-1.65	UT	100	80	70						
ubangular to round	ming dense light brown sandy ed fine to coarse GRAVEL of flint. e predominantly coarse.	1.50	70.65	1.65	D	100		10						
				1.65-2.10 1.65-2.10 1.65-2.20	D				S	N=14				
		-(1.70) 		2.20-2.65 2.20-2.65	D				S	N=40				
		-		2.65 -3.20	В									
	e light brown slightly silty very sandy fine to coarse GRAVEL of flint. Sand el]	3.20	68.95	3.20 -3.65 3.20 -3.65	D				S	N=43				
		 (2.80)		3.65-4.20	В									
				4.20-4.65 4.20-4.65	D				S	N=44				
				4.65 -5.20	в									

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

barn	E	BORE	HO	LE L	.00	3					N	1L03	ehole N 85-CR et 2 of	004	Ļ
Project Name:	Amersham Tunnel to Calvert			Survey G Co-ordina		em:			SGB 3.63 r		lole Typ Checked	e:	21 2 01	C	CP+F /Ie, (
Project No:	1G063-AAZ.			oo oraina	100.				19.98 r		pprove				PM
lient:	High Speed 2 (HS2) Ltd			Ground L	evel:				72.15 r		scale:).			1:2
ngineer:	High Speed 2 (HS2) Ltd									L	.og Sta	tus:			FIN
ate Started:	24/10/2016			Orientatio	n:				c		Print Dat			20/11	1/20
ate Completed:	26/10/2016			Inclination					90 c	•	inal De				5.00
		Depth			Sampl	ina C	orina	and h Si		•		TCF	RIfmin	-	
:	Stratum Description	Legend (Thic ness) (m)		Depth (m)	Туре	-	-	Blows (mins)	Test	Test Res	sult Units	SCR RØD	R Ifave I(mnnna)x		r Ba
	light brown slightly silty very sandy ne to coarse GRAVEL of flint. Sand]	×													00000
				5.20 -5.60 5.20 -5.65	D				S	50/24	5				0000000
		× × + × × + × × +		5.65 -6.00	в										0 0 0 0 0
Gravel is weak, medi	composed of white gravelly SILT.	6 .00	66.15												
subangular fine to co Lewes Nodular Chal				6.00 -6.45	UT	100	100	55							
				6.45	D										
		(1.45)	.1	6.45 -6.90	_				s	N=12					
				6.45-7.00	В										
				700 745		100	100								
				7.00 - 7.45	UT	100	100	40							
					_										,
Structureless CHALK	composed of white sandy silty	7.45	64.70	7.45	D										
angular to subangula	r fine to coarse GRAVEL. Clasts are	Fr Fr		7.45	W										
	ty, white with black specks and quent subangular fine to coarse			7.45-7.90	D										
gravel of flint. (Grade				7.45-7.90 7.45-B.00	в				s	N=B					
Lewes Nodular Chal				1.40 -D.UU	D										
		Frfr													
				B.00 - B.45	UI-NR	100		55							
				B.45 -B.90	D										
		TT-T		B.45 -B.90 B.66					S	N=7					
				B.45-9.00	В										
				0.00 0.15		100		45							
				9.00 -9.45	UI-NR	100		45							
		T T													
				9.45 -9.90	D										
				9.45 -9.90 9.45 - 10.00					S	N=B					
		Fr-Fr-F		9.40 - 10.00	В							1			
		the second se													

Groundwater levels may be subject to seasonal, tidal and other fluctuations and should not be taken as constant.

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

-barn ritchies	E	BOR	EHC	DLE L	00	3					N	IL03	ehole N 5-CR et 3 of	004	
Project Name: Project No:	Amersham Tunnel to Calvert			Survey Gri Co-ordinat		em:		4989 ⁻)SGB 13.63 r 49.98 r	mE C	ole Typ hecked oproved	By:		JMe	P+R(le, Cl PMc(
Client: Engineer: Date Started:	High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd 24/10/2016			Ground Le Orientation					72.15 r c	nOD So Lo	cale: og Sta rint Dat	tus:			1:25 FINA
Date Completed:	26/10/2016			Inclination:					90 c	leg. F	inal De	pth:		55	5.00r
	Stratum Description	Legend (TI	pth hick-Leve ss) (m) n)	Depth	Sampli Type	1	-	andh Si Blows (mins)	itu Test Test	ing Test Res	ult Units	TCR SCR RØD	lfmin Ifave I(mma)x	water	We Bacl
				10.00 - 10.45 10.00 - 10.45	D				s	N=B					
				10.43 10.44	EW EW										
				10.45 - 11.00	В										
11.00m : VIII	ith occasional subangular tO subrounded cobbles of chalk and flint.														
				11.00 - 11.45	UT	100	20	42							
				11.45-11.90					S	N=13					
				11.45 - 12.50	В										
			55)	12.50 - 12.95	UT	100	30	75							
				12.95 - 13.40 12.95 - 13.40					8	N=16					
				12.95 - 14.00	В										
				14.00 - 14.45		100	75	150							
				14.45 14.45 - 14.90 14.45 - 14.90					s	N=54					
		T T -													

Groundwater levels may be subject to seasonal, tidal and other fluctuations and should not be taken as constant.

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

-barn ritchies	BORE	10	LE L	00	3					N	IL03	hole N 5-CR et 4 of	004	
oject Name: Amersham Tunnel to Calvert			Survey Gri Co-ordinate	-	em:)SGB 13.63 r		lole Typ Checked	e:			P+F le, (
opject No: 1G063 -AAZ. ent: High Speed 2 (HS2) Ltd gineer: High Speed 2 (HS2) Ltd			Ground Le					19.98 r 72.15 n	nOD S	opproved cale: .og Sta	tus:		F	PM 1:2 FIN
te Started: 24/10/2016 te Completed: 26/10/2016			Orientation Inclination:	:				d 90 d	-	Print Dat Final De			20/11 55	5.0
	Depth	1		Sampli	ing, C	oring	andh Si	tu Testi	ng Test Re		TCR	Ifmin		,
Stratum Description	Legend (Thick- ness) (m)	(m)	Depth (m)	Туре	(^{Dia})	Rec %	Blows (mins)	Test	Test Re	sult Units	R	tfave tmnnak v	vater E	Ba
			15.50 - 15.95 15.95 - 16.40 15.95 - 16.40	UT	100	40	150	S	N=56					
17.00- 18.00m : Flint graveVcobbles becoming rare. Matrix becoming greyish white with orange mottling			15.95 - 17.00	В										
			17.00 - 17.45 ['] 17.45 17.45 - 17.90 17.45 - 17.90	UT D D	100	30	170	S	N=23					
rilling disturbed. Structureless CHALK composed of hite gravelly SILT. Gravel is weak, medium density. hite with black specks and subrounded. (Grade: Dm) ewes Nodular Chalk Formation]		54.15	17.45 - 18.50	В				5	11-20					808080
			18.50 - 18.95 18.95 18.95 - 19.40 18.95 - 19.40 18.95 - 20.00	D	100	30	165	S	N=17					ão Ro

Groundwater levels may be subject to seasonal, tidal and other fluctuations and should not be taken as constant.

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

•barn ritchies	B	ORE	HO	LE L	00	3					N	IL03	hole N 5-CR et 5 of	004	
roject Name: Amersham Tur roject No: 1G063-AAZ.	nnel to Calvert			Survey Gr Co-ordinat	,	em:		49891)SGB 3.63 r 19.98 r	nE	Hole Typ Checked Approved	By:		JM	P+F /le, (PM
ient: High Speed 2 ngineer: High Speed 2	. ,			Ground Le	evel:			7	72.15 r		Scale: Log Sta	tue			1:2 FIN
ate Started: 24/10/2016	(152) Liu			Orientatior	1:				c		Print Dat			20/11	
ate Completed: 26/10/2016				Inclination:					90 c	· ·	Final De			5	5.0
Stratum Description	n	Legend (Thick ness (m)	- Level	Depth (m)	Type	(Dia)		andh Si Blows (mins)	tu Test	ng Test Re	esult Unit	TCR SCR RØD	lfmin Ifave (mnna)x	Weter	Ba
Drilling disturbed. Structureless CHAI white gravelly SILT. Gravel is weak, r white with black specks and subroun Lewes Nodular Chalk Formation]	nedium density.			20.00 - 20.45	UT	100	60	170							0,80,80,80
Drilling disturbed. Structureless CHAI andy silty angular to subangular fine	e to coarse	20.45	51.70	20.45	D										0°0°0°0
GRAVEL. Clasts are weak, medium of black specks and subrounded. With o coarse gravel of flint and occasion cobbles of chalk. Matrix is greyish wh	rare subangular fine al subangular			20.45 - 20.90 20.45 - 20.90	D				s	N=17	7				0.00.00
(Grade: De) [Lewes Nodular Chalk Formation]	Ū	<u> </u>		20.45 - 21.50	В										0,00,00
															00000
21.45 - 21.50m : Chalk possibly Unable to grade due to disturl:Jance		21.50	50.65	21.50 - 21.63 21.50 - 21.66	D				s	100/1	35				0.0.0.0
Drilling disturbed. Weak locally media o high density, light greyish white CF abundant randomly orientated fractur olanar smooth, with black specks and orange discolouration. Locally with th mart wisps). Possibly Chalk Rock? (undetermined) [Lewes Nodular Chalk Formation]	IALK. With es, closely spaced, d non-penetrative in brown laminae			21.00 - 22.50	RC	102						100 21 0			0808080808080808080808
			,	23.05 - 23.16	с										0.0.0.0
				22.50 - 24.00		102						100 32 14	NIDO 70 160		90 90 90
23.60 - 23.BOm : Fractures locally	have non-penetrative brown staining.														80808080
24.00 - 24.25m : F	Recovered non-intact.														0,80,80,80
Medium strong, medium to high dens white CHALK. With occasional glauce	onitic green staining	24.57										100 10 0			30,20,50,50
and frequent black specks. Chalk Ro Lewes Nodular Chalk Formation Drilling disturbed. Weak locally mediu		(0.56)	,	24.00 - 25.50	RC	102									0000

Groundwater levels may be subject to seasonal, tidal and other fluctuations and should not be taken as constant.

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

•barn	E	BOF	REI	HO	LE L	00	3					N	/L03	hole N 5-CR et 6 of	004	
Project Name: Project No: Client: Engineer: Date Started:	Amersham Tunnel to Calvert 1G063-AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd 24/10/2016				Survey Gri Co-ordinate Ground Le Orientation	es: evel:	em:		49891 19384	SGB 3.63 r 19.98 r 2.15 n c	nN 1OD	Hole Ty Checke Approve Scale: Log Sta Print Da	d By: d By: atus:		JM F	P+RC e, CB PMcG 1:25 FINAL /2017
Date Completed:	26/10/2016		Depth		Inclination:		ing C	oring	andh Si	90 d	•	Final De	pth:	Ifmin	55	5.00m
	Stratum Description	Legend	(Thick- ness) (m)	Level (m)	Depth (m)	Туре	1	-	Blows (mins)	Test	Test R	esult Uni	SCR ts RØ	lfave (mma)x	Weter	Well/ Backfill
abundant randomly of planar smooth, with the orange discolouratio (marl wisps). Possibl undetermined) Lewes Nodular Cha Greenish grey mart s New Pit Chalk Form Drilling disturbed. Mi density, light greyish randomly orientated rough, with black spe discolouration. Chalk [New Pit Chalk Form	seam. Upper Glynde MARL? ation edium strong, medium to high white CHALK. With abundant fractures, closely spaced, planar ecks and locally with orange k Rock. (Grade: Undetermined)		(1.30)	46.92 46.85	26.10 - 26.20 25.50 - 27.00	D RC	102						100 17 0	NIDO 70 160		20 20 20 20 20 20 20 20 20 20 20 20 20 2
density, light greyish randomly orientated rough, with black spe comminuted chalk. V (whispy marl) and ra B5) New Pit Chalk Form	ssibly Lower Glynde MARL?		- -26.60 - - 	45.55 45.28 45.25												2 0 2 0 2 0 2 0 2 0 2 0 2 0 2 0 2 0 2 0
Very weak locally we Fracture set 1: 3 to 1 undulating smooth, w orange staining, infill Fracture set 2: 65 to slighUy rough, with p	eak, low density cream CHALK. O degrees closely spaced, vith black specks and penetrative led (<1mm) with comminuted chalk. 80 degrees medium spaced, planar senetrative orange staining and comminuted chalk. (Grade: B5)		-		27.60 - 27.80 27.00 - 28.50		102						100 60 36			
2	28.60-28.70m: Recovered non-intact.		(2.65) - - - - - - - - - - - - - - - - - - -		28.50 - 30.00	RC	102						90 40 11	NIDO		
29.35 - 29.50m : A	ssumed zone of corbess. Te/eviewer shows possible dissolution cavities.		-													
Fracture set 1: 3 to 1 undulating smooth, w			29:55 - - - - - - - - -	42.60 42.57												
Groundwater levels Explanation of symb Further details giver	asured along borehole axis. may be subject to seasonal, tidal and pols and abbreviations given in 'Key to n on appended 'Borehole Information S es, Glasgow Road, Kilsyth, Glasgow G659B	Explorate Sheer.			hould not be t	aken a	i s con	ıstant.			<u> </u>	BA	U R Boi	rehole L	pg 06/0	412017

ritchies	_	•••			LE L								Sh	eet 7 o	f 11	
roject Name:	Amersham Tunnel to Calvert				Survey Gri		em:			SGB			Type:		CF	P+F
	10000 117				Co-ordinate	es:				3.63 m			ked By:		JMe	
roject No: ient:	1G063-AAZ. High Speed 2 (HS2) Ltd				Ground Le	vol				9.98 m 2.15 m		Appro Scale	oved By	<i>c</i> .		PM 1:2
ngineer:	High Speed 2 (HS2) Ltd				GIUUIIU Le	vei.			,	2.15 11			,. Status:			FIN
ate Started:	24/10/2016				Orientation	:				d	eq.	•	Date:		20/11/	
ate Completed:	26/10/2016				Inclination:					90 d	•	Final	Depth:			5.0
			Depth			Sampl	ing, C	oring a	nd h Sit	uTesti	ng		TC	R If min		
	Stratum Description	Legend	(Thick- ness)	Level (m)	Depth	Туре	(Dia)	Rec E	Blows	Test	Test F	Result	Units R6	260 (mmax	Weter E	Bai
	<u>00 lune lune</u>		(m)		(m)	71 -	\'mm'	% (mins)			1				
	80 degrees medium spaced, planar enetrative orange staining and	г	-													
	comminuted chalk. (Grade: B5)	T T	_											NIDC	,	
New Pit Chalk Form 30.30-30.40m:Dril.	ationj ling disturbed. Recovered as: off-white	г г	_													
	Gravel is weak, law density, off-white, gular fine to coarse. Televiewer shows		-30.40	41.75												
0	ssible stee fractured zone.	T T	-													
	ry weak locally weak, low density ure set 1:3 to 10 degrees dosely		_										10	0		
paced, undulating s	mooth, with black specks and		_		30.00 - 31.50	RC	102						23	3		
	taining, infilled (<1mm) with racture set 2: 65 to 80 degrees		-											,		
edium spaced, plar	nar slightly rough, with penetrative		_													
nalk. (Grade: B5)	infilled (<1mm) with comminuted		_													
New Pit Chalk Form	ation]		_													
			-													
			_													
		, r. , r.	_													
			_ -(2.60)													
			_		31.80 -31.90	c										
		1, 1, 1,	_													
		ТТТ	-										10	_		
			-		31.50 -33.00	RC	102						31	1		
		Tr Tr	_										13	3		
		T T	_													
			-											NIDC		
			_											60		
		T T	_		22.00.22.05	0								100		
		, р. Г. Г.			32.80-32.95	с										
ssumed zone of co		1 11	- 3 3.00 	39.15												
33.00-33.40m:	Televiewer shows possible dissolution features.		 -(0.40)													
villing disturbed Va	ry weak locally weak, low density	- p- p-	-33.40	38.75												
ream CHALK. Fract	ure set 1:3 to 10 degrees dosely		_													
	mooth, with black specks and taining, infilled (<1mm) with		_													
omminuted chalk. F	racture set 2: 65 to 80 degrees		-		33.00 - 34.50	RC	102						73			
	ar slightly rough, with penetrative infilled (<1mm) with comminuted		-		1								9			
nalk. (Grade: B5)																
lew Pit Chalk Form	auonj		-													
			(2.10)													
34	.35m : 1no. black tubular ffint (90mm).		-													
			-													
			-													
		T T	-													
		L. L	_		34.50 - 35.50	RC	102									
	and determine the state of the															L
	sured along borehole axis.	ther fl.	atu ati -	م مصط دا	ould not be	okor -	0.00-	otont								
Jounuwater levels	may be subject to seasonal, tidal and o ols and abbreviations given in 'Key to		Juation			arei) 9	is con	จเสมโ.								

Office: BAM Ritchies, Glasgow Road, Kilsyth, Glasgow G65 9BL

•barn ritchies	E	BORE	HO	LE L	00	3				MLO	rehole I 35-CF eet 8 of	R004
Project Name:	Amersham Tunnel to Calvert			Survey Gr	id Syst	em:	C	SGB	Ho	ole Type:		CP+
				Co-ordinat	es:			13.63 mE		necked By		JMe,
Project No:	1G063-AAZ.							49.98 mN		proved B	y:	PN
lient:	High Speed 2 (HS2) Ltd			Ground Le	evel:			72.15 mO		ale:		1:
ngineer:	High Speed 2 (HS2) Ltd			a						og Status:		FIN
ate Started:	24/10/2016			Orientation				deg		int Date:		20/11/20
Date Completed:	26/10/2016			Inclination:				90 deg		nal Depth:		55.0
S	tratum Description	Legend (Thick-	Level		Samp	1	pring and h S	itu Testing		ult Units R	R Ifmin	
		(m)	(m)	Depth (m)	Туре	(^{Dia})	Rec Blows % (mins)	Test T	est Res	ult Units R	6261D (mma)x	Weter Ba
Drilling disturbed. Ver	y weak locally weak, low density	(,		()								
	ure set 1:3 to 10 degrees closely											
	nooth, with black specks and aining, infilled {<1mm) with	<u> </u>									00 NIDO 60	
comminuted chalk. Fi	acture set 2: 65 to 80 degrees	T T								0	100	
	r slightly rough, with penetrative nfilled {<1mm) with comminuted											
chalk. (Grade: B5)		35.50	36.65									
New Pit Chalk Forma Drilling disturbed Rec	tion covered as: off-white gravelly SILT.									10	00	
	ensity, off-white and subangular.	(0.50)		35.50 - 36.00	RC	102				0	NIDC	
New Pit Chalk Forma	tion] Feleviewershows possible dissolution									C		
-0		:0;n=t-at>00	 36.15									
	covered as: silty sandy subangular		_									
are weak to medium s	strong, medium density, greyish			36.10 -36.23	с							
vhite with black speck New Pit Chalk Forma	ks. (Grade undetermined)											
36.15-37.20m: \	Neak, high density, light greyish white											
	s are 40 to BO degrees closely spaced, h, with non penetrative yellow staining.	T T									NIDO	
	disturbed. Partly recovered non-intact.										120	
				36.00 - 37.50	RC	102				10	0	
										1	3	
		<u> </u>										
		TT-										
		(5.40)										
		┝┸╖┸╼										
				37.50 - 39.00	RC	102				10		
										C		
20.00-20.25m	Medium strong, high density, greyish	<u> </u>										
	egree planar smooth fracture, with no											
	infill.											
				39.35-39.45	D					В		
										2' B	1	
				39.00 - 40.50	RC	102						
		p p										
Stratum depths meas	sured along borehole axis.	1					1					· ·
Groundwater levels n	nay be subject to seasonal, tidal and	other fluctuatior	is and sl	nould not be t	aken a	is cons	tant.					
	ols and abbreviations given in 'Key to		les'									
Further details given	on appended 'Borehole Information S	Sheer.										

•barn ritchies	E	BOF	REF	10	LE L	00	3					N	1L03	hole N 5-CR et 9 of	004	
Project Name: Project No: Client: Engineer: Date Started: Date Completed:	Amersham Tunnel to Calvert 1G063 -AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd 24/10/2016 26/10/2016				Survey Gri Co-ordinate Ground Le Orientation Inclination:	vel:	em:		49891 19384	DSGB 13.63 n 19.98 n 72.15 n d 90 d	nN nOD leg.	Hole Typ Checked Approve Scale: Log Sta Print Da Final De	d By: d By: itus: te:		JⅣ 20/11	P+RC le, CE PMcG 1:25 FINAL I/2017 5.00m
			Depth		inclination.		ing, C	oring	andh Si		0	esult Unit		If min	5	Wel
	Stratum Description		(Thick- ness) (m)	Level (m)	Depth (m)	Туре	(Dia (mm)	Rec %	Blows (mins)	Test	Test R	esult Unit	s RØAD	lfave (mna)x	Weter	Backfi
					40.10 - 40.30	С										
41.3	<u>5-41.40m : Occasional flint framents.</u> re loss.		- - - - - - - - - - - - - - - - - - -	30.75	40.50 - 42.00	RC	102						60 10 0			
Drilling disturbed Re	ecovered as: silty sandy subangular		- 	30.15												
fine to coarse GRAV are weak to medium white with black spec [New Pit Chalk Form	EL with occasional cobbles. Clasts strong, medium density, greyish ks. (Grade undetenmined)		(0.50) 	29.65	42.00 - 43.00	RC	102						100 14	NIDO		
density, light greyish	white CHALK with abundant fractures, very closely spaced.												0			
			- - - - - - - - - - - - - - - - - - -		43.00 - 43.50	RC	102						100 36 0			
			-		43.50 - 45.00	RC	102						83 31 13			
Assumed zone of co	re loss.		- - - - - - - - - - - - - - - - - - -	27.40	44.40 - 44.50	c										
F +450														NR		
		T	-												1	

Office: BAM Ritchies, Glasgow Road, Kilsy1h, Glasgow G65 9BL

•barn ritchies	BO	RE	HO	LE L	00	3						ML03	hole N 5-CR t 10 o	004	
Project Name: Amersham Tunnel to Calvert				Survey Gr Co-ordinat		em:		49891	SGB 3.63 r			ed By:		JM	P+RC e, CB
Project No: 1G063-AAZ. Client: High Speed 2 (HS2) Ltd				Ground Le	vel.				19.98 r 72.15 r		Approv Scale:	ved By:			PMcG 1:25
Engineer: High Speed 2 (HS2) Ltd									2.101	100	Log S	tatus:			FINAL
Date Started: 24/10/2016				Orientation	1:				c	leg.	Print D	ate:		20/11	/2017
Date Completed: 26/10/2016				Inclination:					90 c	leg.	Final	Pepth:		55	5.00m
Stratum Description	Legend	Depth (Thick- ness) (m)	Level (m)	Depth (m)	Sampl Type		•	and h Si Blows (mins)	tu Testi Test	•	esult U	TCR SCR hits RØ2	lfave	Weter	Well Backfi
Weak to medium strong, medium density, light greyish white CHALK with frequent brown laminae (marl wisps). Fracture set 1: horizontal to 10 degrees, closely spaced, smooth planar. Fracture set 2: one 40 degrees fracture, planar smooth, locally infilled (<1mm) with clay. (Grade undetermined) [New Pit Chalk Formation] 45.1 - 45.10m : Greenish grey marl seam. 45.2 to -45.20m : Drilling disturbed. Recovered non- intact.			26.25	45.00 - 46.50 45.70 - 45.95	RC C	102						80 45 45	NIDO 50 150		
Assumed zone of core loss.		_	20.20												
46.10-46.20m : Televiewer shows possible dissolution		-(0.30)											NR		
46.10-46.2011. Interviewent shows possible dissolution feature? Weak to medium strong, medium density, light greyish white CHALK with frequent brown laminae (marl wisps). Fracture set 1: horizontal to 10 degrees, medium spaced, smooth planar, with no infill. Fracture set 2: one 40 to 60 degrees widely spaced, planar slightly rough, locally infilled (<1mm) with clay and comminuted chalk. (Grade: B3) [New Pit Chalk Formation] 46.80-47.10m : Televiewer shows possible dissolution feature? 46.90-47.20m : Drilling disturbed. Recovered non-intact.		-46.20	25.95	46.50 - 48.00	RC	102						100 23 20	NI 60 250		
	T T	-													
		E													
	T T	È.													
	L L	Ē		48.38 - 48.53	с										
Drilling disturbed, recovered non-intact. Extremely weak	- F F	48.55	23.60												
to very weak, low density, light greyish white CHALK with abundant randomly orientated fractures, very closely	T T	÷		10.00 10.50	DO	400						100			
spaced.	T T	Ē		48.00 - 49.50	RC	102						20 7			
[New Pit Chalk Formation]		F													
	T T	E													
		-													
		-													
		E													
		E													
		-													
		-													
			I												
Stratum depths measured along borehole axis.		I		1				I							L
Groundwater levels may be subject to seasonal, tidal and Explanation of symbols and abbreviations given in 'Key t Further details given on appended 'Borehole Infonmation	o Explora			hould not be t	aken a	as con	istant.								

ritchies					LE L								et 11 of	
Project Name:	Amersham Tunnel to Calvert				Survey Gri Co-ordinate		em:	A.C	OSGE 98913.63		Hole T			CF
Project No:	1G063-AAZ.				Co-ordinate	5 5.			98913.63 93849.98			ed By: /ed By:		JM I
lient:	High Speed 2 (HS2) Ltd				Ground Le	vel:				mOD	Scale:			
ngineer:	High Speed 2 (HS2) Ltd										Log S	tatus:		F
ate Started:	24/10/2016				Orientation					deg.	Print D			20/11
Date Completed:	26/10/2016				Inclination:) deg.	FinalD			55
	Stratum Description	Legend	Depth (Thick- ness) (m)	Level (m)	Depth (m)	Sampl Type	1	oring and Rec Blo % (mi		sting t Test	Result U	TCR SCR nits RØD	R Ifmin R Ifave C (mma)	Weter
	covered non-intact. Extremely weak	- P- P- P-	-	_										
	ensity, light greyish white CHALK with orientated fractures, very closely		_											
spaced. New Pit Chalk Form	action		_		49.50 - 51.00	RC	102							
New Fit Chark Form	lation		-									100		
			_									17		
			-									0		
			_											
			_											
			-											
			-											
		<u>г г</u>	_ (3.95)										NIDO	
			(0.90) 											
			_											
			-											
			_									100		
			-		51.00 - 52.50	RC	102					7		
			-											
			_											
			-											
			_											
NA - 1'	Para la colta Pala con la la lata	T T	- 	19.65									<u> </u>	_
	lium density, light greyish white nal thin grey laminae (marl wisps).		-		52.50-52.80	с								
	ontal to 10 degrees closely spaced ghUy rough, with penetrative orange		_		52.50-52.60	C								
brown staining and r	no infill. Fracture set 2: 45 to 86		_											
	ed (60/600/1000), planar smooth nge brown staining and no infill.	TT	_											
Fracture set 3: one 8	35 degree fracture, planar smooth,		-											
with no infill. (Grade: [New Pit Chalk Form	nation]	T T	_									100		
	rilling disturbed. Recovered non-intact. illing disturbed. Recovered non-intact.		_		52.50 - 54.00	RC	102					41 25		
	3	T T	_											
			-											
			-										NI	
			(2.50)										80 130	
			-										150	
		' I' I'	_											
		' F	-											
			_											
			_		54.00 - 55.00	RC	102					100 46		
			-		54.50 - 54.70	c						15		
			_											
		THE P	_											
			-	47.45										
Boreho	ble Terminated at 55.00m		5 5.00	17.15										1
Stratum depths mea	asured along borehole axis.	1			I					- 1	I	I		۰ <u>ـــــ</u>
Groundwater levels	may be subject to seasonal, tidal and				nould not be t	aken a	as con	istant.						
	ools and abbreviations given in 'Key to													

h	9 r	n					-									.		_			Boreho	le No)
,,. b	ritchies			B	OR	EH	0	LE	IN	F	OR	M	٩T		ON	SH	EE	Γ		N	IL035 Sheet		
Project N Project N Client: Engineer	ame: o:	A 1 F	G063 - ligh Spe	am Tunn AAZ eed 2 (H eed 2 (H	S2) L1	td						Surve Co-or Grou	rdina	ates:		4	OSC 198913.1 193849.1 72.	63 mE	C A	Hole Typ Checked Approve	e: I By: d By:	1012	CP+RC JMe, CB PMcG FINAL
Date Star	ted:	2	4/10/20	16								Orier	itatio	n:				deg		Date:		2	0/11/2017
Date Con			6/10/20								I Explora		ole Inf					90 deg		inal De			55.00m
From <ml 0.00 1.20 3.20 6.00 21.50</ml 	To r 1.2 3.2 6.0 21.5 55.0	0 0 0 60	Tvoe IP CP CP CP RC	Start 10/10/201 10/10/201 11/10/201 19/10/201 24/10/201	16 1 16 1 16 24	End 0/10/2016 0/10/2016 1/10/2016 4/10/2016 6/10/2016	T82 T82 T82	Plant ilated diggir 20-758 20-756 20-758 nacchio 305	ig tools	G	Barrel eobor-S (146)	PC	<u>I Bit</u>		M. Gillespi M. Gillespi M. Gillespi M. Gillespi	Crew e /J. Shirrs e /J. Shirrs e /J. Shirrs e /J. Shirrs eeves		Loaae J. Mana J. Mana G. McKe A. McCa N. Chaud	s s an w		R	<u>emarks</u>	
				11-Drillina l										eter	bv Deoth						er bv Dec		
Date 10/10/2016 10/10/2016 11110/2016 11/10/2016 19/10/2016 20/10/2016	17:3 09:3 14:3 13:0 17:3	80 80 80 80 90 80	eoth <ml 0.00 3.20 3.20 6.00 6.00 11.00 11.00</ml 	Casinanl 0.00 3.20 3.20 6.00 6.00 11.00 11.00	Dep	bth Water (m Dry Dry Dry Dry Dry 9.00 7.00	star Enc star Enc star Enc	Remark tt of shift d of shill tt of shift d of shill tt of shift d of shill tt of shift	is		eoth <ml 21.50 55.00</ml 	Dia.I 20 14	00		Rem	narks	Deoth 21.5 55.0	0	<u>Dia.rmm</u> 200 146	1	<u> </u>	<u>emarks</u>	
20/10/2016 20/10/2016 21/10/2016 21/10/2016	17:3	80 80	19.00 19.00 21.50	19.00 19.00 21.50		7.00 8.00 8.00	Enc	d of shill rt of shift d of shill		Fr	om (m)	То	(m)	Vol	lume (Iltres)	wat	er Added	Records	Re	marks			
24/10/2016 24/10/2016 24/10/2016 24/10/2016 25/10/2016 25/10/2016	07:3 10:3 11:3 18:2 07:3	80 30 30 30 25 40	21.50 21.50 21.50 40.50 40.50 55.00	21.50 21.50 21.50 21.00 21.00 21.00		8.00 8.00 6.76 6.52 6.71	star star Enc Enc star	rt of shift rt of shift d of shill d of shill rt of shift d of shill			,												
From (m) 0.50 5.00 21.50 25.65 26.50 29.50 32.50 41.50 47.50	To (m) 6.00 21.50 26.50 27.35 42.50 46.50	Client in Client in Recover Run cut Changin Changin Reduce	structed to structed to ring dropp short as no g from PD g from Im d run leng	canied out i o continue l o commenc ed core - m ot advancin DC bit to Im opregnated	Rem in standp hole with e rotary nostly wa nostly wa pregnate bit to Cu or recover	narks pipe n cable perc coring ashed away ally ed bit ube bit	/	e rig. ing weaker		Fr	om (m) 3.65 4.10 5.00	CI To 3.7 4.2 5.2	20		ation (hh:mm) 00:50		From (i 21.00			rillino Flus eturns (%) 0	h Details Flus VVale		Colour lo returns
Dale 19/10/2016	Strike(m 7.45) caalrci(m) 7.45		er Strikes Depth (m) S 5.20	ealed(m) 11.00	F	Remar	ks	Type I SP	Pipe ID 2) Dia(r		ioe Work Pipe Type Plain	Remarks	From (1		(m) 10	Backfill I legend 909	Details Upstandi	Desaip	
19/10/2016 19/10/2016 19/10/2016	7.45 7.45	7.45 7.45 7.45	10 15 20	5.20 5.20 5.20	11.00 11.00 11.00				SP SP SP	2 1 1	0.50 0.00 16.00	6.00 18.00 26.00	7) 1	599	Slotted Plain Slotted		0.10 0.30 0.50 6.00 18.00 26.00	0. 0. 6. 16 0 26	30 50 00 .00 .00	906 903 902 903 902 903 902 903	Concrete Bentonit Gravel Bentonit Gravel Bentonite	e ie ie	
Depth (ml 1.65	Type s	N Vslue N=14	Casing Cr 1.65	m ater (Dry	mi SWP	Pen(mm Bl	ows1 2	Pen1(mm) 75			Penetra 2(mm) 75		Pen3) Blows4 3	Pen4(mm) 75	Blows5 F	en5(mm 75) Blows	6 Pen6(r 75		mmer BRK1	E. Ratio% 64
2.20 3.20 4.20 6.45 7.45 9.45 9.45 10.00 11.45 12.95 14.45 12.95 14.45 12.95 20.45 21.50		N=40 N=43 N=44 50/245 N=12 N=6 N=8 N=13 N=16 N=54 N=54 N=54 N=17 100/135	2.20 3.20 6.45 7.45 8.45 9.45 10.00 111.45 12.95 14.45 15.95 20.45 21.50	Dry Dry Dry Dry 5.45 6.45 7.45 8.00		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	5 5 8 10 5 1 2 2 2 3 2 5 6 8 5 6 25	75 75 75 75 75 75 75 75 75 75 75 75 75 7	578154222333699765		75 75 75 75 75 75 75 75 75 75 75 75 75 7	10 10 11 15 3 2 2 2 2 2 10 10 6 4 4 50	7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	12 11 14 3 2 2 2 2 5 2 12 11 5 5 4 50	75 75 75 75 75 75 75 75 75 75 75 75 75 60	10 12 15 3 2 2 2 2 3 6 14 15 5 4 4	75 75 75 75 75 75 75 75 75 75 75 75 75 7	8 12 10 6 3 2 2 2 2 2 2 2 2 2 3 6 6 16 20 0 7 4 5	75 20 75 75 75 75 75 75 75 75		9RK1 9RK1 9RK1 9RK1 9RK1 9RK1 9RK1 9RK1	64 64 64 64 64 64 64 64 64 64 64 64 64 6
									. =														
Ground	water le	evels car	n be sub	oject to s	easor			son for H other fluc															

-barn ritchies	E	BORE	HO	LE L	.00	3					N	1L03	hole N 5-RC et 1 of	012
Project Name: Project No: lient: ngineer:	Amersham Tunnel to Calvert 1G063-AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd			Survey G Co-ordina Ground L	tes:	em:		49873 19395	9SGB 39.32 n 50.72 n 79.45 n	nE (nN A nOD S	Hole Typ Checked Approved Scale: Log Sta	l By: d By:		RO+ AB, PM 1: FIN
ate Started: Date Completed:	19/10/2016 25/10/2016			Orientatio Inclination					d 90 d	leg. I	Print Dat Final De	te:		21/11/20 50.0
	Stratum Description	Legend (Thick ness) (m)	- Level (m)	Depth (m)	Samp Type	1	-	and h Si Blows (mins)	itu Testi Test	ng Test Re	sult Units	TCR SCR RQD	Ifmin Ifave I(mma)x	water
Grass over dark bro frequent rootlets. Gr coarse flint. [Alluvium]	wn slightly gravelly SILT with avel is angular to subrounded fine to	${} \begin{cases} \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2$	79.05	0.20-0.40	в									:0; _:- 1 5
Soft orangish brown s is angular to subrou \lluviuml	slightly sandy gravelly CLAY. Gravel """ nded fine to coarse offlint.	1,11,11, 1,	78.85	0.40-0.60	В									
Structureless CHALI ine to coarse of cha Lewes Nodular Cha		0.60		0.80-1.00	В									
	<u>. Gavelis subang</u> ulato subroun <u>de</u> el	=)												
Drillers description: open hole)	CHALK with numerous flints. (Rotary	120 	78.25											
		r - f- f- f-												
		• • •												
		f- f-												
		= f- f- f-												
		- -												
		f-												
		f- f- f -												
		f- f-												

Groundwater levels may be subject to seasonal, tidal and other fluctuations and should not be taken as constant.

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

-barn ritchies	E	BORE	lOl	LE L	OG				N	1L03	hole N 5-RC et 2 of	012
Project Name:	Amersham Tunnel to Calvert			Survey Gr			OSG		Hole Typ			RO+R
Project No:	1G063 -AAZ.			Co-ordinat	es:		498739.3 193950.7		Checked Approve			AB, C PMc
Client: Engineer:	High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd			Ground Le	evel:		79.4	5 mOD	Scale: Log Sta	itus:		1:25 FINA
Date Started: Date Completed:	19/10/2016 25/10/2016			Orientation Inclination:			g	- deg. 0 deg.	Print Da Final De	te: pth:		21/11/201 50.00r
	Stratum Description	Legend (Thick- ness)	Level (m)	Depth (m)	Sampling, Type	-		Test	Result Unit	TCR SCR s R&D	Ifave	Ve
Drillers description: open hole)	CHALK with numerous flints. (Rotary	(m) (m) (m) (m) (m) (m) (m) (m)	69.45									

•barn	B		FН		LEL	\cap	2					M		hole N 5-RC	
ritchies]					IV		et 3 of	-
Project Name:	Amersham Tunnel to Calvert				Survey Gri Co-ordinat		em:			SGB 9.32 n		Hole Typ Checked			RO+
Designed Max	40000 447				CO-orumat	55.									AB,
Project No:	1G063-AAZ.				<u> </u>					60.72 n		Approve	а ву:		PN
Client:	High Speed 2 (HS2) Ltd				Ground Le	vel:			1	'9.45 n		Scale:			1:
Engineer:	High Speed 2 (HS2) Ltd										l	_og Sta	tus:		FIN
Date Started:	19/10/2016				Orientation	:				d	eg. I	Print Dat	te:		21/11/20
Date Completed:	25/10/2016				Inclination:					90 d	eg. I	-inal De	pth:		50.0
			Depth			Sampl	ling C	oring	and h Si	tu Tosti	na		TCR	If min	
	Stratum Description		hick-	Level		oumpi		oninge			ng		SCR	Ifave	
			ess) (m)	(m)	Depth (m)	Туре	(Dia	Rec	Blows (mins) _I	Test	Test Re	sult Uni	ts R Ø 61	D (mna)x	Weter E
white CHALK. Fractu closely spaced (65/' with black specks ar Fracture set 3: two v undulating slightly rc angular coarse gravv [Lewes Nodular Cha 10.00 - 10.34m : 1 coarse angular GR 10.61 - 10.90m greyish white grav Gravelis veiy wea 1 coarse of chalk ar	ong, medium density, light greyish ure set 1: horizontal to 20 degrees, 110/180), undulating slightly rough, dr are orange staining, no infill. ertical to 80 degrees fractures, sugh, no infill. With occasional el of rinded flint. (Grade: A3) Ik Formation] Drilling disturbed. Recovered as: fine to AVEL of rinded flint with occasional flint cobbles. Possible flint band. Drilling disturbed. Recovered as: light velly SILT and occasional flint cobbles. M, medium density, subrounded fine to and anaular fine to coarse of rinded flint. re loss. No flush returns at surface.	₽ ₽- ₽- ₽- ₽- ₽- ₽- ₽- ₽- ₽-	90> 0.90 e	68.55	10.00-11.00	RC	120						90 0 0	NI 110 220 NR	
	ong, medium density, light greyish	r f- f- f- r- r-	1.50 6	67.95			120						0		-
closely spaced (65/' with black specks an Fracture set 3: two v undulating slightly rc angular coarse grav. [Lewes Nodular Cha 11.50-12.00m : D silty subrounded 1 occasional cob medium densi	ure set 1: horizontal to 20 degrees, 110/180), undulating slightly rough, di rare orange staining, no infill. ertical to 80 degrees fractures, bugh, no infill. With occasional el of rinded fiint. (Grade: A3) lk Formation] rilling disturbed. Recovered as: slightly to rounded fine to coarse GRAVEL with bles of chalk and flint. Clasts are weak, ty, off-white with frequent black specks. rilling disturbed. Recovered non-intact.		16)		11.50-12.00	RC	120						100 0 100 22 22	65 110	
		με. r-	10)		12.50-12.72	с								220	
	rilling disturbed. Recovered non-intact. : Drilling disturbed. Recovered as: light	f - f - f - f - f - f - f - f													
greyish white gra	willy SILT with occasional flint cobbles. ak, medium density, subrounded fine to coarse.	5													
13.40- 13.46m .	Rinded flint fragments (up to 120mm). Possible flint band.	r													
Assumed zone of co	re loss.	f- r- r- r- r-	3.66 6	65.79	13.00-14.50	RC	120						44 0 0		
		f- 	.84)											NR -	
Fracture set 1: horizo (65/110/180), undula and rare orange stai degrees to vertical, u	ong, medium density, CHALK. ontal to 20 degrees closely spaced ting slightly rough, with black specks ning, no infill. Fracture set 3: 80 undulating slightly rough, no infill. ular coarse gravel of nodular flint.	f- f-	4.50 6 .87)	64.95										65 110 220	
			1		14.50-15.50	RC	120					1	1		i 1

Groundwater levels may be subject to seasonal, tidal and other fluctuations and should not be taken as constant.

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

•barn ritchies	B	SO	REI	HO	LE L	00	G					N		5-RC et 4 of	012	
Project Name: Project No:	Amersham Tunnel to Calvert 1G063-AAZ.				Survey Gr Co-ordinat Ground Le	es:	em:		49873 19395	SGB 9.32 n 60.72 n '9.45 m	ηN	Hole Typ Checked Approve Scale:	be: I By:	<u>x + 01</u>	RC AE F	0+ B, PN 1:2
Client: ingineer: Pate Started:	High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd 19/10/2016				Orientatior				1	9.45 n		Log Sta Print Da				=IN
Date Completed:	25/10/2016				Inclination					90 d	eg.	Final De	pth:		50).0
	Stratum Description	Legen	Depth (Thick- ness) (m)	Level (m)	Depth (m)	Sampli Type	Die	-	andh Sit Blows (mins)	tu Testi Test	-	esult Unit	TCR SCR s RQD	lfmin Ifave I(mnna)x	Weter	
grey to black fi GRAVEL of rinde 14.90 - 14.97m	Ik Fonmation] : Drilling disturl.Jed. Recovered as: dark ne to subangular 10 subrounded coarse d flint and weak, medium density chalk. : Rinded flint fragments (up 10 60mm). Possible flint band. re loss. No flush returns at surface.		f- f- :::15.37 f- f-	64.08									87 57 57	65 110 220		
15.37	- 15.50m:Assumed zone of COTE loss.		r- µo.63) r- r- r-		15.50 - 16.00	RC	120						0 0 0	NR		
Fracture set 1: horiz (651110/180), undula and rare orange stai degrees to vertical, u	ong, medium density, CHALK. ontal to 20 degrees dosely spaced ting slightly rough, with black specks ning, no infill. Fracture set 3: 80 undulating slightly rough, no infill. ular coarse gravel of nodular flint.		r- - :00 r- r- r- r- r- r- r- r- r- r- r-	63.45											-	
[Lewes Nodular Cha			r- t<1.10) r- r- f- f- f- r-		16.00 - 17.10	RC	120						100 24 24	65 110 220		
Assumed zone of co	re loss. No flush returns at surface.		r- -17.10 r- r- r-	62.35									0		-	
			f-{0.40) f- r- r- 7.50	61.95	17.10 - 17.50	RC	120						0	NR		
frequent thin light gro set 1: horizontal to 2 (200/450/850), undu specks, rare orange 40 degrees to 50 de (210/400/560), undu Fracture set 3: 60 to (200/250/335), undu With occasional nod [Lewes Nodular Cha	sity, light greyish white CHALK with y laminations (marl wisps). Fracture 0 degrees medium to widely spaced lating slightly rough, with black staining and no infill. Fracture set 2: grees medium spaced lating slightly rough, with no infill. 70 degrees, medium spaced lating slightly rough, with no infill. ular flints. (Grade: A 1/2) lk Formation] illing disturlJed. Recovered non-intact.		1		17.50 - 19.00	RC	120						100 59 47			
10.00	- 19.10m : Assumed zone of COTE loss.		f- f- f- f-		18.68 - 18.85	i c							_			
	illing disturlJed. Recovered non-intact.		- 										93 57 57			6 600 50 50 50
			r- r- r- r- r-		19.00-20.50	RC	120								1	0 4 0 4 0 4

•barn	E	BORE	НО	LE L	00	3					N	IL03	hole N 5-RC et 5 of	012	
Project Name:	Amersham Tunnel to Calvert			Survey Gr		em:			SGB		lole Typ				+RC
Project No:	1G063-AAZ.			Co-ordinat	es:				9.32 r 50.72 r		hecked	•			8, CB McG
Client:	High Speed 2 (HS2) Ltd			Ground Le	evel:				′9.45 n		cale:	,.			1:25
Engineer:	High Speed 2 (HS2) Ltd										og Sta				INAL
Date Started: Date Completed:	19/10/2016 25/10/2016			Orientation Inclination:					d 90 d	•	rint Dat inal De			21/11/2 50	2017 .00m
		Depth				ing, C	oring a	indh Si	tu Testi	na		TCR	lf min		
	Stratum Description	Legend (Thick- ness) (m)	Level (m)	Depth (m)	Туре	(^{Dia} mm)	Rec %	Blows (mins)	Test	Test Res	sult Unit	SCR RØJD	lfave (mnna)x	Weter B	Wel Backfi
20.78-21.oom:Dri 21.35-21.91m:Dr	: Rinded flint fragments (up to 55mm). Possible flint band. 20.78m : Brachiopod fossil (40mm). Illing disturbed. Recovered non-intact. rilling disturbed. Recovered non-intact. Ingular medium to Coarse gravel of flint fragments.			20.50 - 22.00	RC	120						100 40 36			හිදා හිදා හිදා හිදා හිදා හිදා හිදා හිදා
	rilling disturbed. Recovered non-intact. gular medium to coarse gravel of rinded flint fragments and finger flint.			22.12 - 22.32	с								NI 100 430		<u> </u>
22.83-22.96m:Dr	illing disturbed. Recovered non-intact.			22.00 - 23.50	RC	120						100 100 56			o ở c ở c ở c ở c ở c ở c ở c ở c ở c
	rilling disturbed. Recovered non-intact. medium to coarse gravel of rinded flint.														80 890 890 8
23.81 - 23.83m	: Rinded flint fragments (up to 40mm). Possible flint band.			23.50 - 25.00	RC	120						100 33 33			රං වැං වැං වැං වැං වැං වැං වි
24.73	3 - 24.77m : Nodular flint (up to 50mm).													0	360 360 360 1

Groundwater levels may be subject to seasonal, tidal and other fluctuations and should not be taken as constant.

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

•barn	B	BORE	HO	LE L	00	3				N	IL03	hole N 5-RC et 6 of	012
Project Name:	Amersham Tunnel to Calvert			Survey Gri Co-ordinat	-	em:	O 49873	SGB 9.32 n		ole Typ necked	e:		RO+F AB, C
roject No: lient:	1G063 -AAZ. High Speed 2 (HS2) Ltd			Ground Le			19395		nN Ap nOD So	prove ale:	d By:		PM 1:2
igineer: ate Started: ate Completed:	High Speed 2 (HS2) Ltd 19/10/2016 25/10/2016	Inclina	tion	Orientatior 90 deg.	:			d		ig Sta int Dat			FIN 21/11/20 50.00
	Stratum Description	Legend (Thick-	Level		Sampl	-	 and h Sit				TCR SCR	If min If ave	Weter W
25.00.25.00m		ness) (m)	(m)	Depth (m)	Туре	Dia (mm)	 Blows (mins)	Test	Test Resu	t Units	RQD %	lf max (mm)	B
greyish white si chalk and nint. Clas density, off-white cha	: Drilling disturbed. Recovered as: light lightly sandy fine to coarse GRAVEL of its are weak to medium strong, medium alk with some dark grey to black rinded flint fragments.	⊧- - - - 25.60	53.85	25.00 - 25.65	RC	120					100 0 0	NI 490	1d 1d' 1d 1d 1d
coarse subangular G and high density. Top <u>ewes Nodular Cha</u> Veak, medium dens requent thin light gre tet 1: horizontal to 2	sity, light greyish white CHALK with ey laminations (marl wisps), Fracture 0 degrees medium to widely spaced	≥-25.65 po.85)	53.80	25.65 - 26.50	RC	120				-	24		1 d 1 d 1 d 1 d 1 d
pecks, rare orange 40 degrees to 50 deg (210/400/560), undu Fracture set 3:60 to (200/250/335), undu With occasional nod	Ilating slightly rough, with black staining and no infill. Fracture set 2: grees medium spaced Ilating slightly rough, with no infill. 70degrees, medium spaced Ilating slightly rough, with no infill. Iular flints. (Grade: A1/2)	L26.50	52.95							-	-	NR	
With occasional ang	IIK Formation] illingdisturbed. Recovered non-intact. jular medium 10 coae gravel of rinded flint fraaments. ore loss. No flush returns at surface.	r- - - - - - -		26.50-27.3	6 RC	120					0 0	-	1d 1d
requent thin light gre set 1: horizontal to 20 (200/450/850), undu black specks, rare o	sity, light greyish white CHALK with ey laminations (marl wisps). Fracture 0 degrees medium to widely spaced lating slightly rough, with frequent range staining and no infill. Fracture		52.10	27.35 - 28.00	RC	120					100 15 15		- 10 10 10 10
undulating slighUy n 70 degrees, medium slightly rough, no inf gravel of flint and oc Lewes Nodular Cha 27.35 - 28.40m : D	es medium spaced (210/400/560), ough, no infill. Fracture set 3: 60 to a spaced (200/250/335), undulating fill. With occasional angular coarse casional flint cobbles. (Grade: A 1/2) (Ik Formation] rrilling disturbed. Recovered non-intact. gular medium 10 coae gravel of rinded	r- r- p1.05) r- r- r- r- r- r- r- r- r- r-		27.75-27.85	D					-	- 15	20 50 120	10 10 10 10
Assumed zone of co	<i>flint fragments.</i> ore loss. Core loss presumed to be due to flint.	28.40	51.05	28.00 - 29.50	RC	120					27 0		
		r- H1.10> r- r- r- r- r- r-									0	NR -	1c 1c 1c
	sity, light greyish white CHALK with	f- [9_50	49.95										0 0 0
frequent thin light gre set 1: horizontal to 2 (200/450/850), undu	ey laminations (marl wisps). Fracture 0 degrees medium to widely spaced lating slightly rough, with frequent	t<0.31)		19.00-40.25				Falling Head	1.2E00	5 mis			< <
slack specksoratege	zasqeestainingpacednezinfilloErsetyre	t29.81	49.64										1d

Groundwater levels may be subject to seasonal, tidal and other fluctuations and should not be taken as constant.

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

•barn ritchies	E	BOR	E	HO	LE L	00	3					Μ	L03	hole N 5-RC et 7 of	012	
Project Name:	Amersham Tunnel to Calvert				Survey Gri		em:			SGB		lole Typ				D+R
Project No:	1G063-AAZ.				Co-ordinate	es:				39.32 r 50.72 r		hecked	•			B, C PMc
Client:	High Speed 2 (HS2) Ltd				Ground Le	vel:				79.45 r		cale:	г Бу.			1:25
Engineer:	High Speed 2 (HS2) Ltd										L	.og Stat	tus:		F	FINA
Date Started:	19/10/2016				Orientation	:				0	•	Print Dat			21/11/	
Date Completed:	25/10/2016				Inclination:					90 c	0	inal De			50	100.C
S	Stratum Description	Legend (1	Depth Thick- ness) (m)	Level (m)	Depth (m)	Sampl Type	ing, C Dia (mm)	Rec	andh Si Blows (mins)	tu Test	Ing Test Re	sult Unit	TCR SCR s RD		water	We Bacl
	ugh, no infill. Fracture set 3: 60 to spaced (200/250/335), undulating	3	80.08	49.37	30.00 - 30.10	D										0000
gravel of flint and occ	II. With occasional angular coarse casional flint cobbles. (Grade: A 1/2)				29.50 - 31.00	RC	120									30,00
[Lewes Nodular Chal 29.50 - 29.81m : N	K Formation] Nodular flint fragments {up t0 100mm). Possible flint band.												89 10			000
strong, high density (0			50.00
	Ik Formation															0000
set 1: horizontal to 20	D degrees medium to widely spaced ating slightly rough, with frequent															0000
black specks, rare or	ange staining and no infill. Fracture es medium spaced (210/400/560),		-													0000
	ugh, no infill. Fracture set 3: 60 to spaced (200/250/335), undulating		2.42)											20 50		000
	II. With occasional angular coarse casional flint cobbles. (Grade: A 1/2)		,_,											120		80
[Lewes Nodular Chal	lk Formation] 30.08 - 30.12m : Grey marl band.	<u>r</u> -r-														600
	Iling disturbed. Recovered non-intact. ular medium to coarse gravel of rinded												95			000
30.69 - 30.70m:	flint fragments. Drilling disturbed. Recovered as: light				31.00 -32.50	RC	120						15 0			00
ar	e subangular GRAVEL of chalk. Clasts e strong and high density. Chalk Rock.															0000
	illing disturbed. Recovered non-intact. ular medium to coarse gravel of rinded		-													000
	flint fragments. - 31.00m : Assumed zone of core Joss.															000
	illing disturbed. Recovered non-intact. ular medium t0 coarse gravel of rinded	TTT-														60
31.25-31.34m	flint fragments. Drilling disturbed. Recovered as: light:	ТТЗ	32.50	46.95												600
	e subangular GRAVEL of chalk. Clasts e strong and high density. Chalk Rock.															00 00
31.34-32.42m:Dri	illing disturbed. Recovered non-intact. ular medium to coarse gravel of rinded															00
J	flint fragments. - 32.50m : Assumed zone of core loss.															000
Medium strong, medi	ium density, greyish white CHALK grey laminations (marl wisps).		-													0000
Fracture set 1: horizo	ontal to 20 degrees, extremely												100			000
	aced (8/68/125), undulating slightly ecks, rare orange staining and no				32.50 - 34.00	RC	120						57 24			000
	60 to 80 degrees, undulating slighUy ecks, orange staining and no infill.												21			800
Possibly Chalk Rock. [Lewes Nodular Chal	(Grade: A4)	<u> </u>														8
	ik i offiaionj													8		8
		r	4.50)											68 125		8
					33.90 - 34.00	D										00
	Drilling disturbed. Recovered as: light		-													80
	esubangular GRAVEL of chalk. Clasts e strong and high density. Chalk Rock.															000
																0000
													97			000
													27 7			000
					24.00 05.55		100									000
					34.00 - 35.50	кС	120									000
																000
			- 1											ĺ		

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Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

•barn ritchies	E	BORE	10	LE L	00	3					Μ	L03	hole N 5-RC et 8 of	012		
Project Name:	Amersham Tunnel to Calvert			Survey Gr		em:			GB		Іе Тур	e:		R	0+R(2
Project No:	1G063-AAZ.			Co-ordinat	es:			198739 193950			ecked provec	-			B, CI PMc0	- 1
Client:	High Speed 2 (HS2) Ltd			Ground Le	evel:).72 n).45 n		ale:	і Бу.			1:25	- 1
Engineer:	High Speed 2 (HS2) Ltd									Lo	g Stat	tus:		F	FINA	L
Date Started:	19/10/2016			Orientation					d	0	nt Dat			21/11		
Date Completed:	25/10/2016	Depth		Inclination:		ing C	oring and	dh Situ	90 d	-	nal Dep	otn: TCR	If min	50	0.00n	n —
:	Stratum Description	Legend (Thick- ness) (m)	Level (m)	Depth (m)	Туре	-	Rec Bl		Test	Test Resu	It Units	SCR RØD	lfave (mma)x	Weter	We Back	ell fil
35.50 - 35.63m : greyish white coars ar 36.26 - 36.34m : Dr	- 35.50m : Assumed zone of core loss. : Drilling disturl.Jed. Recovered as: light e subangular GRAVEL of chalk. Clasts re strong and high density. Chalk Rock.			35.50 -37.00 36.30 - 36.40	RC C	120						98 33 8	8 68 125		න් හිර	
Weak, medium dens frequent thin light gre set 1: horizontal to 2/ (200/450/850), unduli black specks, rare or set 2: 40 to 50 degre undulating slighUy ro Fracture set 3: 60 de spaced (200/250/335 (Grade: A1/2) [New Pit Chalk Form 37.00-37.57m : Dr 37.89-38.29m : Dr	- 27.00m : Assumed zone of core less ity, light greyish white CHALK and ey laminations (mar1 wisps). Fracture 0 degrees, medium to widely spaced ating sligh11y rough, with frequent range staining and no infill. Fracture ees medium spaced (210/400/560), pugh, with black specks and no infill. egrees to 70 degrees medium b), undulating slighUy rough, no infill. ration] rilling disturIJed. Recovered non-intact. rilling disturIJed. Recovered non-intact.		42.45	37.00 -38.50	RC	120						86 6 0			20 500 500 500 500 500 500 500 500 500 5	
	illing disturlJed. Recovered non-intact.			38.80 - 38.95 38.50 - 40.00		120						89 20 20	70 150 370		छ <u>े. किंग के</u> किंग के कि	

Groundwater levels may be subject to seasonal, tidal and other fluctuations and should not be taken as constant.

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

•barn ritchies	В	OF	REI	HO	LE L	00	3					N	IL03	hole N 5-RC et 9 of	012	
Project Name: Amersham Tunne Project No: 1G063-AAZ. Client: High Speed 2 (HS Engineer: High Speed 2 (HS Date Started: 19/10/2016 Date Completed: 25/10/2016	62) Ltd				Survey Gr Co-ordinat Ground Le Orientatior Inclination:	es: evel:	em:		49873 19395	9SGB 39.32 r 50.72 r 79.45 r c 90 c	nE (nN) nOD S	Hole Typ Checked Approved Scale: Log Sta Print Dat Final De	l By: d By: tus: te:		Al ا ا 21/11	O+RC B, CB PMcG 1:25 FINAL //2017 0.00m
Stratum Description		Legend	Depth (Thick- ness)	Level (m)	Depth		-	-	andh Si Blows (mins)	tu Testi	· ·		TCR	lfmin Ifave (mma)x		Well Backfi
40.00-40.94m : Drilling disturbed. Reco 40.61 - 40.74m : Rinded flint fragme			(m)	38.51	(m) 40.00 - 41.50	RC	120		(mins)				63 0 0	70 150 370		200 200 200 200 200 200 200 200 200 200
Weak, medium density, light greyish whi frequent thin light grey laminations (mar		T.T.	 	37.95										NR		
(a) (200/450/850), undulating slightly rough (200/450/850), undulating slightly rough black specks, rare orange staining and r set 2: 40 to 50 degrees medium spaced undulating slightly rough, with black spe Fracture set 3: 60 degrees to 70 degree spaced (200/250/335), undulating slightl (Grade: A1/2) [New Pit Chalk Formation] 41.50-41.84m:Drillin disturbed. Reco	to widely spaced with frequent no infill. Fracture (210/400/560), cks and no infill. s medium y rough, no infill.		(0.60)	37.35	41.50 - 42.50	RC	120						60 14 14	70 150 370		
Assumed zone of core loss. No flush ret Weak, medium density, light greyish whi frequent thin light grey laminations (mar set 1: horizontal to 20 degrees, medium (200/450/850), undulating slightly rough black specks, rare orange staining and r set 2: 40 to 50 degrees medium spaced undulating slightly rough, with black spe Fracture set 3: 60 degrees to 70 degree spaced (200/250/335), undulating slightl (Grade: A1/2) [New Pit Chalk Formation] 43.00-43.52m: Drilling disturbed. Reco	te CHALK and I wisps). Fracture to widely spaced , with frequent no infill. Fracture (210/400/560), cks and no infill. s medium y rough, no infill.			36.95	42.50 - 43.00 42.73 - 43.00	RC C	120						100 60 60			
44.50-44.91m : Drilling disturbed. Reco	overed non-intact.				43.00 - 44.50	RC	120						100 25 25			
Stratum depths measured along boreho Groundwater levels may be subject to s Explanation of symbols and abbreviation Further details given on appended 'Bore	seasonal, tidal and o ns given in 'Key to E	Explora			hould not be t	aken a	us con	istant.							I	<u> </u>

•barn	E	BORE	НО	LE L	00	3					M	L03	hole N 5-RC t 10 of	012	
	mersham Tunnel to Calvert			Survey Gr Co-ordinat	-	em:		49873)SGB 39.32 r 50.72 r		Hole Typ Checked Approved	By:		A	O+RC B, CB PMcG
Client: H Engineer: H	High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd			Ground Le					79.45 r	nOD	Scale: Log Stat	tus:		F	1:25 FINAL
	9/10/2016 25/10/2016	1	1	Orientation Inclination:					c 90 c	leg.	Print Dat Final De	oth:		21/11 50	/2017 0.00m
Stra	atum Description	Legend (Thick ness) (m)		Depth (m)	Samp Type	1	•	and h Si Blows (mins)			esult Units	TCR SCR RØD		Weter	Well Backfi
Recovered as: light g of chalk with occasio medium strong,	ing disturbed. Recovered non-intact. rreyish white fine to coarse GRAVEL nal chalk cobbles. Gravel is weak to medium density, off-white with black e orange staining. Possibly fractured zone?			44.50 - 46.00	RC	120						100 43 43			
	ng disturbed. Recovered non-intact. ar medium to coarse gravel of rinded			45.84-45.94	c										
	rmeaium to coarse gravel or indee flint fragments.			46.00 - 47.50	RC	120						88 15 13	70 150 370		
Recovered as: ligf coarse GRAVEL of cha weak to medium strong 47.32-4	nt greyish white slightly sandy fine to alk with rare chalk cobbles. Gravel is g and medium density, off-white with frequent black specks. 7.50m :Assumed zone of core Joss. ng disturbed. Recovered non-intact.														
48.14-48.31m:Drillir	ng disturbed. Recovered non-intact.			47.50 - 48.50) RC	120	0					90 16 16			
Possibly New Pit Marl 2 [New Pit Chalk Formati	eyish green slighUy silty MARL. ?? (Grade Undetermined) on] 3.50m:Assumed zone of core Joss.		31.13										NIDO		
Drilling disturbed. Weak white CHALK with frequ	r, medium density, light greyish uent thin light grey laminations s vertical, undulating slightly ade: A1?)		30.80	48.74-48.84	D										
		· · · · · · · · · · · · · · · · · · ·		49.03-49.13 48.50-50.00	D RC	120						85 0 0	NIDO		
Assumed zone of core	loss.	49.77	29.68										NR		
r Boreho1e	Flerminated at50.com+	+ <i>-</i> 5uoo	29.45											-	
Groundwater levels ma Explanation of symbols	red along borehole axis. ay be subject to seasonal, tidal and s and abbreviations given in 'Key to n appended 'Borehole Information :	Exploratory Ho		hould not be t	aken a	as con	hstant.						L	1	L

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Office: BAM Ritchies, Glasgow Road, Kilsyth, Glasgow G65 9BL

	,,.b	a r] itchie:			BO	REH	OLE	IN	FOR	MA	ΓI	ON	SHI	EET			MLO	rehole N 35-RC neet 1 of	012
	Project No Client:	0:	I	1G063 High Sp	-AAZ eed 2 (HS2	!) Ltd				Co-ordin	ates			98739.32 93950.72	mN	Che App Log	ecked By proved B g Status	y:	AB, CB PMcG FINAL
										Inclinatio	on:								
							Plant					Ria (Inspection		(S
	1.20 10.00 29.50	10.0 29.5 32.5	0 0 0	RO RC RC	19/10/2016 20/10/2016 20/10/2016	19/10/2016 20/10/2016 21/10/2016	Cornacchio 30 Cornacchio 30	5	T6-146	PCD Impregnate	ed	A.Rob A.Rob	oinson oinson	A.R A. A.	obinson Barnard Barnard		Rotaiy ope Rotaiy cor Rotaiy cor	en hole ed ed	
	Date	Tim	ie D				Remark	s	Deoth <ml< td=""><td></td><td></td><td></td><td>arks</td><td>Deoth <m< td=""><td></td><td></td><td>Diameter b</td><td></td><td>s</td></m<></td></ml<>				arks	Deoth <m< td=""><td></td><td></td><td>Diameter b</td><td></td><td>s</td></m<>			Diameter b		s
201011 1100 0.00 0.00 End orbit Form (10) To (0) Water Reso Results	19/10/2016 20/10/2016 20/10/2016 21/10/2016 21/10/2016 24/10/2016 24/10/2016	18:3 07:3 18:1 07:3 15:0 08:4	0 5 60 00 00	10.00 10.00 31.00 26.52 41.18 40.89	10.00 10.00 31.00 28.52 41.18 40.89 20.50	3.91 13.36 13.27 13.32 13.34 13.33	End of shill start of shift End of shill start of shift End of shill start of shift		10.00 50.00	166 146				50.00	14				
Term (n) To (n) Term (n) To (n) Prove (n)						13.35			From (m)	To (m)	Vo	olume (litres)	wate	er Added Re		Rema	irks		
1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 100				Dept															
Date Strategy Jesteries Dept Type Perform	19.00 25.85 26.50 29.50 32.50 41.50	40.25 26.50 27.35 42.50	Droppe Run cu Changi Changi Reduce	ed core. wa t short as r ng from P(ng from Im ed run leng ed core. wa	earned out in s shed away whi iot advancing a CD to Impregna ipregnated to C th after poor re shed away whi	tandpipe ilst trying to reco as expected. ated drill bit. Cube drill bit. ecovery on previo	ous run.						1001	1.20 10.00 11.00 12.00 13.00	10.00 11.00 12.00 13.00 14.50	50 90 90 90	-100 -90 0 -90 -90 0	VValer Nater VValer VValer Nater Nater	Nhite o returns o returns Nhite
SP 1 20.00 40.00 60 Solited 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 </td <td>Dale</td> <td>Strike(m</td> <td>) caalrci(m</td> <td></td> <td></td> <td>ed(m) R</td> <td>emarks</td> <td></td> <td>ipe ID From(m</td> <td>n) To (m) D</td> <td>a(mm)</td> <td>Pipe Type</td> <td>Remarks</td> <td></td> <td></td> <td>leg</td> <td>gend</td> <td>Desa</td> <td></td>	Dale	Strike(m) caalrci(m			ed(m) R	emarks		ipe ID From(m	n) To (m) D	a(mm)	Pipe Type	Remarks			leg	gend	Desa	
Depth (m) Type N Value Casino Cm Nature (m) BW Pen (m) Biows1 Pen/1 (m) Biows2 Pen/2 (m) Biows3 Pen/2 (SP	1 20.00	40.00	50	Slotted		0.10 0.50 19.00	0.50 19.00 40.25	9 9 9	006 Co 003 Be 002 Gra	n crete ntonite avel	
	Depth (ml	Туре	N Vslue	Casino C	m ater (m)	SWPen(mm Blo	ws1 PenHmm)						Pen4(mm)	Blows5 Fen	5(mm) Blo	ows6	Pen6(mm)	Hammer	E. Ratio%
Groundwater levels can be subject to seasonal, tidal and other fluctuations and should not be taken as constant.							Reason for H	oleTer	mination: 1	Reached	sche	duled de	pth						
	Ground	water le	evels ca	ın be sul	bject to sea														

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-barn	E	BOI	RE	HO	LE L	.00	3					ľ	/LO 3	ehole N 5 5-R0 et 1 of	001	
Project Name:	Amersham Tunnel to Calvert				Survey G	rid Syst	em:		C	SGB		Hole Ty	pe:			RO
					Co-ordina	ites:				53.96 n		Checke	-			e, CB
Project No: Client:	1G063-AAZ.				Ground L	avalı				11.88 r 76.00 n		Approve Scale:	ed By:			PMcG
Engineer:	High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd				Ground L	evel.				76.00 11	IOD	Log St	atus:			1:25 INAL
Date Started:	10/10/2016				Orientatio	n:				d	eg.	Print Da			20/11/	
Date Completed:	17/10/2016	- .			Inclination	1:				90 d	eg.	Final D	epth:		50	.00m
Ş	Stratum Description	Legen	Depth (Thick- ness) (m)	Level (m)	Depth (m)	Sampl	1	-	andh Si Blows (mins)		-	Result Un	TCR SCF ts RØE	Ifave	water	Vel ckf
MADE GROUND: Gr gravelly clay with free Made Groundl	ass over dark brown slightly sandy quent rootlets.	- .	r- >-0.10	75.90												:0: ₂ , ,
with occasional stran angular to subrounde	ark brown slightly sandy gravelly clay ids of string. Sand is fine. Gravel is ed fine to coarse of various brick fragments and flint.		50.50)		0.50	В										;;; IZ ;z ,,
[Made Ground]	s <u>andy gravelly (C</u> AY_Sand i ≴ in <u>e</u> ""		-0.50 >-	75.40												i/ '
	ubrounded fine to coarse of various f :	. 1:"""	f-													,, ,, 7
11 including	flint.	f:s=:	- :[<0.60)		1.1	В										,,,
		,,		- 4 00												
		q	r-	74.80												
	ight brown sandy CLAY. (Rotary	. * *	1.20													
open hole)			r- f-													
			f- f													
			f-													
			I-													
			r- k-													
			1 f													
		11	f-													
			r													
			(<2.30)													
		-	t-													
		f	r- r- f- f- f- f- f- f- f- f- f- f- f- f- f-													
			r r													
			r- f_													
			- -													
		11	1- 3.50	72.50												
Drillers description: C open hole)	Coarse SAND and GRAVEL. (Rotary		r- f- f-	12.00												
			f													
		-	f.													
			r-													
			f-													
			r [<3.00)													
		- •	I -												.	
			r- f-													
			i-													
			r													
			[

Groundwater levels may be subject to seasonal, tidal and other fluctuations and should not be taken as constant. Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

-barn ritchies	BOI	RE	HOI	LEL	.00	3					M	L03	hole N 5-R0 et 2 of	001
Project Name: Amersham Tunnel to Calvert Project No: 1G063-AAZ. Client: High Speed 2 (HS2) Ltd ngineer: High Speed 2 (HS2) Ltd				Survey G Co-ordina Ground L	tes:	em:		49865 1942)SGB 53.96 n 11.88 n 76.00 n	nE nN	Hole Typ Checked Approved Scale: Log Stat	e: By: I By:		R JMe, C PMc 1:25 FINA
Date Started: 10/10/2016 Date Completed: 17/10/2016				Orientatio Inclinatior					d 90 c	•	Print Dat Final De			20/11/201 50.00r
Stratum Description	Legend	Depth (Thick- ness) (m)	Level (m)	Depth (m)		Dia	Rec	Blows	itu Testi Test 1		sult Units	TCR SCR RQD %	If min If ave If max (mm)	water Bad
Drillers description: Coarse SAND and GRAVEL. (R open hole)	btary													16 1c1 1c1 1 = 1 = 1c1 1c1 1c1 1 = 1 = 1 = 1 = 1 = 1 = 1 = 1
Drillers description: Brownish yellow SAND. (Rotary open hole)			69.50											$ \begin{array}{c} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\$

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

-barn ritchies	L	BOF	RE	HOI	LE L	.00	3					Μ	L03	hole N 5-R0 et 3 of	001
Project Name: Project No: Dlient: ingineer: Date Started:	Amersham Tunnel to Calvert 1G063-AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd 10/10/2016				Survey G Co-ordina Ground L Orientatio	tes: evel: n:	em:		4986 1942	DSGB 53.96 r 11.88 r 76.00 r d	nE C nN A nOD S L eg. F	lole Typ checked pprovec cale: .og Sta Print Dat	be: By: d By: tus: te:		F JMe, (PM 1:2 FIN, 20/11/20
Date Completed:	17/10/2016 Stratum Description	Legend	Depth (Thick- ness)	Level (m)	Inclination Depth	Sampl	Dia	Rec	and h S Blows		ing	inal De	TCR SCR	lf min If ave If max	50.00 water W Ba
Drillers description: open hole)	Brownish yellow SAND. (Rotary		(m) (m) (m) (m) (m) (m) (m) (m)		(m) 10.43 10.43 11.21	EW EW	(mm)							(mm)	16 1c1 1c1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 <tr td=""></tr>
Drillers description (Rotary open hole)	: CHALK with flint gravel bands.	- •	r- 13.80 r- r- r- r- r- r- r- r- r- r- r- r- r-	62.20											101 1 101 101 101 101 105

Groundwater levels may be subject to seasonal, tidal and other fluctuations and should not be taken as constant.

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

-barn ritchies		BO	REI	HOI	LEL	.00	6					Μ	L03	hole N 5-R0 et 4 of	001
Project Name: Project No: Client: Engineer: Date Started: Date Completed:	Amersham Tunnel to Calvert 1G063-AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd 10/10/2016 17/10/2016				Survey G Co-ordina Ground L Orientatio Inclinatior	tes: evel: n:	em:		498653 19421	6GB 3.96 mE 1.88 mN 6.00 mC deg 90 de	E Cł I Ap DD So Lo g. Pr	ole Typ necked oprove cale: og Sta rint Dat nal De	be: By: d By: tus: tus:		R JMe, C PMc 1:25 FINA 20/11/201 50.00r
	Stratum Description	Legend	Depth (Thick- ness) (m)	Level (m)	Depth (m)		Dia	Rec	ind h Situ Blows mins) T	uTestin	-		TCR SCR	If min If ave If max (mm)	water Bac
(Rotary open hole)	CHALK with flint gravel bands.		F- F- F- F- F- F- F- F- F- F-	57.00											$ \begin{array}{c} 166\\ 1c16\\ 1c16\\$

Groundwater levels may be subject to seasonal, tidal and other fluctuations and should not be taken as constant.

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

-barn ritchies		BOREHO	LE LOG		ML03	nole No: 5-R0001 it 5 of 10
Project Name: Project No: Client: Engineer: Date Started: Date Completed:	Amersham Tunnel to Calvert 1G063-AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd 10/10/2016 17/10/2016		Survey Grid System: Co-ordinates: Ground Level: Orientation: Inclination:	OSGB 498653.96 mE 194211.88 mN 76.00 mOD deg. 90 deg.	Hole Type: Checked By: Approved By: Scale: Log Status: Print Date: Final Depth:	RO JMe, CB PMcG 1:25 FINAL 20/11/2017 50.00m
Drillers descriptior with possible flint b open hole)	Stratum Description n: No flush returns at surface. CHALK bands and softer horizons. (Rotary	Legend (PARR- Level ness) (m)	Depth Dia Red	g and h Situ Testing c Blows (mins) Test Test R	TCR RQD Result Units %	$ \begin{array}{ c c c c } & \text{If min} \\ \text{If max} \\ \text{If max} \\ \text{(mm)} \end{array} \text{ water } \begin{array}{ c c c c } & \text{Well} \\ & \text{Backfill} \\ & \text{Backfill} \\ & \text{Icl6} & \text{Icl6} & \text{Icl6} \\ \end{array} $
						$\begin{vmatrix} c 6: \\ & = \\ & = \\ & = \\ c 6: \\ c 6: \\ c 6: \\ & = \\ & = \\ c 6: \\ c 6: \\ c 6: \\ \end{vmatrix}$
	reasured along borehole axis.					$ \begin{array}{c} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 6 \\ 1 \\ 6 \\ 1 \\ 6 \\ 1 \\ 6 \\ 1 \\ 6 \\ 1 \\ 6 \\ 1 \\ 6 \\ 1 \\ 6 \\ 1 \\ 6 \\ 1 \\ 6 \\ 1 \\ 6 \\ 1 \\ 1 \\ 6 \\ 1 \\ 1 \\ 6 \\ 1 \\ 1 \\ 6 \\ 1 \\ 1 \\ 6 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ $

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

-barr ritchies	1	BOREHO	LE LOG		ML03	nole No: 5-R0001 t 6 of 10
Project Name: Project No: Client: Engineer: Date Started: Date Completed:	Amersham Tunnel to Calvert 1G063-AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd 10/10/2016 17/10/2016		Survey Grid System: Co-ordinates: Ground Level: Orientation: Inclination:	OSGB 498653.96 mE 194211.88 mN 76.00 mOD deg. 90 deg.	Hole Type: Checked By: Approved By: Scale: Log Status: Print Date: Final Depth:	RO JMe, CB PMcG 1:25 FINAL 20/11/2017 50.00m
Drillers description with possible flint b open hole)	Stratum Description I: No flush returns at surface. CHALK vands and softer horizons. (Rotary	Legend (PRRR- Level ness) (m) 	Depth Dia Rea (m) Type (mm) %	c Blows (mins) Test Test R	SCR RQD Result Units %	If ave water Well/ If max water Backfill (mm) I 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
						$\begin{array}{c} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 $
	easured along borehole axis.					

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

-barn ritchies	I	BOREHOI	E LOG		ML035	ole No: 5 -R0001 t 7 of 10
Project Name: Project No: Client: Engineer: Date Started:	Amersham Tunnel to Calvert 1G063-AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd 10/10/2016		Survey Grid System: Co-ordinates: Ground Level: Orientation:	OSGB 498653.96 mE 194211.88 mN 76.00 mOD deg.	Hole Type: Checked By: Approved By: Scale: Log Status: Print Date:	RO JMe, CB PMcG 1:25 FINAL 20/11/2017
Date Completed:	17/10/2016		Inclination:	90 deg.	Final Depth:	50.00m
ş	Stratum Description	Legend (Pepth- Level ness) (m)	Depth Dia Re	g and h Situ Testing c Blows 5 (mins) Test Test F	CR SCR RQD Result Units %	If min If ave If max (mm) Well/ Backfi
Drillers description: N with possible flint bar open hole)	No flush returns at surface. CHALK hds and softer horizons. (Rotary	Iness) (III) (III) (IIII) (III) (IIII) <td< td=""><td>(m) Type (mm) %</td><td>6 (mins) Test Test F</td><td>Result Units %</td><td>$\begin{array}{c} 100\\ 100\\ 100\\ 100\\ 100\\ 100\\ 100\\ 100$</td></td<>	(m) Type (mm) %	6 (mins) Test Test F	Result Units %	$\begin{array}{c} 100\\ 100\\ 100\\ 100\\ 100\\ 100\\ 100\\ 100$
						1 6

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

-barn ritchies		BOREHOI	E LOG		ML03	nole No: 5-R0001 t 8 of 10
Project Name: Project No: Client: Engineer: Date Started: Date Completed:	Amersham Tunnel to Calvert 1G063-AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd 10/10/2016 17/10/2016		Survey Grid System: Co-ordinates: Ground Level: Orientation: Inclination:	OSGB 498653.96 mE 194211.88 mN 76.00 mOD deg. 90 deg.	Hole Type: Checked By: Approved By: Scale: Log Status: Print Date: Final Depth:	RO JMe, CB PMcG 1:25 FINAL 20/11/2017 50.00m
Drillers descriptior with possible flint b open hole)	Stratum Description	Legend (PARK- Level ness) (m) 	Depth Dia Rec	g and h Situ Testing Blows (mins) Test Test R	TCR RQD Result Units %	$\begin{array}{c c} \text{If min} \\ \text{If ave} \\ \text{If max} \\ \text{(mm)} \end{array} \text{ water } \begin{array}{c} \text{Well/} \\ \text{Backfill} \\ \hline \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1$
	reasured along borehole axis.					1 = 1 = 1 c16: 1 = 1 = 1 = 1 = 1 = 1 = 1 = 1 = 1 = 1 = 1 = 1 = 1 6 1 6 1 6 1 6 1 6 1 6 1 6 1 6 1 6 1 6 1 6 1 6 1 6

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

-barn ritchies	l I	BOREHO	LE LOG		ML03	hole No: 5-R0001 et 9 of 10
Project Name: Project No: Client: Engineer: Date Started: Date Completed:	Amersham Tunnel to Calvert 1G063-AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd 10/10/2016 17/10/2016		Survey Grid System: Co-ordinates: Ground Level: Orientation: Inclination:	OSGB 498653.96 mE 194211.88 mN 76.00 mOD deg. 90 deg.	Hole Type: Checked By: Approved By: Scale: Log Status: Print Date: Final Depth:	RO JMe, CB PMcG 1:25 FINAL 20/11/2017 50.00m
	Stratum Description	Legend (THICR- Level ness) (m) (m)	Depth Dia Re	ng and h Situ Testing ec Blows % (mins) Test Test R	TCR SCR RQD Result Units %	If min If ave If max (mm) water Well/ Backfi
open hole)	No flush returns at surface. CHALK.					$ \begin{array}{c} 16\\ 1c16\\ 1\\ 1\\ 1\\ 1\\ 1\\ 1\\ 1\\ 1\\ 1\\ 1\\ 1\\ 1\\ 1\\$

Groundwater levels may be subject to seasonal, tidal and other fluctuations and should not be taken as constant.

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

	-	501	ΚΕΙ	HOI	LE L	.00	5							5-R0 t 10 of	
roject Name: roject No: lient:	Amersham Tunnel to Calvert 1G063-AAZ. High Speed 2 (HS2) Ltd				Survey G Co-ordina Ground L	tes:	em:		49865 19421	SGB 3.96 m 1.88 m 6.00 m	nE Ch nN Ap nOD Sc	ile Typ ecked proveo ale:	be: By: d By:		R JMe, C PMc 1:25
ngineer: ate Started:	High Speed 2 (HS2) Ltd 10/10/2016				Orientatio					de	eg. Pr	g Sta int Dat	ie:	;	FINA 20/11/201
ate Completed:	17/10/2016				Inclination					90 d	-	nal De		<u> </u>	50.00
	Stratum Description	Legend	Depth (Thick- ness) (m)	Level (m)	Depth (m)	Sampl Type	Dia	Rec	and h Sit Blows (mins)		ng Test Resu	It Units	TCR SCR RQD %	If min If ave If max (mm)	water Ba
Drillers description: (Rotary open hole)	: No flush returns at surface. CHALK.	-	f= f= f= f= f=												106 1c1 1c1
															1 =
		_	r r- f-												+ = 1c1 1c1
		_	f- f r- r-												1
			r- f- f- f- r-												1 1c1 1c1
		-	r- r- r- f- f-												1c1 1 1
			f- r- r r-												1 1c 1c
			r- f- f- r- r- tf-i.50)												101 101 1
		_	f- f- f-												1
		_	f= f= f= f=												1c 1c
		-	f= f= f= f= f=												1
			r- r- r- f- f-												1c1 1c1
		-	F F F F												1c1 1 1
			f- f- f- t-												101
			r- F- F-												10 10 10
			- - - - -												16 16

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Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

	a rr	l		B	DR	EH	OLE	E IN	JF	FOR	M	47	F I(ON	SH	EET	•		Μ	Borehole L035-R0 Sheet 1 c	0001
Project N Project N Client: Engineer	lo:	ŕ	G063 High Sp	M Tunne AAZ eed 2 (H eed 2 (H	52) Lt	td					Surv Co-o Grou	rdina	ates			OSGE 98653.96 94211.88 76.00	mE		Hole Typ Checkec Approvec Log Stat	d By: d By:	RO JMe, CB PMcG FINAL 20/11/2017
Date Sta Date Cor			0/10/20								Orier Inclir	natior	n:				- deg.) deg.	I	Final De	pth:	50.00m
From <ml 0.00 1.20</ml 	To rm 1.20 50.00	1	Tvoe IP RO	Start 11110120 11/10120	16 1 16 17	End 1/1012016 7/1012016	Pl Insulated di P450	lant		ated Explora Barrel Geobor-S (146)	Dril	ole Inf	form	Ria (S. K		J.	Loaaer Dudson S. Kelly			Rema	rks
Date	Time	D	Bolir eoth <ml< td=""><td>11-Drillina F Casinanl</td><td></td><td>s oth Water (m)</td><td>Ren</td><td>marks</td><td>_</td><td>Deoth <ml< td=""><td></td><td>Diam Imml</td><td></td><td>bv Deoth Rem</td><td>arks</td><td>Deoth <r< td=""><td>nl Dia</td><td>Casi a.rmm</td><td></td><td>er by Deoth Rema</td><td>rks</td></r<></td></ml<></td></ml<>	11-Drillina F Casinanl		s oth Water (m)	Ren	marks	_	Deoth <ml< td=""><td></td><td>Diam Imml</td><td></td><td>bv Deoth Rem</td><td>arks</td><td>Deoth <r< td=""><td>nl Dia</td><td>Casi a.rmm</td><td></td><td>er by Deoth Rema</td><td>rks</td></r<></td></ml<>		Diam Imml		bv Deoth Rem	arks	Deoth <r< td=""><td>nl Dia</td><td>Casi a.rmm</td><td></td><td>er by Deoth Rema</td><td>rks</td></r<>	nl Dia	Casi a.rmm		er by Deoth Rema	rks
10/1012016 10/10/2016 1111012016 11/1012016 12/10/2016 12/10/2016 13/10/2016	5 14:15 1B:OC 5 11:15 5 17:30 OB:40 17:30 OB:45)	0.00 0.00 19.00 19.00 46.00 46.00	0.00 0.00 19.00 19.00 46.00 46.00		Dry Dry 9.55 9.95 B.05 8.30	start of shif End of shill start of shif End of shifl start of shif End of shill start of shifl	 ft ft		15.00 50.00	1) 1.	68 46				15.00 50.00		168 146			
13/10/2016 14/10/2016 14/10/2016 17/10/2016	OB:30 14:15)	50.00 50.00 50.00 50.00	50.00 50.00 50.00 0.00		9.35 9.35 9.30	End of shill start of shif Hole compl start of shif	ft lete	-	From (m)	То	(m)	Vo	lume (lltres)	wate	r Added Re	ecords	Re	emarks		
17/10/2016			50.00	0.00 Related F	emark	s	End of shill				C	hiselli	in i D	etails		1		D	Prillino Flus	sh Details	
From (m) 0.00	To (m) 50.00	water q	uality logg	er installed		harks Ipipe				From (m)	Το	(m)	Du	ration (hh:mm)	Tool	From (m) 1.20 19.00 19.50	To (r 19.0 19.5 50.0	i0 i0	teturns (%) 100-100 0 - 50 0	Flush Polymer- Polymer- Purebore Polymer- Purebore	Colour No returns
Dale	Strike(m)	caalrci(m)		er Strikes Depth (m) S	ealed(m)	R	emarks	Туре	e Pip	ID From(m) To (m	1) DB ((mm)	ioe Work Pipe Type	Remarks	From (m)			Backfill [legend	Des	aiption
								SP		1 0.00	5.00	D B		Plain	water quality monitor installed in standpipe water quality monitor installed in standpipe	0.00 0.10 1.00 2.50 4.50	0.10 1.00 2.50 4.50 50.0		910 906 904 903 902	Flush cover U headworks co Concrete Grout Bentonite Gravel	
Depth (ml	Type N	Vslue	Casino (m ater (ni SWP	en(mm Blo	ws1 Pen1(r			dard Penetra Pen2(mml				nl Blows4	Pen4(mml I	Blows5 Fe	n5(mml	Blow	s6 Pen6(r	mml Hamm	er E. Ratio%
<u> </u>							Reasonfo	or Hole T	ern	nination: F	Reach	edso	che	duled de	pth						
	water lev tchies, G			-			and other i 9BL	fluctuati	ons	s and sho	uld no	t be t	ake	en as con	istant.					BAM R Info	o 06/04/2017

-barn ritchies	E	BORE	EHO	LEL	OG				ML03	ehole N 85-RC et 1 of	013
Project Name: Project No: Client: Engineer: Date Started: Date Completed:	Amersham Tunnel to Calvert 1G063-AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd 10/10/2016 19/10/2016			Survey G Co-ordina Ground L Orientatio Inclination	evel: n:		OSGB 602.06 mE 083.53 mN 85.82 mC de 90 de	E Che N App DD Sca Log g. Prin	e Type: ecked By: proved By: lle: g Status: nt Date: al Depth:		RO+R(PMcG, Cl PMcd 1:25 FINA 21/11/201 61.50r
	Stratum Description	Legend (Th nes (n	s) (m)	Depth (m)	Sampling, C	Coring and h Rec Blow % (min		g Test Resul	TCF SCF t Units RQL	R Ifmin R Ifave (mnna)k	Ve water E ck
frequent rootlets. Gr \ [Topsoil] دلامت: رابع المعالية subangular flint cobb	t brown slightly gravelly CLAY with ravel is subangular fine to coarse of ish brow <u>n g</u> ravel ly-CLAYwit <u>hocasional</u> bles. Gravel is angular to subrounded + bus lithologies including flint.	0 /_;_:_:-> <u>-</u> <u>-</u> <u>-</u> <u>-</u> <u>-</u> <u>-</u> <u>-</u> <u></u>	85.62								*2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Drillers description: 3 CLAY. Gravel is of fl	Soft to finm yellowish brown gravelly lint. (Rotary open hole)		84.62								
Drillers description: (Rotary open hole)	Creamish white CHALK with flints.		84.02								

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

Project No: 1G063 - AAZ. Co-ordinates: 498602.06 mE Checked By: PMcG Project No: 1G063 - AAZ. 194083.53 mN Approved By: P Client: High Speed 2 (HS2) Ltd Ground Level: 85.82 mOD Scale: Engineer: High Speed 2 (HS2) Ltd Log Status: F Date Started: 10/10/2016 Orientation: deg. Print Date: 21/11/2	-barn ritchies	BOI	REI	HOI	LE L	.00	3				N	ML03	ehole N 5-RC et 2 of	013
Engineer: High Speed 2 (HS2) Ltd Log Status: Log Status: P Date Strated: 10/10/2016 00/de; Print Jate: 2/11/Late:	Project No: 1G063 -AAZ.				Co-ordina	ites:	em:	49860 19408	02.06 r 83.53 r	mE mN	Checked Approve	vpe: ed By:		RO+RO PMcG, CE PMcC
Stratum Description Legend ness (m) Depth (m) Type RMR b Test Result Units SCR Itave rest Result Units Note of the transformation of transformatio of transformatio of transformation of transformatio of transforma	Engineer: High Speed 2 (HS2) Ltd Date Started: 10/10/2016				Orientatio	in:		č	C	deg.	Log Sta Print Da	ate:		1:25 FINAI 21/11/2017 61.50m
(Rotary open hole)			nd (Thick ness)	Level (m)							esult Uni	SCR	Ifave	Ve
			n											

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Further details given on appended 'Borehole Infonmation Sheer.

Office: BAM Ritchies, Glasgow Road, Kilsyth, Glasgow G65 9BL

BAM R Borehole Log 06/0412017

-barn ritchies	l	BOR	E	IOH	LE L	.00	G				Ν	NL03	ehole N 5-RC et 3 of	013
Project Name: Project No: Client: Engineer: Date Started: Date Completed:	Amersham Tunnel to Calvert 1G063 -AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd 10/10/2016				Survey G Co-ordina Ground L Orientatio Inclinatior	ates: .evel: on:	em:		-	6 mE 3 mN 2 mOD - deg.	Hole Ty Checke Approve Scale: Log Sta Print Da Final De	rpe: d By: ed By: atus: ate:		RO+RC PMcG, CI PMcC 1:25 FINA 21/11/2013 61.50n
Date Completed.	19/10/2016 Stratum Description	Legend	ness)	- Level (m)	Depth		1	ring and Rec B % (r	dh Situ Te	0 deg. esting st Test	Result Uni		R Ifmin Ifave (mma)	
Drillers description: (Rotary open hole)	Creamish white CHALK with flints.				(m)	EW EW								
			- 											o l cPo o l cPo o l cPo o l cPo
Groundwater levels	easured along borehole axis. s may be subject to seasonal, tidal a nbols and abbreviations given in 'Key		:00 tuations		nould not be	taken a	as cons	stant.						1 cP 0 1 cP

•barn	E	BOR	REI	HO	LE L	00	3					Ν	IL03	hole N 5-RC	013
ritchies Project Name:	Amersham Tunnel to Calvert				Survey Gri	-	em:			SGB		ole Typ	e:	et 4 of	RO+
Project No:	10062 447				Co-ordinate	es:				2.06 n		hecked			PMcG,
roject No:	1G063-AAZ.				0	1				3.53 n		oprove	а ву:		PN
lient:	High Speed 2 (HS2) Ltd				Ground Le	vel:			5	85.82 m		cale:			1:
ngineer:	High Speed 2 (HS2) Ltd											og Sta			FI
ate Started:	10/10/2016				Orientation	:				d	eg. P	rint Dat	e:		21/11/2
ate Completed:	19/10/2016				Inclination:					90 d	eg. F	nal De	pth:		61.5
			Depth			Sampl	ing, C	oring	andh Sit	u Testi	ng		TCR	If min	
	Stratum Description	Legend	(Thick- ness) (m)	Level (m)	Depth (m)	Туре	(^{Dia})	Rec %	Blows (mins)	Test	Test Res	ult Unit	SCR Rଷ୍ଟପ	lfave (mna)x	Weter Ba
subrounded fine to c	HALK recovered as: black angular to oarse GRAVEL of rinded flint with Presumed chalk washed away lk Formation]	f- f- p	- 00.SS)											- NIDO -	, <u>8, 0, 8, 0, 8, 0</u> , 8, 0
	re loss. Driller notes very weak resumed chalk scrubbed away by	r.	5.56	70.26	15.00 - 16.50	RC	102						37 0	f	
0 0		r. f. f. f. r.	- - - 10.94)										0	_ NR	808080
		r. r. f. f.	-	00.07											808080
recovered as: light g gravelly SILT. Grave	covered non-intact. CHALK reyish white slightly sandy slighUy I is very weak, low density, light		6.50 ::16.72	69.32 69.10											- 80804
	unded fine and medium of chalk. It gravel of flint fragments. (Grade Ik Formationl	F. F. F.	-	00110	16.50 - 17.50	RC	102						22 0		50808
	re loss. Driller notes very weak resumed chalk scrubbed away by	r. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.	_ J0.78) _ _ _ _										Ō	NR -	0 8 0 8 0 8 0
Fractures are randor	density, light greyish white CHALK. nly orientated, very closely spaced ating and planar slightly rough, with		7.50	68.32									90	40	80808
frequent black and b [Lewes Nodular Cha 17.50- 17.63m : I	rown specks. (Grade: A4) lk Formation] Rinded nodular flint fragment (130mm). Possible flint band.	8	8'''' 00	67.82	17.70 - 17.76 17.50 - 18.00		100 102						18 0	40 40 60	8080 8080 80
17.95 Very weak locally e density, light greyish and rare rounded fin	Drilling disturbed, recovered non-intact. - 18.00m: Assumed zone of core Joss. xtremely weak, medium locally low white CHALK with rare black specks ger flint nodules (up to 60mm).	- F- F- F-	-		18.00 - 18.50	RC	102						100 8 0		80808 0
		G	21.15)		18.50 - 18.76	с	100					-	- N	220	8080
	Drilling disturbed, recovered non-intact.	f-	-			-								300	80808
	ded nodular flint fragment (90mm) with ion cavities (upto 20mm). Possible flint	f.	-19.15	66.67	18.50 - 19.50	RC	102						65 46 46	f	20 20 S
	band. re loss. Driller notes very weak resumed chalk scrubbed away by														08080
-		p	o.BS)											NR	5080808 80808
				65.82											00
		-			1 I				. I						1

•barn ritchies	E	BOR	EH	0	LE L	00	3				N	/L03	hole N 5-RC et 5 of	013
Project Name:	Amersham Tunnel to Calvert				Survey Gr		em:		DSGB	_	Hole Ty			RO+R
Project No:	1G063-AAZ.				Co-ordinat	es:			02.06 r 83.53 r		Checkee			PMcG, C PMc
lient:	High Speed 2 (HS2) Ltd				Ground Le	vel:			85.82 r		Scale:	и Бу.		1:2
ngineer:	High Speed 2 (HS2) Ltd										Log Sta	atus:		FIN
ate Started:	10/10/2016				Orientation	c			0	leg.	Print Da	te:		21/11/20
Date Completed:	19/10/2016				Inclination:				90 c	leg.	Final De	pth:		61.50
	Stratum Description	Legend (TI	epth nick- L ess) m)	evel (m)	Depth (m)	Sampl Type	1	oring and h S Rec Blows % (mins)		ing Test F	Result Un	TCR SCF ts RØJ	lfmin Ifave D(mnna)k	W Weter Bac
CHALK with rare gre no.) 40 to 60 degrees frequent black and b degrees to vertical, u frequent black speck [Lewes Nodular Cha 20.00-20.10n					19.50-21.00 20.35-20.40	RC D	102 100					67 19 15		රේ පිරි පිරි පිරි පිරි පිරි පිරි පිරි පි
21.00	-21.10m :Assumed zone of core loss.				20.90-21.00	D							NI	500000
	inded nodular and sheet flint fragments {up to BOmm). Possible flint band.	1 1 1 1 1 1 1 1 1 1	.24)		21.14							90	NI 50 230	800 800 800 1
					21.00 - 22.00	RC	102	2				7 0		රේ පිරි විසි විසි විසි විසි විසි විසි විසි ව
	Rinded nodular flint fragment (70mm). Possible flint band. pre loss. Driller notes very weak		6	3.58	22.00 - 22.50	RC	102					48 0 0		960 960 960
CHALK with flints. P flints during drilling.	resumed chalk scrubbed away by	 0 	.75)										NR	රේ පිරි පිරි පිරි පිරි පිරි පිරි පිරි පි
with rare thin grey m Fractures are randor fractures. Fracture s spaced (10/80/210m rough, with frequent	density, light greyish white CHALK nart laminations and burrows. mly orientated. Some distinct et 3: 70 degrees to vertical closely m}, undulating and planar slighUy black specks, locally with orange ed (<1mm) with a veneer of greyish		,.99 62	2.83	22.50 - 23.50	RC	102					51 0 0		හි ඉති ඉති ඉති ඉති ඉති ඉති ඉති ඉති ඉති ඉත
[Lewes Nodular Cha	alk Formation]	kt.t			23.58-23.64	D	100							0000
23.20-23.35m	Rinded nodular flint fragments {up to 50mm). Possible flint band.				23.50-24.00	RC	102					100 12		000
			.31)									0 87 18 14	NI 210	දී මෙම මෙම මෙම මෙම මෙම මෙම මෙම
24.76-24.85m:i	Frequent rinded nodular flint fragments (up to 50mm).				24.00 - 25.50 24.80 - 25.02	RC C	102 100							00000

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

•barn	E	BORE	HO	LE L	00	3					r	ML03	ehole I 85-RC et 6 of	013
Project Name:	Amersham Tunnel to Calvert			Survey Gri Co-ordinate	-	em:			9SGB 92.06 r	nE	Hole Ty Checke	pe:		RO+ PMcG,
Project No:	1G063-AAZ.								33.53 r		Approve	ed By:		PN
lient:	High Speed 2 (HS2) Ltd			Ground Le	vel:			8	35.82 r	nOD	Scale:			1::
ngineer:	High Speed 2 (HS2) Ltd										Log St	atus:		FIN
ate Started:	10/10/2016			Orientation	1:				C	leg.	Print Da	ate:		21/11/20
Date Completed:	19/10/2016			Inclination:					90 c	leg.	Final D	epth:		61.5
	Stratum Description	Legend (Thick ness) (m)	- Level (m)	Depth (m)	Sampli Type	ng, Co (Dia (mini),	-	andh Si Blows (mins)	tu Test Test	-	esult Uni	TCR SCF s RØD	R Ifave	
with rare thin grey m Fractures are rando fractures. Fracture s spaced (10/80/210m rough, with frequent	alk Formation]	r- -	60.52	25.50 - 27.00	RC	102						30 4 0	NI 210 	පිරි මුදිර මුදිර මුදිර මුදිර මුදිර මුදිර මුදිර මුදිර මුදිර මුදිර මුදිර මුදිර මුදිර මුදිර මුදිර මුදිර මුදිර මුදිර
		f-												00
		-26.55	59.27										' <u> </u>	- 00
very weak, medium	ecovered non-intact. Recovered as: density, light greyish white gritty ire randomly orientated. (Grade alk Formation]	Q0.45) f- f-		26.75 - 26.81	D	100							NIDO -	გ <u>ი</u> ფი ფი გ
		::7.00	58.82											- 00
Assumed zone of co		r- r- r- r- r- r- r- r- r- r- r- r-	58.20	27.00 - 28.00	RC	102						38 12 12	- NR -	
white CHALK with ra burrows. Fracture se undulating locally str specks. Fracture set spaced (430mm), pl black specks. (Grad [Lewes Nodular Cha 27.80 - 28.00 28.10 - 28.20m :	alk Formation] 0m : Rare rinded nodular and sheet flint fragments (up to 40mm). Rinded nodular flint fragment (100mm)	-21.02 - - - - - - - - - - - - -	50.20	28.22 - 28.27 28.00 - 28.50	D RC	100 102						100 18 0		හිදු හිදු හිදු හිදු හිදු හිදු හි
28.50	ownish orange silt coating (up10 5mm). 0-28.78m : Assumed zone of core loss.	r- r- r- r- r- r- r- tJ2.38)										_	- NIDO	960 860 860 860 860 860
28.85-29.00)m : Rare bivalve fossil fragments (upt0 30mm).	r		28.50 - 30.00	RC	102						81 27	-	96 80 86 6
		τ τ τ τ τ τ τ τ τ τ τ τ τ τ		20.30 - 30.00		102						27 20		හිද හිද හිද හිද හිද හිද
		:00	55.82			1								1

ritchies								0000	Sh)35-R neet7c	of 13	
Project Name:	Amersham Tunnel to Calvert				Survey Grid Co-ordinate		em:	OSGB 498602.06 mE	Hole Type: Checked By		PMc	
Project No: Slient:	1G063 -AAZ. High Speed 2 (HS2) Ltd				Ground Lev	/el·		194083.53 mN 85.82 mOD	Approved E Scale:	y:		PMc 1:2
ngineer:	High Speed 2 (HS2) Ltd								Log Status	:		FINA
Date Started:	10/10/2016				Orientation			deg.	Print Date:		21/1	
Date Completed:	19/10/2016	1	Inclina	tion:	90 deg.	0		Final Dept				1.50
	Stratum Description	Legend	(Thick- ness)	Level (m)	Depth	<u>Samp</u> Type	Dia Rec	Blows (uiting) Test Test R	esult Units RO	CR Ifmir Ifav QD ₁ Ifma	x	, Wo Ba
Assumed zone of co	reloss.		(m) =		(m)		(mm) %	(mins)		% (mm)	1d'
			r							_		1ď
			po.56) r- r-							NR -		1d'
Vory work modium	density, grevish white locally light		r₋ ≸⊶v0.56	55.26						f	_	1d'6
	with locally with grey mart burrows.		r-		30.60 - 30.76	с	100		6	3		1d'
	mly orientated. Some distinct set2:60 to 65 degrees, closely				30.00-31.50	RC	102		1 1	6		1d'6
	m), with frequent black specks, taining. (Grade: A4)		f=							I		1d'
Lewes Nodular Cha	lk Formation]		f r-									1ď
	30.56 - 30.70m : Drilling disturbed.		F=									10
			r- r- f-									1.1
			f- f-									
31.50	- 31.75m : Assumed zone of core loss.		r- t<2.09)						_	NI 80 15(1d'(1d'(
			r-							150)	1d
	31.75-31.85m : Drilling disturbed.		f- f-									1d
			r- r-		31.50 - 32.50	RC	102		7 1	5		1d'
			r- r-							1		1ď
	nillingdisturbed, recovered non-intact. nded finger fiint nodules (up 10 60mm).		r- f-							·		ld
	- · · · /		f- f-									
32.50	- 32.65m : Assumed zone of core loss.		r- r-						_	-		ld
Drilling disturbed, re	covered non-intact. Medium strong,		- 32.65	53.17						0 -	-	1d'
very high density, gro	eyish white CHALK. Fractures are		f-		32.50 - 33.00	RC	102		2	2 NIDC)	1d
randomly orientated,	planar slighUy rough, with frequent		po.35)						-2	2 30	_	
	with black and orange staining. nodules (up to 20mm), glauconitic		f a 2.00	E0 00						50		1ď
nodules (up to 10mr	n), bioturbation cavities (up to		f-a-3.00 r- r-	52.82								1cf
undetermined)	tic staining. Chalk Rock. (Grade		f- f-									
Lewes Nodular Cha 32.65-32.69m:Or	ange and brownish orange conchoidal		po.55)							NF _		
Assumed zone of co	stainina. preloss.		r- r-	E0.07							_	1c1
•	covered non-intact. Recovered as: barse GRAVEL. Gravel is medium		33.55 f- f-	52.27							-	
0	nsity, greyish white chalk. Chalk		po.35)		33.00-34.50	RC	102			4 NID	0	lcf
Lewes Nodular Cha	alk Formation!	-	33.90	51.92					() -		lct
high density, greyish	eak locally very weak, medium and white nodular CHALK with frequent traclasts (up to 70mm). Fractures		r- r- t ⁽ ≂0.60)							løe		
) vertical, undulating slighUy rough, ted. Some distinct fractures.		f-								_	
	pecks, locally infilled (up to 5mm)									70		0_
with light greyish whi [Lewes Nodular Cha	te silt. (Grade: C4) Ik Formation]		4.50	51.32								l <f ⊛</f
Assumed zone of co	34.23-34.50m : Drillina disturbed. re loss.		f- f-									l <f< td=""></f<>
			(<0.75)		34.76-34.83	D	100			NF -	2	80 1d
			r- r- f-									

Traged Name: Ameriham Tunnelu Calvert Survey Grif System: DSGB Hole Type: RD-H Traged Nom: 10083-AAZ 10083-AAZ 1908353-30 Constraints:: 1908353-30 PPM66. PM66. PM66. PM66. PM66. PM67.	•barn	E	BOR	E	HO	LE L	00	3					N	IL03	hole 1 5-RC	2013	3
Line: High Speed 2 (H32) Lid Conduct Level: B 52 mOD Section: T mod	Project Name:							em:		49860	02.06 r	nE Ch	ecked	ie: I By:		R PMc	G, C
ngingene: High Spend 2 (HS2) Lid Los 2010201 Los 2010201 Los 2011201 Los 2011201201 Los 2011201 Los 201120	Client:					Ground Le	vel:							u Бу.			1:2
James Completed 19/10/2016 Interfunction 0 0 deg Final Depth Final Depth Final Depth 60 5 5 Simum Description Immunol (n) I	ngineer:	• • • •												tus:			FIN
Stratum Description Level (m) Sampling Compared bits (m) Sampling Compared bits (m) Setting (m) Setting (m) <td>Date Started:</td> <td>10/10/2016</td> <td></td> <td></td> <td></td> <td>Orientation</td> <td>:</td> <td></td> <td></td> <td></td> <td> d</td> <td>leg. Pri</td> <td>int Dat</td> <td>ie:</td> <td></td> <td>21/1</td> <td>1/20</td>	Date Started:	10/10/2016				Orientation	:				d	leg. Pri	int Dat	ie:		21/1	1/20
Strutin Discription Lease Output Type Typ	Date Completed:	19/10/2016	I	Inclina	tion:	90 deg.					Fina	al Depth:				6	1.50
Status Desk Type Dial Res Booth Dial Res Dial Res Dial Res		Stratum Description	d	Pienetik-	Level		Sampl	ing, C	oring	andhS	ituTest	ing		36R	If _i min		W
Dilling disturbed. Weak locally vary weak, medum and high directly gravely while nodular CHALK with frequent back speeds. 35.25 50.57 34.50-36.00 RC 102 Dilling disturbed. Weak locally vary weak, medum and high directly gravely back (2008) speed (2006) 000000, locally high gravely while nodular. 35.25 50.57 34.50-36.00 RC 102 New weak is the counter of the fragments are randomly orientated. (course shull). 0.0751 0.0751 0.0751 0.0751 Grave Call 0.0751 0.0751 0.0751 0.0751 0.0751 Sate Transform of the fragments (1000) 0.0751 0.0751 0.0751 0.0751 Sate Transform of the fragments (1000) 0.0751 0.0751 0.0751 0.0751 Sate Transform of the fragments (1000) 0.0751 0.0751 0.0751 0.0751 Sate Transform of the fragments (1000) 0.051 0.0751 0.0751 0.0751 Sate Transform of the fragments (1000) 0.051 0.0751 0.0751 0.0751 Sate Transform of the fragments (1000) 0.0751 0.0751 0.0751 0.0751 Sate Transform of the fragments (1000)		Suatum Description	Legend	ness)			Туре				Test	Test Resul	t Units	RQD	lf max	Weter	Ba
Uning disturbed. Veak locally very weak, medulum and might disturbed. Veak locally very weak, medulum and might disturbed. Veak locally weak, medulum and for an endomy orientated. closely spaced (306:000mm), unituation gisthyty rough, with request black spacek, disturbed register that disturbed. Second with medule of the formation second with medule of	Assumed zone of co	re loss.	f- f-														1d' 1d
Lewsys-Bogly 6x/P blinking stabuloud, recovered non-intact. r Recovered as: brownich while medium of anit tragmant. 56:5:36.77.3 35:77:36.00 7.00 35:77:36.00 20min): Chark Rock 35:77:36.00 20min): Chark Rock 7:73:00 26.00 - 37.50 RC 100 100 7.73:00 26.00 - 37.50 RC 102 101 101 101 101 101 102 7.73:4 48.47 26.00 - 37.50 RC 102 103 100 101 101 101 101 104 101 101 101 101 101 105 17.73:4 48.47 102 101 101 106 101 101	high density, greyish subrounded chalk int are randomly orientat undulating slighUy ro locally infilled (up to s	white nodular CHALK with frequent tradasts (up to 70mm). Fractures ted, closely spaced (30/60/90mm),	1- 1- 1- 1- 1-		50.57	34.50-36.00	RC	102								-	1ď 1ď 1ď 1ď
gravely fin to coarse SAND. Grave is subconded for to	[Lewes Nodular Chal		f=														ld 1d
35.77 - 36.00m :Omit : Omiting disturbed, feedweet on on-intect. Medum strong, were high density, greysh wither of LALK with Tate observative sample and observative sample and the observative	gravelly fine to coars	se SAND. Gravel is subrounded fine to medium of flint fragments.	f-	· .00	49.82												1ď
20mmil: Chark Rock 1 Charling Sight/Dec/Very weak, medium and Expression/Edd Akk Intradests (Cally Very weak, medium and Subrunded Akk Intradests (Cally Controls are randomly control of Chark Kink Intervent Subrunded Akk Intradests (Cally Controls are randomly control of Chark Kink Intervent Subrunded Akk Intradests (Cally Foreign and Cally Infiled (Cally Foreign and Cally Infiled (Cally Foreign and Cally Infiled (Cally Foreign and Cally Infiled (Cally Foreign and Call Akk Intradests (Cally Foreign and Cally Infiled (Cally Foreign and Cally Infiled (Cally Foreign and Call Akk Intradests (Call Cally Foreign and Call Akk Intradests (Cally Foreign and Call Akk Intradests (Cally Foreign and Call Akk Intradests (Cally Foreign and Call Akk Intradests (Call Cally Foreign and Call Akk Intradests (Call Call Call Akk Intradests (Call Call Call Akk Intradests (Call Cal	35.77 - 36.00m : D Medium strong, v	Prilling disturbed, recovered non-intact. Prince of the recovered non-intact.	-	,	40.47										NR -		1 d
high density, greyteh white nodular CHALK with frequent lack specks, subrounded chalk intradasts (up to 70mm). Fractures are randomly orientated, closely spaced (30/60/90mm), Hogel (Crade: C4) (10, 200 mm) with light greytsh white silt. (11, 200 mm) with light greytsh white motified and greyth white silt. (11, 200 mm) with light greytsh white motified greytsh greytsh white motified greytsh g		20mm) Chalk Rock	F-	-30.33	49.47	36.37-36.50) c	100							r		1d' 1d'(
undualing sliphUy rough, with frequent black specks, (Grade: C4) (Grade: C4) (Lewes Nodular Chaik Formation] Very thinly to thinly bedded light greyish green clayey MARL with frequent black specks, are randomly orientated, closely spaced (Jackews Nodular Chaik Formation] Very thinly to thinly bedded light greyish white sitt. (Grade: C4) (Grade: C4) (Grad						36.00 - 37.5	0 RC	10	2					77 23			1d 1d'é
Very thinky to thinky bedded light greyish green clayey 37.33 48.49 7.39 48.43 Very thinky to thinky bedded light greyish green clayey 7.39 48.43 10.36 10.36 Drilling disturbed, Weak locally very weak locally weak medium density, grey ish white locate 200 37.50 - 38.50 RC 102 Failing disturbed recovered as brownish weak with requert black speecks, locally very weak locally weak medium and high density, grey ish white mottled and speeck local very weak locally weak, high locally medium density, light revish white revisit is the revisit of the revisit is the revisit is the revisit of the revisit is the revisit is the revisit of the revisit is the revisit of the revisit is the revisit of the revisit is the revisit i	undulating slighUy ro locally infilled (up to 5	ough, with frequent black specks,	HI f=	0.98)										10			1d' 1d'
Very miny to miny bodded light greysh green clayey 7.39 48.43 MARL with frequent burrows. Chalk Rock Marl. 40.36) Drilling disturbed. Weak locally very weak, medium and high density, greysh white rodular CHALK. Fractures are randomly orientated. closely spaced (30/60/90mm), undulating sightly rough, with frequent back specks, locally infilled (up to Smm) with light greysh white sit. 37.75 48.07 I (and Light Greysh with requert black specks, locally infilled (up to Smm) with light greysh white sit. 37.75 48.07 I (and Light Greysh with requert black specks, locally infilled (up to Smm) with light greysh white sit. 37.50 - 38.50 RC 102 I (and Light Greysh with requert black specks, locally infilled (up to Smm) with light greysh white sit. 50 75 11 I (and C: CH) Chalk Rock. F(0.30) 48.50 47.32 Weak Medium and high density, greysh white mottled greysh white mottled grey CHALK. Fracture set 1: (1 no.) 10 degrees, planar speces, locally with light greysh white frequent black specks. 50.75 50.75 Wery weak locally weak, high locally medium density, greysh white frequent black specks. 50.75 46.27 53.50 76 Very weak locally weak, high locally medium density, informations (marwisps). Fractures are randomly orientated. Some gister fractures are 1: predominations (marwisps). Fractures are randomly orientated. Some gister fractures are 1: predominations (ma	[Lewes Nodular Chal	lk Formation]	1. 														1d
Automote 2010 of conductor Image: Section of conductor			f-														1c 1d
Drilling disturbed. Weak locally very weak, medium and high Bensity, grey ish white moduliar CHALK with frequent are randomly orientated. closely spaced (30/60/90mm), undulating slightly rough, with frequent black specks, locally infilied (up to 5mm) with light grey ish white sitt. (Grade: C4) Lewes Nodular Chalk Formation] 37.75 48.07 14.50 - 61.50 arc Id 37.75 - 38.05m : Drilling disturbed Recovered as brownish white medium to ccarse SAND. Weak, medium and high density, grey ish white CHALK. New Pit Chalk Formation?! arc Id 38.50 - 38.00 RC 102 Failing Head for 90 Ni 60 Ni 90 Ni Ic 30 Id 60 Ni 90 81dFlightly Grege State S	Assumeded Herofte	Ke Forgenation]	/ fJi f-	0.36)											NR		1d
are randomly orientated. Closely spaced (30/60/90mm), undulating slightly rough, with frequent black specks, locally infilled (up to 5mm) with light greyish white silt. (Grade: C4) (Lewes Nodular Chalk Formation] 37.50 - 38.50 RC 102 102 Falling Head mis 9 0 NI 10 IC 37.75 - 38.05m : Drilling disturbed Recovered as brownish white medium to coarse SAND. 38.15 - 38.05m : Drilling disturbed, recovered non-intact. Medium strong, very high density, greyish white CHALK, Chalk Rock, r 8.50 47.32 47.32 60 NI 20 60 NI 20 102 Weak, medium and high density, greyish white CHALK becks. With Graques (2) Alcresto Beges end VEM cal extremely, undulating slightly rough, with frequent black becks. With Graques and Dlack statining. (Grade: A475) New Pit Chalk Formation ?! 38.50 - 39.00 RC 102 102 60 NI 20 10 Very weak locally weak, high locally medium density, light greyish white CHALK with rare thin grey laminations (mart wisps). tractures are rule of proteintated. New Pit Chalk Formation ?! 39.00 - 40.50 RC 102 10 10 10 Very weak locally weak, high locally medium density, light greyish white CHALK with rare thin grey laminations (mart wisps). tractures are rule of proteintated. Do.90) 39.00 - 40.50 RC 102 13 10	Drilling disturbed. We high density, greyish	eak locally very weak, medium and white nodular CHALK with frequent		37.75	48.07										f	-	1d'6
white medium 10 coarse SAND. 8.50 47.32 38.15 - 38.30m : Drilling disturbed, recovered non-intact. 60 Ni Medium and high density, greyish white (HALK, Fracture set 1: (1 no.) 10 degrees, planar 102 38.50 - 39.00 RC 102 Siightly Grugb, with frequent black specks and grey cal extremely, undulating slightly, rough, with frequent black staming. (Grade: A47/5) 38.50 - 39.00 RC 102 0 102 New Pit Chalk Formation?! Assumed zone of core loss. 50.75) 50.75) 102 102 102 Very weak locally weak, high locally medium density, light greyish white CHALK with rare thin grey laminations (marine species, Fracture set 1: predominantly nonzontal and vertical externes of core loss. 102 102 102 103 (arrow weak locally weak, high locally medium density, honzontal and vertical extreme set 1: predominantly nonzontal and vertical extreme set 1: predominantly nonzontal and vertical extreme set 1: predominantly nonzontal and vertical extremest of core local set 1: predominantly nonzontal and vertical extremest of core local set 1: predominantly nonzontal and vertical extremest of core local set 1: predominantly nonzontal and vertical extremest of core local set 1: predominantly nonzontal and vertical extremest of core local set 1: predominantly nonzontal and vertical extremest of core local set 1: predominantly nonzontal and vertical extremest of core local set 1: predominantly nonzontal and vertical extremest of core local set 1: predominantly forecal extremest if the remet is the remet is the remet	undulating slighUy ro locally infilled (up to § (Grade: C4) [Lewes Nodular Chal	bugh, with frequent black specks, 5mm) with light greyish white silt. Ik Formation]	i- f- f- f-	o.75)			0 RC	10	2				mis	9			10 1cf 1cf
Chalk Rock. F{0.30} Weak, medium and high density, greyish white mottled grey CHALK. Fracture set 1: (1 no.) 10 degrees, planar 38.50 - 39.00 RC 102 Slightly Greyish white mottled grey CHALK. Fracture set 1: (1 no.) 10 degrees, planar 38.80 47.02 38.50 - 39.00 RC 102 Slightly Greyish white Status (2 no.) 10 degrees, planar 538.80 47.02 38.50 - 39.00 RC 102 Slightly Greyish white Status (2 no.) 10 degrees, planar 538.80 47.02 47.02 38.50 - 39.00 RC 102 New Pit Chalk Formation?! 50.75) 50.75) 50.75) 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 102 103 102 102 103		white medium to coarse SAND.	-	8.50	47 32											-	
grey CHALK. Fracture set 1: (1 No.) 10 degrees, planar >-38.80 47.02 slightlig output with frequent blacks set of grey call - - stightlig output with frequent black statistical extremely, undulating slightly, output, with frequent black - - New Pit Chalk Formation?! - - - - New Pit Chalk Formation?! - - - - - Very weak locally weak, high locally medium density, light greyish white CHALK with rare thin grey laminations (marlwisps). Fractures are randomly orientated. Some distinct fractures. Fracture set 1: predominantly norizontal and vertical very closely spaced - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - <td< td=""><td>Weak, medium and h</td><td><u>Chalk Rock.</u> high density, greyish white mottled</td><td>1 F.</td><td>(0.30)</td><td></td><td>38.50-39.00</td><td>RC</td><td>102</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	Weak, medium and h	<u>Chalk Rock.</u> high density, greyish white mottled	1 F.	(0.30)		38.50-39.00	RC	102									
New Pit Chalk Formation?! - - IU Assumed zone of core loss. - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -	slightly rough with fr	equent black specks and grey		-38.80	47.02								-			-	
Very weak locally weak, high locally medium density, light greyish white CHALK with rare thin grey laminations (marl wisps). Fractures are randomly orientated. Some distinct fractures. Fracture set 1: predominantly horizontal and vertical very closely spaced (30(40(190 mm) undulation sliptly, rough with frequent	New Pit Chalk Form	ation?!	- f- p(o.75)											NĪR		1cf 1
Very weak locally weak, high locally medium density, light greyish white CHALK with rare thin grey laminations (marl wisps). Fractures are randomly orientated. Some distinct fractures. Fracture set 1: predominantly horizontal and vertical very closely spaced (30/40/140mm) undulating slightly, rough with frequent																	l <f G f</f
(30/40/190mm) undulating slightly rough with frequent	light greyish white Cł (marl wisps). Fractur	HALK with rare thin grey laminations es are randomly orientated. Some	f-		46.27	39.00-40.50) RC	102							f	-	l≷F I <f< td=""></f<>
			f-			39.90 - 40.10	с	100									lu

•barn	E	SUI	ΚΕΙ	HU	LE L		כ							5-RC(et 9 of 1	
Project Name:	Amersham Tunnel to Calvert				Survey Gr		em:			SGB		Hole Typ			RO+
Project No:	1G063-AAZ.				Co-ordinat	es:				2.06 n 3.53 n		Checked Approvec	•	1	PMcG, PM
Client:	High Speed 2 (HS2) Ltd				Ground Le	evel:				5.82 m		Scale:	т Бу.		1:
ingineer:	High Speed 2 (HS2) Ltd											Log Stat	lus:		۶IN
Date Started:	10/10/2016				Orientation	ו:				d	eg.	Print Dat	e:	2	21/11/20
Date Completed:	19/10/2016				Inclination:					90 d	eg.	Final Dep	oth:		61.5
	Stratum Description	Legend	Depth (Thick-	Level		Sampl	ling, C	oring	and h Si	tu Testi	ng		TCR SCR	If min If ave	
	Stratum Description	Legend	ness) (m)	(m)	Depth (m)	Туре	(Pia)	Rec	Blows,	Test	Test Re	esult Unit			
[New Pit Chalk Form	stained black. (Grade: A4) ation] ling disturbed Recovered as brownish white medium to coarse SAND.		f- f-											NI 80 190	80 80 80
	reyish green silty MARL. Upper	ł	f- b ∰5	45.37 45.32											0000
Glynde Marl. New Pit Chalk Form	ation		- f- f-											-	000
Assumed zone of co			t<0.40)											NR	000
			r- f-											-	de o
	locally low density, greyish white	1	0.90 f-	44.92	40.50-41.50	RC	102						ବଦ	f	d
	e randomly orientated. Some acture set 2: 50 degrees closely		f-				-						11		o
spaced, planar and u	undulating slightly rough, with		4 - [-												d
	s, black staining, locally infilled (up ght greyish green clay. Fracture set		f- f-												0
3: vertical, planar and	d undulating slightly rough, with		f- f-		44.00 44.50									NI	o
frequent black speck	s and black staining. (Grade: C4/5)		r- r- t:<_1.10)		41.36-41.50	с	100							60	0
[New Pit Chalk Form	ation]		<_1.10) f-									-	110	o l	00
	-41.75m : Assumed zone of core loss.		f- f-												00
			f-		41.50-42.00	RC	102						50 4		000
41 82-41 89m · [Drilling disturbed, recovered non-intact.		f- f-		41.50-42.00	RC	102						0		00
	: light greyish green clay. Possible marl		f-												0
	seam? <u>4</u> 1-89,_42-oofh-:'-Drimna_,,,,•sturbed.J [*] 1-	rr cr-1	i-4-2.00	43.82											d.
	covered non-intact. CHALK	,_, -													6
	/ sandy silty angular to subangular EL. Gravel is extremely weak and		f-												d
very weak, low and r	nedium density, greyish white with		po.75)												de la
black specks. Matrix undetermined)	is light greyish white. (Grade				42.00-43.00	RC	102						100 0	NIDO	000
[New Pit Chalk Form					12100 10100								Ő		0
	rilling disturbed, recovered non-intact. white medium to coarse SAND.		t												000
	Possible fall in. bedded greyish green si'lly"- 1-rr	,cf+42	2 75 a2	43.07 43.00											000
MARL. Lower Glynde		_,													000
New Pit Chalk Form	ationI ry weak, medium locally low density,	/													00
greyish white CHALI	K. Fractures are randomly		b0.68)											KU .	0
	tinct fractures. Fracture set 1:10 to ely to closely spaced				43.22-43.28	D	100						80 8	NI 60	000
(40/60/100mm), plan	nar and undulating slightly rough,				43.00-43.50	RC	102						0	100	00
with frequent black s (Grade: A4/5)	pecks, locally with orange staining.		3.50	42.32											o
New Pit Chalk Form			0.00	12.02										_	6
Assumed zone of co	re loss.		po.35)											NR	d.
	,-;;-;;,:,::;	t-	43 55	41.97											d
	ry weak, medium locally low density, K. Fractures are randomly			41.9/											000
orientated. Some dis	tinct fractures. Fracture set 1: 10 to		r-												000
	elytocloselyspaced nar and undulating slightly rough,		f- f-										77	NI	000
	pecks, locally with orange staining.				43.50-45.00	RC	102						77 33	60	0
(Grade: A4/5)			po.75)										27	100	000
	rilling disturbed, recovered non-intact.														00
Recovered as: bro	ownish white medium to coarse SAND. Possible fall in.		f	41.22										f	202
	, medium density, greyish white	— L	r- A∙4.60												00
	with rare marl burrows and p to 20mm). Fracture set 1: (2 no.)														000
	ced (1200mm), undulating slightly		+												00

 $\label{eq:Further} Further \, details \, given \, on \, appended \, 'Borehole \, Information \, Sheer.$

Constrainting: Constra	•barn	E	BORI	EHO	LE L	00	G					1	ML03	hole N 5-RC t 10 o	013	
Dates Earlied: 10/10/2016 Orientation: diag. Promotopic 21/11/2017 Statum Description Lange of the data species in the	Project No:	1G063-AAZ.			Co-ordinat	es:	em:		49860 19408	02.06 n 33.53 n	nN	Checke Approve Scale:	d By: ed By:		PMc	PMcG 1:25
Stituun Description Large (n) Deph (n) Type Deph (n) Type (n) Deph (n) Type (n) Deph (n)	Date Started:	10/10/2016									•	Print Da	ate:		21/11	FINAL /2017 1.50m
with Draw Pit Chaik Formation] 45.00-45.35 c 100 Very Werk Chaik Formation] 45.00-45.35 c 100 Very weak, medium density, greyish whate CHALK with rare black specks and rare black specks		Stratum Description	Legend (Th	ick- Level ss) (m)		· ·	1	•		tu Testi Test	ng Test R	Result Ur	TCR SCF iits R Ø	lfmin Ifave Df(mnna)x	Weter I	Well Backfi
Very weak, medium daradiy greyish white CHALK with rartures. Fractures are randomly orientated. Some dianer and undulating slightly rough, with requent black specks, orange staining. (Grade: A45) [New Pit Chaik Formation] 46.50-46.50 RC 102 73 Very binky bedded greyish white CHALK with rartures. Fractures are randomly orientated. Some dianer 45.00-46.50 RC 102 Very binky bedded greyish white CHALK with rare black specks and rare bixely fossil fragments (up to Domit). Fractures are randomly orientated. Some dianer 46.50-48.00 RC 102 Very binky bedded greyish white CHALK with rare black specks and rare bixely fossil fragments (up to Domit). Fractures are randomly orientated. Goeging 0.69 33.51 Very weak, medium density, greyish white CHALK with rare black specks and rare bixely fossil fragments (up to Domit). Fractures are randomly orientated. Goeging 0.69 37.82 Weak, medium and high density, greyish white CHALK with rature are randomly orientated. Goeging 37.82 48.00-49.50 RC 102 Weak, medium and high density, greyish white CHALK with rature are randomly orientated. Goeging with frequent black specks, orange and horwith frequent black sp	with brownish grey s	taining. (Grade: A1)		50)	45.00-45.35	с	100						400	1200		Řº 80 80 80 80 80 80
Inactures. Fracture set 3: 80 dégrees to vertical, planar and unduaing sighty rough, with frequent black specks, corage staining, (Grade: A4:5) [New Pri Chalk Formation] // ery view, frequent black specks, orage staining, (Grade: A4:5) [New Pri Chalk Formation] // ery view, frequent black specks, corage staining, (Grade: A4:5) [New Pri Chalk Formation] // ery view, frequent black specks, corage staining, (Grade: A4:5) [New Pri Chalk Formation] // ery view, frequent black specks, corage staining, (Grade: A4:5) [New Pri Chalk Formation] // ery view, frequent black specks, corage staining, (Grade: A4) [New Pri Chalk Formation] // ery view, frequent black specks, corage staining, (Grade: A4) [New Pri Chalk Formation] // ery view, frequent black specks, corage staining, (Grade: A4) [New Pri Chalk Formation] // ery view, frequent black specks, corage staining, (Grade: A4) [New Pri Chalk Formation] // ery view, frequent black specks, corage staining, (Grade: A4) [New Pri Chalk Formation]	rare black specks an	nd rare bivalve fossil fragments (up to		10 39.72	45.00 - 46.50	RC	102						73			9 0 8 0 8 0 8 0 8 0 8 0 8 0 8 0 8 0 8 0
Very thinly bedded greyish green MARL. Possibly New Pri Man 27 38.51 0 0 0 Very weak, medium density, greyish white CHALK with rare black specks and rare bivalve fossil fragments (up to 20mm), Fractures are randomly orientated. Some distinct fractures. Fractures are stable (Some distinct fractures. Fractures are randomly and high density, greyish white CHALK to an and high density, greyish white CHALK to an an and high density, greyish white CHALK to an and high density, greyish white CHALK to an an an and high density, greyish white CHALK to an an an and high density, greyish white CHALK to an an an and high density, greyish white CHALK to an an an and high density, greyish white CHALK to an an an and high density, greyish white CHALK to an an an and high density, greyish white CHALK to an and high density, greyish white CHALK to an an an and high density, greyish white CHALK to an an an and high density, greyish white CHALK to an an an and high density, greyish white CHALK to an an an and high density, greyish white CHALK to an an an and high density, greyish white CHALK to an an an and high density, greyish white CHALK to an an an and high density, greyish white CHALK to an an an and high density, greyish white CHALK to an an an and high density, greyish white CHALK to an an an and high density, greyish white CHALK to an an an and an an an an an an an an an and high density, greyish white CHALK to an an an an an an an and high density, greyish white CHALK to an	fractures. Fracture se and undulating slight orange staining. (Gra [New Pit Chalk Form 46.50	et 3: 80 degrees to vertical, planar ly rough, with frequent black specks, ade: A4/5) (ation] - 46.BOm : Assumed zone of core loss.						2						40		a Seo Seo Seo Seo Seo Seo Seo Seo
Weak, medium and high density, greyish white CHALK locally with frequent thin grey laminations (marl wisps) and rare Zoophycos streaks. Fractures are randomly orientated. Some distinct fractures. Fracture set 3: 70 to 80 degrees, undulating slightly rough, rarely slickensided, with frequent black specks, orange and brownish grey staining. (Grade: A4) [New Pit Chalk Formation] 48.00 - 49.50 RC 48.95 - 49.0B C 102 11 7 49.50 - 49.75m : Assumed zone of core loss. Image: Additional state of core loss.	Pit Marl 2? New Pit Chalk Form Very weak, medium rare black specks an 20mm). Fractures ar fractures. Fracture su and undulating slight orange staining. (Gra	ation density, greyish white CHALK with id rare bivalve fossil fragments (up to e randomly orientated. Some distinct et 3: 80 degrees to vertical, planar ily rough, with frequent black specks, ade: A4/5)		38.51									0			ନିତ ନିତ ନିତ ନିତ ନିତ ନିତ ନିତ ନି
Weak, medium and high density, greyish white CHALK 60 locally with frequent thin grey laminations (marl wisps) 48.00 - 49.50 RC and rare Zoophycos streaks. Fractures are randomly 7 7 orientated. Some distinct fractures. Fracture set 3: 70 to 80 degrees, undulating slightly rough, rarely 102 11 slickensided, with frequent black specks, orange and brownish grey staining. (Grade: A4) 100 100 [New Pit Chalk Formation] 100 100 100			(0.1	50)										NR		900 000 000 000
49.50 - 49.75m : Assumed zone of core loss.	locally with frequent t and rare Zoophycos orientated. Some dis 80 degrees, undulati slickensided, with fre brownish grey staining	thin grey laminations (marl wisps) streaks. Fractures are randomly stinct fractures. Fracture set 3: 70 to ng slightly rough, rarely equent black specks, orange and ng. (Grade: A4)						2					11	120		
	49.50	- 49.75m:Assumed zone of core loss.		I	49.50 - 50.50) RC	102							200		

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

•barn	B	SOF	RE	HO	LE L	00	3					N		hole N 5-RC		5
ritchies Project Name: Project No: Client:	Amersham Tunnel to Calvert 1G063-AAZ.				Survey Gri Co-ordinate Ground Le	d Syste es:			49860 19408	9SGB 92.06 r 33.53 n 35.82 r	nE nN	Hole Typ Checked Approve	be: By:	et 11 of	RC PMcG F	D+R G, C PMc 1:25
ingineer: Date Started: Date Completed:	High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd 10/10/2016 19/10/2016				Orientation	:			c	d 90 c	eg.	Scale: Log Sta Print Da Final De	te:		F 21/11/	FINA
	Stratum Description	Legend	(Thick- ness) (m)	Level (m)	Depth (m)	Sampl Type		Rec	and h Si Blows (mins)	tu Test Test	Ť	sult Units	TCR SCR RQD %		Weter	W Ba
50.39- 50.50m	: Frequent 60 degree crosscutting thick grey marl laminations (up lo 10mm).		لمهرب المراجع المراجع المراجع الم										25 26	NI 12 2 00		1d'(1d' 1d'(1d'
Assumed zone of co	ore toss.		f- f- f- f- f- f- f- f- f- f- f- f- f- f	34.82	50.50 - 51.00	RC	102						100 20		-	1d 1d 1d 1d
Weak m edium and	high density, greyish white CHALK	1.5	f- Q0.55) [- [- 5 34.2 f-	7										NR -	-	1 d' 1 d' 1 d' 1 d'
vith locally frequent Fractures are rando o closely spaced (3	t thin grey laminations (marl wisps). mly orientated, very closely spaced 30/60/70mm), planar and undulating frequent black specks, locally with rade: A4)		F- F- F- F- F- F- F- F- F- F- F- F- F-		51.00 - 52.50) RC	102	2					63 11 0	NI 60 70		1d'(1d' 1d' 1d' 1d' 1d'(1d'(
Assumed zone of co		2.50) 33.3 - - - - - - - - - 2.94	2 32.88									36	NĪR -		1d 1d' 1d' 1d
greyish white CHAL (marl wisps). Fractu slightly rough, with f (2 no.) 50 to 60 deg	'		f- f-(0.56) f-3.50	32.32	52.50 - 53.50 53.05 - 53.39	RC C	102 100						34 30	NI 40 300		1 c 1 cf 1 cf 1 cf
Drilling disturbed, re and high density, gr 50 to 80 degrees ve planar slightly rough	ecovered non-intact. Weak, medium reyish white CHALK. Fracture set 2: ery closely spaced (NI/50/60mm?), h, with frequent black specks, brown locally infilled (up to 10mm) with (Grade: C4)		f- f- 80.50) g00	31.82	53.50 - 54.00	RC	102						70 6 0			lef lef lef
53.65 - 53.70m : V Assumed zone of co Weak locally very w	veak, medium density greyish white		r- - tJ0.55) f- f- f- f- f-	31.27									63 11 11	NR - 16	_	lcf 1 I&Fi KM
slightly rough, with f	et2:(1no.)45 degrees, planar frequent black specks. Fracture set 3: tremely closely spaced and very 45/60mm), planar slightly rough, with ks. (Grade: A4/5)		f-		54.00 - 55.50	RC	102									I <f 1d'</f

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

Engineer: High Speed 2 (HS2) Ltd Logar Status: Date Started: 10/10/2016 Understation: Understatio: Understatio: Understation: Understation: Understation: U	PMcG F		I By:	lole Typ Checked pprovec cale:	nE Cł nN Ap	9SGB 02.06 m 33.53 n 35.82 n	49860 19408		em:	tes:	Survey Gr Co-ordina Ground Le				Project Name: Amersham Tunnel to Calvert Project No: 1G063 -AAZ. Client: High Speed 2 (HS2) Ltd
Stratum Description Legend (Thick Level ness) (m) Sampling, Coring and h Stu Testing TCR ison [NewPitChalk Formation] 0 0 0 0 0 0 55.35 - 55.50m : Drilling disturt.led. 0 0 0 0 0 0 -A ssame "B" zone of COPE-LOSS	F 21/11/		e:	rint Dat	eg. Pr										Date Started: 10/10/2016
(m) (e	Ifave	TCR SCR		ng			0				Level	(Thick	Legend	·
55.35 - 55.50m : Drilling disturi.Jed.) 55.31 - 55.41 C 100		J (rmax				Test	(mins))"%"	(mm	Туре	(m)"	(11)		<u> </u>	[NewPitChalk Formation]
-DAI ling detributed		45							100	с	55.31 - 55.41	30.32	,	₽55.	•
recovered as: greyish white angular to subrounded fine to coarse GRAVEL. Gravel is very weak, low density, light greyish white. (Grade undetenmined) [New Pit Chalk Formation] 57.00-57.28m : Assumed zone of core loss. 01.15) 57.28-57.32m : Drilling disturi: Jed, recovered non-intact. Recovered as: brownish white medium to coarse SAND. Possible fall in. 57.00-58.00 RC 102 CMeti"K beal ly very ve ats.meti : lumand"""ft""fgh-dens.ity;f=l ==iFI-57.70 greyish white CHALK with rare black specks. Fracture set 1: (3 no.) horizontal to 15 degrees medium spaced		- NR -	1						102	RC	55.50 -57.00	20.07	f- f- f-		
57.28 - 57.32 m : Drilling disturl: Jed, recovered non-intact. Recovered as: brownish white medium to coarse SAND. Possible fall in. c/4eti""K beal ly very ve ak;##7.lumand"""H""fghelens.ity;f=l ==iFl-57.70 greyish white CHALK with rare black specks. Fracture set 1: (3 no.) horizontal to 15 degrees medium spaced		_	_									29.27	f- f- f- f-	 e	recovered as: greyish white angular to subrounded fine to coarse GRAVEL. Gravel is very weak, low density, light greyish white. (Grade undetenmined) [New PitChalk Formation]
dWeil""K' bocal ly very we ak met I'umand"""h""T'gh-dens.ity,f=l==iFl-\$7.70 28.12 greyish white CHALK with rare black specks. Fracture set 1: (3 no.) horizontal to 15 degrees medium spaced	C	NIDO -	29						102	RC	57.00 -58.00		01.15) f- f- f-		
(200/200mm), phara logical subplex signed rough, with frequent black specks. (Jocally vellowish orange staining, no infill. Fracture set 2: (1 no.) 60 degrees, undulating HD.B0) slighUy rough Fracture set 3: 80 degrees to vertical, fractional undulating slighUy rough, with frequent black fractional statement black fracting fractional statement black fractional statement		90	100	-					102	RC	58.00-58.50	28.12		/==iFI-5	greyish white CHALK with rare black specks. Fracture set 1: (3 no.) horizontal to 15 degrees medium spaced (200/250mm), planar locally stepped slighUy rough, with frequent black specks, locally yellowish orange staining, no infill. Fracture set 2: (1 no.) 60 degrees, undulating slighUy rough Fracture set 3: 80 degrees to vertical, planar and undulating slighUy rough, with frequent black specks (Grade: A4)
-A ssame"T" zone of core-lossB.50 27.32 50.40)		NR -											50.40)		
W"'ed""K-=bca=f1-yveryweak,med I'um adc-=h_ig-hedersity, -rrt ftesa 90 26.92 greyish white CHALK with rare orange staining (sponge beds) and rare thin grey laminations (marl wisps). Fracture set 1: horizontal to 20 degrees widely spaced (120/850/920mm), undulating smooth, with frequent black specks, yellowish orange staining, no infill. Fracture set 2: (2 no.) 50 to 60 degrees medium spaced (280mm), planar slighUy rough, with frequent black specks. (Grade: A4) [New PitChalk Formation] 59.00-59.01m: Mytiloide fossil fragment (20mm).		90	50									φ, 3 ∠	r- r- r- r-	+rt-#≫a.	greyish white CHALK with rare orange staining (sponge beds) and rare thin grey laminations (marl wisps). Fracture set 1: horizontal to 20 degrees widely spaced (120/850/920mm), undulating smooth, with frequent black specks, yellowish orange staining, no infill. Fracture set 2: (2 no.) 50 to 60 degrees medium spaced (280mm), planar slighUy rough, with frequent black specks. (Grade: A4) [New PitChalk Formation]

Project No: Client: I Engineer: I Date Started:	Amersham Tunnel to Calvert 1G063 -AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd												0.100	t 13 of	10	
Date Started:					Survey Gr Co-ordinat Ground Le	tes:	em:		49860 19408	SGB 2.06 n 3.53 n 35.82 n	nE nN nOD	Hole Typ Checked Approve Scale: Log Sta	l By: d By:		PMcC F	D+RC G, CB PMcG 1:25
Jale Completed.	10/10/2016 19/10/2016				Orientation Inclination	:				d 90 d	eg. leg.	Print Da Final De	te:		21/11	
Sti	ratum Description	Legend	Depth (Thick- ness) (m)	Level (m)	Depth (m)	Samp Type	1		andh Sit Blows	tu Test Test	•	sult Unit	TCR SCR RQD	lfmin lfave l(mma)x	Weter	Wel Backi
Recovered as: w	ling disturbed, recovered non-intact. thite silty very sandy GRAVEL of f/int. Possible fall in? rare orange staining (sponge beds). Terminated at 61.50m		(m)	24.32	(m) 60.00-61.50 60.75-60.89	RC C	102 100	70					97 37 26	50 90 330 NI 40 60		තේ කොති කොති කොති කොති කොති කොති කොති කොති
	ured along borehole axis.		r- f													L
Explanation of symbol	ay be subject to seasonal, tidal and o Is and abbreviations given in 'Key to on appended 'Borehole Information S	Explora			nould not be	taken a	as con	istant.								

ProjectName	Central Package A												Hole ID	
Project No.	TE7967						Explo	ratoi	ry Ho	le Lo	g		ML036-RC	004
Engineer Employer	High Speed Two (HS2) Limited High Speed Two (HS2) Limited												Sheet 1 of 1	
Ground Level	+108.68mOD	Coordina	ates	498267.9	92E, 194250).28N	I	Gri	d	Na	ational G	rid	Officer for	·
Hole Type	IP+RO+RC	Inclinatio			horizontal	.§!								
	Description of Strata	,g	Legeno	Depth d (Thick-	Datum Level	111	Sampling		8	0	(a) 		In Situ Test Details	Install- ation
	_ II(Driller's description)		J	ness)			Details	Dia.	u" f-"	bl				
(MGR) [Made Ground	d] ling. Brown CLAY (Driller's description)			0.20	108.48									• •
riolary opennoic and														_
				_										
				(4.30)										
				-										
				-										
Rotary openhole drill	ling. Brown sandy gravelly CLAY (Driller's		>	4.50	104.18									
description)														
ļ												1	T 212	
	All depth in metres, all diameters in millin See header sheet for details of boring, pr		nd wate'										Lili	
	For details of abbreviations, see key.				1.00	checkod	by Chris Norton					SC	DIL en On _{ee}	RmG
Form No. SIEXPHOLELC			5 50.13	Issue Da	te 12/10/2016		Ly onno monton						of the Bachy Soletanch	

Project Name	Central Package A								Hole ID	
Project No. Engineer	TE7967 High Speed Two (HS2) Limited					Explo	oratory Hole	e Log	ML036-RC	004
Employer	High Speed Two (HS2) Limited								Sheet 2 of	14
Ground Level	+108.68mOD	Coordinates		498267.9	2E, 194250.28N		Grid	National Grid		
Hole Type	IP+RO+RC	Inclination		90° from	horizontal					
	Description of Strata	L	egend	Depth (Thick- ness)	Datum Level	Sampling Details	Dia. u	° [°] a _{"'} bl	In Situ Test Details	Install- ation
Rotary openhole dril	lling Brown sandy gravelly CLAY (Driller's						f- "'			

Rotary openhole drilling. Brown sandy gravelly CLAY (Driller's description)

(2.90)

-

Rotary openhole drilling. CHALK (Driller's description) Very soft lightbrown slightly sandy slightly gravelly CLAY. Gravel is subrounded to subangular fine to coarse of flint. Sand is fine to coarse. (ALV) [Alluvium] / Assumed zone of core loss. CHALK (Driller's description) (LECH) [Lewes Nodular Chalk Formation]				c717.55-7.65 7.50-8.00	102	40	N	Ą
		- (0.85)					NF	R
Structureless CHALK composed of slightly sandy gravelly SILT.Clasts are extremely weak to very weak low density subrounded light		8.55	100.13	8.00 - 9.00	102	45	_	
brownish white chalk with rare nodular flint. Matrix is light brown. Matrix is 80%. (LECH) [Lewes Nodular Chalk Formation]	E O	(0.65)		C72 8.70-8.80			N	A
No Recovery. CHALK (Driller's description)		9.20	99.48	C 73 9.10-9.20 9.00 - 9.50	102	40		



Notes: All depth in metres, all diameters in millimetres. н. See header sheet for details of boring, progress and wate' For details of abbreviations, see key.

Form No. SIEXPHOLERCLOG	Issue.Revision No. 2.04		Issue Dat	e 19/09/20	17				Parto	f the Bachy Soletanch	ne Gro	up

ProjectName	Central Package A											Hole ID)	
Project No.	TE7967					Explo	oratory	/ Hol	e Lc	og		ML036-R0	C004	4
Engineer Employer Ground Level	High Speed Two (HS2) Limited High Speed Two (HS2) Limited +108.68mOD	Coordinates	408267	.92E, 194250	28N		Gri	ч	N	ational	Grid	Sheet 3 of	f 14	
Hole Type	IP+RO+RC	Inclination		horizontal	.2014		GI	u	1.4	ational	Ond			
	Description of Strata	₽ J	Depth Legend (Thick- ness)	Datum Level	.§! I!I	Sampling Details	Dia.	8 u "	o bl	a #		In Situ Test Details		stall- t ion
No Recovery. CHAL	K (Driller's description)	•						t- "'						
							102	0	0	0				
							102	0	0	0				
												SPT(S) N=4		
												(1,0,1,0,12) 10.50		
						10.50 - 11.00	102	0	0	0				
				-										
											NR			
			(3.20}											
													===	
						11.00 - 12.00	102	0	0	0				
				-										
						12.00 - 12.50	102	20	0	0				
	K composed of slightly sandy gravelly SILT.Cla		12.40	96.28										
	to very weak low density light creamish white g. Matrix is light brownish white, dark brown													
patches. Matrix is 7 (<80mm).	0%. Submunded flint found throughout interv	al												
	ular Chalk Formation] 0m assumed zone of core loss					12.50 - 13.00	102	50	0	0				
			(1.35)	-										
						C74 13.20-13.30	102	50	0	0				
from 13.25m to 13.S	Om assumed zone of core loss					13.00-13.50	102	50	0	0				
		E Cl									NA			
		u												
			13.75	94.93										
	ore loss. CHALK (Driller's description) ular Chalk Formation]		0.10	04.00		13.50 - 14.25	102	33	0	0				
			(0.50)	-										
			(
			14.25	94.43										
are extremely weak	K composed of slightly sandy gravelly SILT.Cla to very weak low density light creamish white	2	(0.30}			C75 14.35-14.45								
	g. Matrix is light brownish white, dark brown i 0%. Submunded flint found throughout interva		(0.30)	94.13										
. ,	ular Chalk Formation]		1455	94.13		14.25 - 15.00	102	40	0	0				
Assumed zone of co	pre loss. CHALK (Driller's description)													



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Notes: All depth in metres, all diameters in millimetres. See header sheet for details of boring, progress and wate' For details of abbreviations, see key.

Final, monitoring in progress

Form No. SIEXPHOLERCLOG	Issue.Revision No. 2.04		Issue Date	e 19/09/2017					Partof	the Bachy Soletanch	e Group
					-		 				
					-						
		((
		t t									
		1					 				
								I			

ProjectName	Central Package A													Hole ID		
,	TE7967							Explor	atory	/ Ho	le Lo	g	N	1L036-RC	004	4
Engineer Employer	High Speed Two (HS2) Limited High Speed Two (HS2) Limited													Sheet 4 of	14	
Ground Level Hole Type		dinates nation			2E, 1942 horizonta		l		Grio	d	Na	tional G	irid			
	Description of Strate	e ∎	Logond	Depth	Datum	.§!	Sai	mpling		Q	o	сі 4 .		In Situ Test Details		tall- ion
Assumed zone of core	Description of Strata eloss. CHALK. (Driller's description)	J	Legend	(Thick- ness)	Level	111	Deta	ails	Dia.	u " f- "	bl			Details		
7135411642016 010016															=====	
							15.00 -	15.50	102	0	0	0			====	
				(1.05)			15 50	1 2 0.0	100				NR		====	
				(1.95)			15.50 -	16.00	102	0	0	0				
at 1&0Dm 1No coarse	cobble sized fragment of partially rinded flint			-											====	
							16.00 -	16 50	102	50	0	0				
							18.00 -	0.50	102	50	0		_	_		
Extremely weak to ve with widely spaced b	ery weak low density light brownish white CHALK			16.50	92.18								NI			
(LECH) [Lewes Nodul	ar Chalk Formation]			(0.30) 16.80	91.88								110			
with widely spaced b				10.00	31.00		16.50 -	17.25	102	47	20	20	-			
(LECH) [Lewes Nodul	ar Chalk Formation]			-									NR			
				(0.85)			0.70.47	00.47.05								
							C 76 17.:	28-17.35					NI 30			
													110			
Assumed zone of core (LECH) [Lewes Nodula	e loss. CHALK. (Driller's description) ar Chalk Formation]			17.65	91.03		17.25 -	18.00	102	53	20	20	NR		====	
				(0.35)											=====	
with widely spaced b				18.00 -	90.68								NI			
(LECH) [Lewes Nodul				(0.30) 18.30	90.38								_			
Assumed zone of core (LECH) [Lewes Nodul	e loss. CHALK. (Driller's description) ar Chalk Formation]						18.00 -	18.75	102	40	0	0	NR		====	
				(0.45)												
Extremely weak to ve	ery weak low density light brownish white CHALK			18.75	89.93		C 77 18.8	80-18.87								
with widely spaced b (LECH) [Lewes Nodul													NI			
at 19.00m coarse grav	vel sized fragment of black partially rinded flint			-			18.75 -	19.50	102	67	53	45	70 130		=====	
from 19.25m to 19.SOr	m assumed zone of core loss			į									NR			
				 											====	
				1									NI		====	
									102	77	0	0				
							19.50-: 	20.25 							====	
	Il denth in metree all diameters is million-to													T :1:		
	II depth in metres, all diameters in millimetres. See header sheet for details of boring, progres For details of abbreviations, see key.		vate'						_							
Final, monitoring in p	progress Print date and time 08/05	/2018	09:19	SSUE Do	Lo te 19/09/20	-	ked by Chr	is Norton						the Bachy Soletand		
- UNIT NO. SIEAPHULERU	15508.Revision NO. 2.04			issue Da	w/u9/20								r all O	are bacity soletand	e Gi(oup

ProjectName	Central Package A													Hole ID		
Project No.	TE7967							Explora	ator	у Нс	ole Lo	g		ML036-RC	:004	4
Engineer Employer	High Speed Two (HS2) Limited High Speed Two (HS2) Limited													Sheet 5 of	14	
Ground Level Hole Type	+108.68mOD	Coordinat			2E, 1942 horizonta		1		Grid	d	Na	itional	Grid			
				Depth	Datum	.§!	San	npling			0	сі 4 ,		In Situ Test	Ins	tall-
	Description of Strata	J	Legen	d (Thick- ness)	Level	1!!	Detai	ils I	Dia.	u "	bl	<i>q</i> ,		Details	at	ion
Extremely weak to v with widely spaced b (LECH) [Lewes Nodu		K											NR			
	5m assumed zone of core loss			1					_					-		
				ç											====	
				Į.			20.25 - 2	21.00	102	86	0	0	NI			
				ç												
from 20.90m ID 21.0	00m assumed zone of core loss						C 79 <u>2</u> 0.9	5-21.00					NR			
				(3.45)												
at 21.20m 1No coars	e gravel sized fragment of black partially rinded flint						2100 -	21.40	102	92	0	0			===	
				Ś												
				[NI			===
													60		====	
				ſ			21.40-2	22 50	102	72	13	0			====	
				-			C 80 22.			12		Ū				
Assumed zone of cor	re loss. CHALK. (Drill er's description) ilar Chalk Formation]			22.20	86.48		0.00 22.						 NR			
(LECH) [Lewes Nodu				(0.30)												
	ery weak low density light brownish white CHA	<u>_K</u>		22.50	86.18				_				NI	_		
	ılar Chalk Formation] massumed zone of core loss	_/		22.60	86.08											=
Assumed zone of cor (LECH) [Lewes Nodu	re loss. CHALK. (Driller's description) ılar Chalk Formation]			(0.05)			22.50 - 2	23.25	102	13	0	0	NR		====	
				(0.65)												
				23.25	85.43											
with widely spaced b		ĸ		23.25	85.33								<u></u> NI			
I <u>(LECH)[LewesNodu</u> Assumed zone o	f core loss. CHALK. (Driller's description)	_														
							23.25 - 2	24.00	102	13	0	0				
				(1.40)					_				NR			
				(1.40)												
							24.00 - 2	24.75	102	0	0	0				
							24.00-2	24.75	102	0						
	sturbed. Very weak low density light creamish range stained surfaces throughout.	_		24.75	83.93		C81 24.85	5-24.95	_				NI	-		
(LECH) [Lewes Nodu				(0.30)											===	
													1			
	All depth in metres, all diameters in millime See header sheet for details of boring, pro For details of abbreviations, see key.	tres. gress and	wate'											Lili.		
Final, monitoring in	progress Print date and time 0		3 09:19			-	ked by Chris	s Norton	_					IL enGme		
Form No. SIEXPHOLER	CLOG Issue.Revision No.	2.04		Issue Da	te 19/09/20)17							Part	of the Bachy Soletand	che Gro	oup

ProjectName	Central Package A												Hole ID		
Project No.	TE7967						Exploi	rator	у На	le Lo	g	N	/L036-RC	004	
Engineer Employer	High Speed Two (HS2) Limited High Speed Two (HS2) Limited												Sheet 6 of ²	14	
Ground Level Hole Type	+108.68mOD Coord	linates		498267.9 90° from			!	Gri	d	Na	itional (Grid			
				Depth	Datum	.§!	Sampling			0	a,		In Situ Test	Inst	tall-
	Description of Strata	J	Legend	(Thick- ness)	Level	1!1	Details	Dia.	u "	bl	4,		Details	ati	on
Non intact drilling dia white CHALK with or 1/LECH) [Lewes Nodu	sturbed. Very weak low density light creamish range stained surfaces throughout. Iar Chalk Formation] refoss. CHALK. (Driffer's description)			25.05	83.63		24.75-25.50								
(LECH) [Lewes Nodu				(0.45)				102	40	0	0	NR			
Non intact drilling di	sturbed. Very weak low density light creamish			25.50	83.18										
-	range stained surfaces throughout.			25.65	83.03							NI			
	re loss. CHALK. (Driller's description) Jlar Chalk Formation]			(0.35)			25.50-26.00	102	30	0	0	NR			
Non intact drilling	disturbed. Very weak low density light creamish			26.00 -	82.68										
white CHALK with or	range stained surfaces throughout. Jlar Chalk Formation]											NI		====	
from 26.30m to 26.5	Om assumed zone of core loss						26.00-26.50	102	60	0	0	NR	F		
				1											
												NI			
from 26.SOm to 27.0	00m assumed zone of core loss			(1.50)			26.50-27.00	102	60	0	0	NR			
at 27.00m angular b	lackflintfragments			 -											==_
				1										====	
												NI			
	re loss. CHALK. (Driller's description)			27.50	81.18										
(LECH) [Lewes Nodu	Jiar Chaik Formation]						27.00-28.50	102	43	0	0		-	====	
				(0.05)			27.00-20.00	102	43	0	0			====	
				(0.85) -								NR			
														====	
	sturbed. Very weak low density light creamish			28.35	80.33		C83 28.35-28.42								
	range stained surfaces throughout. Jlar Chalk Formation] Jackflint fragments											NI			
				(0.65)			28.50-29.00	102	60	0	0				
from 28.SOm to 29.0	00m assumed zone of core loss														
blackflint, nodulara	ity creamish white CHALK with medium spaced nd sheeV Discontinuities: 1)60-90 degrees			29.00 -	79.68							NI			
2) 44 degrees undul	ar slightly rough clean but heavily speckled black. lating slightly rough clean with black speckling. Jlar Chalk Formation]			 			29.00-29.50	102	60	20	10	90 100		=====	
at 29.0Dm nodular fl															
at 29.SOm nodular f	lints											NI			
							29.50-30.00	102	70	0	0				==-
from 29.85m to 30.0	0m assumed zone of core loss											NR			
															<u> </u>
												1			
Notes: /	All depth in metres, all diameters in millimetres. See header sheet for details of boring, progress For details of abbreviations, see key.	s and	wate'										Lili.		
Final, monitoring in	progress Print date and time 08/05/	2018	09:19	logue D. (-	ked by Chris Norton					SOIL			
Form No. SIEXPHOLER	CLOG Issue.Revision No. 2.04			issue Dat	e 19/09/20	17						Parto	fthe Bachy Soletanc	ne Gro	up

ProjectName	Central Package A												Hole ID		
Project No.	TE7967						Explo	orato	ry Ho	ole Lo	og		ML036-RC	004	4
Engineer Employer	High Speed Two (HS2) Limited High Speed Two (HS2) Limited												Sheet 7 of	14	
Ground Level	+108.68mOD C	oordinate	S		92E, 19425	0.281	1	Gri	d	Na	ational	Grid			
HoleType	IP+RO+RC In	clination g> "iii		90° from Depth	horizontal	.§!									
	Description of Strata		Legend		Datum Level	1!1	Sampling		u	0	а а		In Situ Test Details		ion
	ity creamish white CHALK with medium spaced	J		11633)			Details	Dia.	0	bl				 	
widely spaced plana	nd sheeV Discontinuities: 1) 60-90 degrees ar slightly rough clean but heavily speckled black.											NI			
(LECH) [Lewes Nodu							30.00-30.50 C 84 30.30-30.36	102	60	0	0				
at 30.10m oodular f	Om sheet flints (<30mm) lints Om assumed zone of core loss														
													-		
		!;;!		(2.50)			30.50-31.00	102	100	42	0	NI			
		.,,:		(2.00)			00.00 01.00	102		72	Ŭ	60			
				-											
							CBS 31.10-31.41								
at 31.15 zoophycos	traces						31.00-31.50	102	100	0	0				
(10.15															
at 30.1Dm inoceram	sturbed. Extremely weak to very weak low			- 31.50	77.18				<u> </u>			NI			
density creamish wh	nite CHALK with widely spaced nodular black flint uities: 1)60-90 degrees medium to widely spaced														
	slightly rough heavily speckled black and														
(LECH) [Lewes Nodu	Ilar Chalk Formation]						31.50-32.25	102	80	0	0				
				-											
from 32.10m to 32.2	5m assumed zone of core loss											NR			
													-		
							00.05.00.00	100				NI			
							32.25 - 33.00	102	80	32	32	120			
from 32 85m to 33 0	0m assumed zone of core loss														
				-											
												NI			
				(4.60)											
							33.00-33.75	102	71	0	0	NR			
							C 87 33.68-33.79					NI			
													-		
				-								NI			
							33.75-34.50	102	66	0	0				
from 34.25m to 34.S	Om assumed zone of core loss														
														===	
							C 88 34.64-34.72							==	
							0.00 04.04-04.72	102	72	27	0	NI			
							34.50 - 35.25					60		$\left \right $	
		_		r				-							
Notes:	All depth in metres, all diameters in millimet See header sheet for details of boring, progr		wate'	1	1	1	1	1	1	1			Lili.	<u>ı </u>	
Final, monitoring in	For details of abbreviations, see key. progress Print date and time 08/	05/2012	09.10		Log	cher	ked by Chris Nortor	h				sc	lL en Gn eel	Rm	G
Form No. SIEXPHOLER			20.10	Issue Da	te 19/09/2017			-				Part	of the Bachy Soletanc	he Gro	oup

ProjectName	Central Package A													Hole ID		
Project No.	TE7967							Exploi	ratoi	'y Ho	ole Lo	g	N	//L036-RC	004	1
Engineer Employer	High Speed Two (HS2) Limited High Speed Two (HS2) Limited													Sheet 8 of	14	
Ground Level Hole Type		dinates ation	;		2E, 194250 horizontal).28N	N		Gri	d	Na	itional	Grid			
		¢} ¶≣		Depth	Datum	.§!		Sampling			ο	сі 4 ,		In Situ Test	Inst	
	Description of Strata	J	Legend	(Thick- ness)	Level	1!1	[Details	Dia.	u " f- "	bl	۳i		Details	ati	ion
density creamish w	isturbed. Extremely weak to very weak low hite CHALK with widely spaced nodular black flint nuities: 160-90 degrees medium to widely spaced															
planar to undulating occasionally stained	gslightly rough heavily speckled black and															
	25m assumed zone of core loss												NI 180			
								35.55-35.65 25-36.00	102	73	32	16				
from 35.BOm to 36.0	00m assumed zone of core loss														====	
(00.00 ··· ID co.													NR		====	
	DSm coarse black partially rinded flint sity light greyish white CHALK with widely spaced			36.10	72.58											
to widely spaced pla	60mm). Discontinuities: 1)60-90 degrees medium anar to undulating slightly rough heavily speckled 2) 0-30 degrees medium to widely spaced						C 90	36.20-36.46					NI 70 210			
undulating rough to marl seams). 3) 30-6	slightly rough clean (broken along zoophycos and 60 degrees widely spaced planar slightly rough						36.	00 - 36.75	102	66	46	35				
	ular Chalk Formation] 75massumed zone of core loss												NR			===
															====	
								75-37.50	102	100	93	44				
				(2.40}			C 91	37.15-37.25								
													NI 30		====	
													100			
															====	
at 38.1Dm flint				-											====	
							37	.50-39.00	102	66	27	18				
	ore loss. CHALK (Driller's description) ular Chalk Formation]			38.50	70.18										====	
				(0.50)									NR			
				00.00	60.00		_								====	
rindedblackflint(<6	sity light greyish white CHALK with widely spaced 50mm). Discontinuities: 160-90 degrees medium			39.00 -	69.68											
black with no infill. 2	anar to undulating slightly rough heavily speckled 2) 0-30 degrees medium to widely spaced slightly rough clean (broken along zoophycos and												NI 210			
	60 degrees widely spaced planar slightly rough						39.	00-39.75	102	66	44	37	21 0		====	
at 39.30m coarse fli	lodular Chalk Formation] ints 75m assumed zone of core loss			(1.50)								NR			
													110 130			
						-	-								11	
	All depth in metres, all diameters in millimetres. See header sheet for details of boring, progress For details of abbreviations, see key.	s and v	vate'			1	<u>.</u>			1	1	·]		Lili.	1	
Final, monitoring in		/2018	09:19	66110 120	Log		cked by	Chris Norton						L enGme		-
	133UE.NEVISION NO. 2.04			19906 Dg										. are baciny obleiding		-up

ProjectName	Central Package A												Hole ID		
Project No.	TE7967						Explo	rator	у Но	le Lo	g	N	/L036-RC	004	4
Engineer Employer	High Speed Two (HS2) Limited High Speed Two (HS2) Limited												Sheet 9 of	14	
Ground Level Hole Type	+108.68mOD Coord	dinates ation	;		2E, 194250 horizontal).28N	I	Gri	d	Na	tional (Grid			
		∂ ¶≣		Depth	Datum	.§!	Sampling			o			In Situ Test	1	tall-
	Description of Strata	J	Legend	(Thick- ness)	Level	1!1	Details	Dia.	u " f- "	bl	411		Details	at	ion
rinded black flint (<60 to widely spaced plan black with no infill. 2) undulating rough to s marl seams). 3) 30-60 clean.	ty light greyish white CHALK with widely spaced 0mm). Discontinuities: 1)€0-90 degrees medium narto undulating slightly rough heavily speckled 0-30 degrees medium to widely spaced slightly rough clean (broken along zoophycos and 0 degrees widely spaced planar slightly rough						39.75-40.50	102	66	61	43	NR		 	
Very weak to weak lo with rare thin grey ma Medium spaced bla degrees widely spac degrees widely spac (LECH) [Lewes Nodul at 4D.95m coarse bla	measumed sense of correctees			40.50	68.18		40.50 - 41.25	102	70	65	57	NI 310 310 		 	
at41.60m 1No cobbi	e sized fragment of black flint	:1		(2.50)			4125 - 42.00	102	90	84	52	40 100 130			
at 42.00m cobble of t	flint			-			C 95 42.05-42.28					1111			
at 42.2Sm black fli	nt cobble						42.00-42.75	102	73	58	50	NI 130 170 NR			
brownish white CHA (LECH) [Lewes Nodul	sturbed. Weak medium to high density light LK with shell fragments and burrows. lar Chalk Formation e loss. CHALK (Driller's description) lar Chalk Formation]			43.00 - 43.20 (0.30)	65.68		42.75 - 43.50	102	60	38	27	NI 80 100 NR			 - •
spaced rinded black zoophycos trace foss medium to widely sp rough clean. Broken a widely spaced undula undulating slightly rc (LECH) [Lewes Nodul				- 43.50	65.18		C 96 43.77-44.00 43.50-44.25	102	87	80	68	NI 140 210			
from 44.ISm to 44.2:	5m assumed zone of core loss											NR			
							44.25 - 45.00 C 97 44.80-45.00	102	100	93	93				
															·
	Il depth in metres, all diameters in millimetres. See header sheet for details of boring, progress For details of abbreviations, see key. progress Print date and time 08/05.				Loa	chec	ked by Chris Norton					SOII	Lili. enGmee	eRn	nG
Form No. SIEXPHOLERC				issue Da	te 19/09/2017							Parto	f the Bachy Soletand	he Gro	oup

ProjectName	Central Package A												Hole ID	
Project No.	TE7967						Explo	rator	у Нс	ole Lo	og	N	ML036-RC	004
Engineer Employer	High Speed Two (HS2) Limited High Speed Two (HS2) Limited												Sheet 10 of	14
Ground Level Hole Type		ordinates lination	5		2E, 194250 horizontal).28N	1	Gri	d	Na	ational Gr	id		
	Description of Strata	₽ I	Legend	Depth (Thick- ness)	Datum Level	.§! I!I	Sampling Details	Dia.	0 u "	o bl	сі 4 ,		In Situ Test Details	Install- ation
	edium density greyish white CHALK with widely			 					f- "'					
medium to widely sp rough clean. Broken	Slist&(s7@mm), 31d/wimp/gtleg:11/96090 degrees vaced undulating to planar rough to Slightly along marl seams/zoophycos. 2) 30-60 degrees ating rough clean. 3) 0-30 degrees widely spaced bugh clean with black speckling. lar Chalk Formation]													
at 45.62m interwov	en mari seam						45.00-46.50	102	97	75	49	NI 110 200		··· ···
at 46.0Sm cobble of	f black flint						C 98 46.20-46.37							
				(4.50)									-	
at 46.9Dm cobble of	blackmint				-		46.50-48.00	102	93	80	62	NI 110 330		····
from 47.90m to 48.00	Im assumed zone of core loss						C 99 47.61-48.00					NR		
frequent interwover degrees medium spa	ow to medium density greyish white CHALK with n rarely flaser marls. Discontinuities: 160-90 aced undulating rough black speckled. ular Chalk Formation]			48.00 -	60.68									····
				(1.15)			C OO 48.47-48.94 48.00-49.50	102	90	81	45	NI 110 330		
phosphatic CHALK st (LECH) [Lewes Nodul			-	- 49.15 (0.35)	59.53						_			··· ··· ···
0-30 degrees mediu	density greyish white CHALK Discontinuities: 1) m spaced undulating rough clean. 2) 60-90 ed undulating rough clean. lar Chalk Formation]			49.50	59.18		C 94 49.54-49.88 C IOI 49.80-50.00					NR	-	
	All depth in metres, all diameters in millimetre See header sheet for details of boring, progre For details of abbreviations, see key.		ı wate'	1	I	L	I	I	I	I			Lili.	1
Final, monitoring in p Form No. SIEXPHOLERC			09:19	Issue Dat	Log te 19/09/2017		ked by Chris Norton						L enGmee	

ProjectName	Central Package A													Hole ID	
Project No.	TE7967							Explo	rator	у Нс	ole Lo	g	N	ML036-RC	004
Engineer Employer	High Speed Two (HS2) Limited High Speed Two (HS2) Limited													Sheet 11 of	14
Ground Level Hole Type	+108.68mOD IP+RO+RC	Coordina Inclinatio				2E, 194250 horizontal).28N	1	Gri	d	Na	itional G	rid		
	Description of Strata		Ĵ	Legend	Depth (Thick- ness)	Datum Level	.§! I!I	Sampling	Dia.	0 u "	o bl	сі 4 ,		In Situ Test Details	Install- ation
	density greyish white CHALK. Discontinuities: រួមក្នុងក្រសួមដែរស្វាអូងម៉្នាណ្ឌូស្វាស្វា clean. 2) 60-90 ilar Chalk Formation]	1)						49.SO-SI.00	102	100	91	7S	NI 100 140		· · ·
at 50.GSm orange st	aining			I	(2.50)	-									· · · · · · · · · · · · · · · · · · ·
								C102 SI.43-SI.61 SID0-S2.SO	102	90	76	69	NI 120 210		· · · · · · · · · · · · · · · · · · ·
stained orange greer (LECH) [Lewes Nodu				 	S2.00 -	S6.68		C103 S2.21-S2.39				-	NR	_	
at 53.60m interwove	n marls				(3.00)			52.SO - 54.00	102	100	48	37	NI 90 130		· · · · · · ·
at 54.60m interwov	ren maris			I	-			C104 ^{4.} 64.95.9294	102	100	45	21			· · ·
	All depth in metres, all diameters in milli See header sheet for details of boring, pr For details of abbreviations, see key.		nd w	vate'									800	Lili.	Dres
Final, monitoring in p Form No. SIEXPHOLER			18 (09:19	Issue Dat	Log e 19/09/2017		ked by Chris Norton						L enGmee	

ProjectName	Central Package A												Hole ID		-
,	TE7967						Explor	ator	у Но	le Lo	g	N	//L036-RC	004	ŀ
Engineer Employer	High Speed Two (HS2) Limited High Speed Two (HS2) Limited												Sheet 12 of	14	
Ground Level Hole Type	+108.68mOD Coo	ordinates			92E, 194250 horizontal	.28N	I	Gri	d	Na	ational (Grid			
	Description of Strata	ê	Legend	Depth	Datum Level	.§! I!I	Sampling	Dia.	. 8	o bl	а,		In Situ Test Details	Insta atic	
n seaced iotoroops p	ity greyish white CHALK with medium to widely ຢູ່ຂອດ ເກດເປີຣ ທີ່ເຮັດດາງ ໂອ ນເປັດຈ ີ່ເຊິ່ງ ເຊິ່ງ n by marl seams). 2)60-90 degrees undulating c clean. lalk Formation]			(3.1S)			C OS SS.96-S6.15 SS.SO-S7.00	102	97 ⁻	61	31				
Assumed zone of con (NPCH) [New Pit Cha	e loss. CHALK. (Oniller's description) Ilk Formation]			S8.1S (0.35)	50.53		C106 S7.72-S7.88 S7.00-S8.SO	102	77	62	S7	NI 80 130 NR			
spaced well develop; medium to widely sp rough clean (broken a (R바란)위원과과 관순유 at 59.IOm 1Nothin la	ity greyish white CHALK with medium to widely ed marl seams. Discontinuities: 1)0-30 degrees vaced undulating to planar rough to slightly along marl seam). 2) 60-90 degrees undulating ald egrees and a slightly rough clean. amination of grey mart e loss. CHALK. (Driller's description) alk Formation]			(1.20) (1.20) (1.20)	48.98		C107 59.04-59.18 58.50-60.00	102	80	60	60	NI 90 130 NR			
	All depth in metres, all diameters in millimetre See header sheet for details of boring, progre For details of abbreviations, see key.	es. ess and v	vate'										Lili.		<u> </u>
-													L enGmee	D	~

ProjectName	Central Package A												Hole ID		
Project No.	TE7967						Exploi	rator	у Но	le Lo	g	N	ML036-RC	200	1
Engineer Employer	High Speed Two (HS2) Limited High Speed Two (HS2) Limited												Sheet 13 of	14	
Ground Level Hole Type		rdinates ination	•		2E, 194250 horizontal).28N	I	Gri	d	Na	itional G	rid			
	Description of Strata	¢ ∎	Legend	Depth (Thick- ness)	Datum Level	.§! I!I	Sampling Details	Dia.	0 u " f- "	o bl	сі 4 ,		In Situ Test Details	Inst ati	tall- ion
Assumed zone of cor (NPCH) [New Pit Ch	re loss. CHALK. (Driller's description) halk Formation]								1-						
spaced well develop medium to widely sp fough clean. (b) step (NPCH) [New Pit Cha at 6D.4Dm 1No thin	ity greyish white CHALK with medium to widely bed marl seams. Discontinuities: 10-30 degrees baced undulating to planar rough to slightly along marl seam), 2,60-90 degrees undulating of degrees planar singhtly foughtrean. alk Formation] lamination of grey marl. I lamination of grey mart	_		(0.65)	48.33		C108 60.66-60.83 60.00 - 61.50	102	100	91	85	NI 120 210			
at61.4Dm 1Nothin	lamination of grey marl.			(1.90)								NI 28	-		
A ssumed zone of cor (NPCH) [New Pit Cf	refoss. CHALK. (Driller's description)			62.25	46.43		C109 62.07-62.25 6150 - 63.00	102	26	26	26	NR			··· ··· ··· ··· ···
spaced well develop medium to widely sp rough clean (broken rough clean. 3) 30-6((NPCH) [New Pit Cha at 63.14m 1Nothin	sity greyish white CHALK with medium to widely ed marl seams. Discontinuities: 10-30 degrees baced undulating to planar roughto slightly along marl seam). 2) 60-90 degrees undulating 0 degrees planar slightly rough clean. alk Formation] I amination of grey marl. 5m assumed zone of core loss	_		63.00 -	45.68		C112 63.20-63.45 63.00 - 63.75	102	66	53	53	NI 90 120 NR	-		
from64.35mtx64.S0	Om assumed zone of core loss						63.75-64.50	102	80	57	57	NI 240 240 NR			
spaced well develop medium to widely sp rough clean (broken	ity greyish white CHALK with medium to widely yed marl seams. Discontinuities: 10-30 degrees paced undulating to planar rough to slightly mostly along marl seams). 2) 60-90 degrees very ulating rough speckled black clean. halk Formation]			64.50	44.18		64.50-65.25	102	76	61	48	NI 80 120			
	All depth in metres, all diameters in millimetre See header sheet for details of boring, progre For details of abbreviations, see key.		wate'									800		Det	
Final, monitoring in p Form No. SIEXPHOLERC			09:19	Issue Dat	Log e 19/09/2017		ked by Chris Norton						L enGmee		

ProjectName	Central Package A											Hole ID	
Project No.	TE7967							Explo	ratoi	ry Hole Log	N	ML036-RC	004
Engineer Employer	High Speed Two (HS2) Limited High Speed Two (HS2) Limited											Sheet 14 of	14
Ground Level	+108.68mOD	Coordina	tes	498	3267.9	2E, 19425	50.28N	I	Gri	d National Gri	d		
Hole Type	IP+RO+RC	Inclinatio	on			horizonta							1
	Description of Strata		Leg	end (T	epth hick- ess)	Datum Level		Sampling Details	Dia.	u bl "		In Situ Test Details	Install- ation
	sity greyish white CHALK with medium to widel		-					Details	Dia.	f- "'		Dotano	
medium to widely s	ped marl seams. Discontinuities: 1) 0-30 degree paced undulating to planar rough to slightly n mostly along marl seams). 2) 60-90 degrees v										NR		
widely spaced undu (NPCH) [New Pit Ch	ulating rough speckled black clean. nalk Formation]												
from 65.07m ID 65.2	25m assumed zone of core loss												
								65.25-66.00	102	96			
								66.00 - 67.50	102	100			
					-			C 111 67.00-67.24					
				(5	5.50)						NI		
					-								
								67.SO-69.00	102	81			
from 68.71m to 69.0	00m assumed zone of core loss												
					-								
								C 113 69.35-69.72					
								69.00 - 70.00	102	98			
End of borehole at 70.0	00m. Termination Reason: Achieved Scheduled I	Depth											
Notes:	: All depth in metres, all diameters in millin						L		I	<u> </u>		Lili	I
	See header sheet for details of boring, pro For details of abbreviations, see key.	ogress ar	id wate'								SC	DIL en Cen _{ee}	RmG
Final, monitoring in Form No. SIEXPHOLER			8 09:19	22	ueDat	Lo e 19/09/20		ked by Chris Norton				fthe Bachy Soletanch	
. om to oie AFTIOLER		. =7		100	JUDd		• /				i aitu	Baony Coletaritti	oroup

ngineer	Central Packag TE7967	<u>م ۸</u>							
ngineer	111/00/	CA .					racture Log -	HoleID	
liont	High Speed Tw	o (HS2) Limit	ed			Disc	continuity Data		SOIL ENGINEERING
lient	High Speed Tw	o (HS2) Limit	ed					ML036-RC004	Part of the Bachy Soletanche Group
Discontinuity Number	Depth From	Depth To	Fracture Type	Dip	Roughness	JRC	Infilling	Weathering (Staining)	Remarks
1	m	m	e.g. Joint	0		0	a		
1	29.30	29.42	Rock Joint	30	Rough	8	Clean	Slightly weathered	
2	29.54	29.60	Rock Joint	40	Rough	8	Clean	Slightly weathered	
3	30.50	30.78	Rock Joint	86	Rough	8	Clean	Slightly weathered	
4	31.06	31.18	Rock Joint	78	Rough	8	Clean	Slightly weathered	
5	31.68	31.92	Rock Joint	80	Rough	10	Clean	Slightly weathered	
6	32.37	32.48	Rock Joint	82	Rough	12	Clean	Slightly weathered	
7	33.15	33.40	Rock Joint	72	Rough	12	Clean	Slightlyweathered	
8	33.42	33.45	Rock Joint	48	Rough	8	Clean	Slightly weathered	
9	33.85	34.20	Rock Joint	85	Rough	10	Clean	Slightly weathered	
10	34.63	34.90	Rock Joint	85	Rough	8	Clean	Slightly weathered	
11	35.47	35.57	Rock Joint	64	Rough	8	Clean	Slightly weathered	
12	36.82	36.98	Rock Joint	40	Rough	8	Clean	Slightlyweathered	
14	37.38	39.00	Rock Joint	89	Rough	8	Clean	Slightly weathered	
13	37.71	37.71	Rock Joint	74	Rough	8	Clean	Slightly weathered	
15	39.75	39.84	Rock Joint	69	Rough	10	Clean	Slightly weathered	
16	40.40	40.48	Rock Joint	60	Rough	12	Clean	Slightly weathered	
17	40.56	40.57	Bedding	4	Rough	8	Clean	Slightly weathered	
18	41.33	42.38	Rock Joint	77	Rough	10	Clean	Slightly weathered	
19	43.69	43.69	Bedding	4	Rough	8	Clean	No staining	
20	43.78	43.78	Bedding	2	Rough	8	Clean	No staining	
21	44.78	44.79	Bedding	10	Rough	8	Clean	Slightly weathered	
22	44.94	45.00	Rock Joint	44	Rough	12	Clean	No staining	
23	45.15	45.27	Rock Joint	60	Rough	12	Clean	No staining	
24	45.56	45.80	Rock Joint	76	Rough	10	Clean	Slightly weathered	
25	45.98	46.04	Rock Joint	42	Rough	12	Clean	No staining	
26	46.10	46.11	Bedding	8	Rough	8	Clean	No staining	
27	46.88	46.90	Rock Joint	43	Rough	12	Clean	Slightly weathered	
28	47.50	47.50	Bedding	13	Rough	12	Clean	Slightly weathered	
29	47.64	47.74	Rock Joint	28	Rough	12	Clean	Slightly weathered	
30	48.16	48.43	Rock Joint	79	Rough	12	Clean	Slightly weathered	
31	48.77	48.98	Rock Joint	79	Rough	12	Clean	Slightly weathered	
32	49.72	49.73	Bedding	8	Rough	12	Clean	No staining	

-barn	E	BORE	HO	LE L	.00	3				N	1L03	hole N 8-RC et 1 of	004	
roject Name:	Amersham Tunnel to Calvert			Survey Gi Co-ordina	-	em:	4965	DSGB 59.95 r	nΕ	Hole Typ Checked	be: I By:		RC JMe	
roject No: ient: ngineer:	1G063 -AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd			Ground L	evel:			05.46 r 20.86 r	nOD	Approve Scale: Log Sta	-			PN 1: FIN
ate Started: ate Completed:	04/10/2016 10/10/2016	1 1		Orientation Inclination	:			c 90 c	leg.	Print Da Final De	pth:	_	21/11 75	
	Stratum Description	Legend (Thick ness) (m)	- Level	Depth (m)	1	Dia	ring and h S Rec Blows % (mins)			ult Units	TCR SCR RQD %	lf min If ave If max (mm)	water	V E
Firm brown slightly : subangular to round chalk. Sand is fine t Head]	sandy gravelly CLAY. Gravel is ded fine to coarse of flint and rare o coarse.			0.20-0.40	В									
		(1.20)		0.60-0.80	В									
Drillers description: nole)	Brown GRAVEL of flint. (Rotary open	1.20	119.66	1.00 -1.20	В									
		F- F- F- F- F- F- F- F-												
		r- r- f- f- f-												
		r- r- r- r- r-												
		F- F- F- F-												
		5- 5- 5- 5-												
		f- f- f- f- f-												
		5- 5- 7- 7-												
		f f f f f f f												
		f												
	easured along borehole axis. s may be subject to seasonal, tidal and	other fluctuatio												

-barn ritchies	E	BOREHOL	E LOG		ML038-	ole No: -RC004 2 of 15
Project Name:	Amersham Tunnel to Calvert		Survey Grid System:	OSGB	Hole Type:	RO+RO
Project No:	1G063 -AAZ.		Co-ordinates:	496559.95 mE 195405.46 mN	Checked By: Approved By:	JMe, CE PMcC
Client:	High Speed 2 (HS2) Ltd		Ground Level:	120.86 mOD	Scale:	1:25
Engineer: Date Started:	High Speed 2 (HS2) Ltd 04/10/2016		Orientation:	deg.	Log Status: Print Date:	FINAL 21/11/2017
Date Completed:	10/10/2016		Inclination:	90 deg.	Final Depth:	75.00m
		Depth Legend (Thick- Level	1 1	andhSituTesting	SCR I	fmin fave
	Stratum Description	Legend (miner 2000) (m)	(m) Type Dia Rec	Blows (mins) Test	esult Units R&D (fave rmma)x water ck
Drillers description: E	Brown GRAVEL of flint. (Rotary open					
Stratum denths mea	asured along borehole axis.					
Groundwater levels Explanation of symb	may be subject to seasonal, tidal and ools and abbreviations given in 'Key to n on appended 'Borehole Information :	Exploratory Holes'	ould not be taken as constant			

-barn ritchies	В	BOF	RE	HOI	LE L	00	G					I	ML03	ehole N 8-RC et 3 of	004
Project Name:	Amersham Tunnel to Calvert				Survey G Co-ordina		em:)SGB 59.95 n	~ F	Hole Ty			RO+R
Project No:	1G063 -AAZ.								19540)5.46 r	nN	Checke Approv	-		JMe, C PMc
Client: Engineer:	High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd				Ground L	evel:			1:	20.86 n	nOD	Scale: Log St	atus:		1:25 FINA
Date Started: Date Completed:	04/10/2016 10/10/2016				Orientation Inclination					d 90 d	-	Print Da Final D			21/11/20 ⁷ 75.00
	Stratum Description	Legen	Depth d (Thick ness)	- Level (m)		Sampl	1	-	andh Si	tu Testi	ng	esult Un	TCR	lf min If ave	V water E
Drillere descriptions ((m)	(m)	Depth (m)	Туре	(mm)	Rec %	Blows (mins)	Test		esult Un	ts Real) (rnma)k '	water I >
hole)	Brown GRAVEL of flint. (Rotary open	*	** ** ** ** ** ** ** ** ** ** ** ** **												
Drillers description: \$ hole)	SAND and GRAVEL. (Rotary open		r- f- f- r- r- r- r-	109.86											
			r- f- f- f- f- Lf1.00) r- r- r-												
Drilloro docoriotion: (Creamish white CHALK with flints.		r- f- f- f- r- 2.00	108.86											
(Rotary open hole)		-	r												
		-	r												
		_	r- r- r- r- f- f-												
			f f f f												
			f - t - t - t - t - t - t - t - t												
	asured along borehole axis. may be subject to seasonal, tidal and d	ather (f-												

-barn ritchies	BOF	REI	HOI	LEL	.00	3				ľ		8-RC et 4 of		
Project Name:	Amersham Tunnel to Calvert				Survey G	rid Syste	em:	С	SGB		Hole Ty	pe:		RO+R
					Co-ordina	ites:			59.95 n		Checke			JMe, C
Project No: Client:	1G063 -AAZ. High Speed 2 (HS2) Ltd				Ground L	evel:)5.46 n 20.86 n		Approve Scale:	ed By:		PMc 1:2
Engineer:	High Speed 2 (HS2) Ltd								20.00 11		Log Sta	atus:		FINA
Date Started:	04/10/2016				Orientatio	in:			d	leg.	Print Da	ite:		21/11/20
Date Completed:	10/10/2016				Inclination				90 d	•	Final De			75.00
	Stratum Description	Legen	Depth (Thick ness) (m)	- Level (m)	Depth (m)	Sampl Type	1	and h Si Blows (mins)	tu Testi Test	ng Test R	esult Uni	TCR SCF ts RØE	lfmin Ifave (mma)	V water E sl
Drillers description: ((Rotary open hole)	Creamish white CHALK with flints.		f- f-											
			r r											
			r- r-											
			r- f- e											
			1- f- r-											
			r r											
			r- r-											
			r- f- f											
			r											
			r- r-											
			f- f-											
		_	r- f- r-											
			r- r-											
		_	r r											
			f- f- f-											
		-	r- r											
			r- r-											
			f- f-											
			f- r-											
		_	r- r-											
			r- r-											
		_	f- f- f-											
			r- r-											
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			f- f- f-											
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		_	r- r-											
			r- f-											
		-	f- r-											
			r- r-											
			r- r- f-											

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

-barn		BOF	RE	HOI	E L	.00	3					N	/L03	hole N 8-RC et 5 of	004
Project Name: Project No: Client: Engineer: Date Started: Date Completed:	Amersham Tunnel to Calvert 1G063 -AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd 04/10/2016 10/10/2016				Survey Gi Co-ordina Ground Li Orientation	tes: evel: n:	em:		49655 19540	9SGB 59.95 n 95.46 n 20.86 n d 90 d	nN nOD leg.	Hole Ty Checked Approve Scale: Log Sta Print Da Final De	d By: d By: atus: atus:		RO+RC JMe, CE PMcC 1:25 FINAI 21/11/2017 75.00m
	Stratum Description	Legen	Depth (Thick ness) (m)	- Level (m)	Depth (m)	Sampli		-	andh Si Blows	tu Test	-	esult Unit	SCR	lfmin Ifave I(mma)x	Ve water ck
Drillers description: (Rotary open hole)	Creamish white CHALK with flints.														
			f- f- f- f- f-			-	-	-			-				
	asured along borehole axis. may be subject to seasonal, tidal a	and other flu	ctuation	is and sh	ould not be	taken a	is con	istant.							

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

Further details given on appended 'Borehole Infonmation Sheer.

Office: BAM Ritchies, Glasgow Road, Kilsyth, Glasgow G65 9BL

BAM R Borehole Log 06/0412017

-barn ritchies		BOF	REI	HOI	E L	.00	3				Ν	/L03	hole N 8-RC et 6 of	004
Project Name:	Amersham Tunnel to Calvert				Survey G Co-ordina		em:	49655)SGB 59.95 n)5.46 r		Hole Ty Checker Approve	d By:		RO+R JMe, C PMc
Project No: Client: Engineer:	High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd				Ground L	evel:			20.86 n		Scale: Log Sta	-		1:25 FINA
Date Started: Date Completed:	04/10/2016 10/10/2016				Orientation Inclination				d 90 d	leg.	Print Da Final De	te: pth:		21/11/201 75.00r
	Stratum Description	Legen	Depth (Thick ness) (m)	- Level (m)	Depth (m)	Sampl Type	1	and h Si Blows (mins)	tu Testi Test	ng Test R	esult Uni	TCR SCR SRQC	lfmin Ifave (mnna)x	Ve water E ck

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

-barn ritchies	BOREHO	LE LOG		ML038-	ole No: -RC004 7 of 15
Project Name: Amersham Tunnel to Calve Project No: 1G063 -AAZ.	rt	Survey Grid System: Co-ordinates:	OSGB 496559.95 mE 195405.46 mN	Hole Type: Checked By: Approved By:	RO+R(JMe, Cl PMc(
Client: High Speed 2 (HS2) Ltd Engineer: High Speed 2 (HS2) Ltd Date Started: 04/10/2016		Ground Level: Orientation:	120.86 mOD deg.	Scale: Log Status: Print Date:	1:25 FINA 21/11/2017
Date Completed: 10/10/2016	Depth	Inclination:	90 deg. og and h Situ Testing	Final Depth:	75.00n
Stratum Description Drillers description: Creamish white CHALK with	Legend (Thick- Level (m) (m)	Depth (m) Type (mm) %	C Blows Test R (mins) Test	SCR ۱ Result Units R&D ا(fave Ve mma)xwater ck
(Rotary open hole)					

•barn	E	BOF	RE	HO	LE L	00	3					Μ		8-RC	004	
Project Name: Project No:	Amersham Tunnel to Calvert				Survey Gr Co-ordinat	,	em:		4965)SGB 59.95 r 05.46 r	mE Ch	ole Typ necked oprovec	e: By:		R(JM	O+ le, PM
Client: Engineer:	High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd				Ground Le	evel:			1:	20.86 r		cale: og Stat	tus:			1:2 FIN
Date Started: Date Completed:	04/10/2016 10/10/2016				Orientatior Inclination					d 90 d	•	rint Dat nal Dej		:	21/11/ 75	/2(5.0
	Stratum Description	Legend	(Thick- ness) (m)	Level (m)	Depth (m)	Sampl Type	ling, C Dia (mm)	Rec	and h S Blows (mins)		ing Test Resu	It Units	TCB SCR RQD %	If min If ave If max (mm)	Weter	V E
Assumed zone of co dissolution features.	re loss. Televiewer shows possible		- - - - - - - - - - - - - - - - - - -											NR		
Very weak, medium	density, light greyish white CHALK		- - - ⁻ 35.60	65.26	35.45-35.60	с							60	-		
four horizontal to 20 (40/400/1500mm), u frequent black speck 2:three 50 to 60 deg (500/1000/2000), un black specks and inf Fracture set 3: two 8 undulating slightly rc (Grade: B2/3) Lewes Nodular Cha	ining (sponge beds). Fracture set 1: degree fractures, medium spaced indulating slightly rough, with so and orange staining. Fracture set ree fractures, widely spaced dulating slightly rough, with frequent illed (0/0/2mm) with soft brown clay. 5 degree to vertical fractures, pugh, with frequent black specks. Ik Formation] : Rinded nodular flint fragments (upto				35.00 - 36.50	RC	102					_	31 31			
35.86 - 36.00m	40mm), Possible flintband. a: Rinded nodular flint fragments (up to 100mm). Possible flintband. Nodular flintfragments (up to BOmm).				36.50 - 37.50) RC	102	2					BO 44 44			
37.50	- 37.70m:Assumed zone of core Joss.		- - [-{3.40) [- [-		37.20-37.30	D						_		0 120 300		
	: Rinded nodular flint fragments (up to 100mm). Possible flintband.															
					37.50 - 39.00 36.26 - 36.36	RC C	102	2					67 33 27			
Assumed zone of co flint bands.	ore loss. Televiewer shows possible		- - - -	61.66												
			- po.65) - - - 		39.00 - 40.00	RC	102						35 14 14	NR -		
Fracture set 1: 20 de (80/80/400mm), plan	density, light greyish white CHALK. egrees, closely spaced aar and undulating slightly rough, specks and rare orange staining.	_	39.65 _{f-}	61.21										_		

Further details given on appended 'Borehole Information Sheer.

Office: BAM Ritchies, Glasgow Road, Kilsyth, Glasgow G65 9BL

•barn ritchies	B	SOF	RE	HO	LE L	00	3					Μ	IL03	hole N 8-RC et 9 of	004	
Project Name: Project No:	Amersham Tunnel to Calvert				Survey Gr Co-ordinat		em:		49655	9SGB 59.95 n 05.46 n	nE Cł	ole Typ necked provec	By:		JM	D+F e, C PMc
Client:	High Speed 2 (HS2) Ltd				Ground Le	evel:				20.86 n		ale:	,.			1:2
Engineer:	High Speed 2 (HS2) Ltd											g Stat	tus:			-IN/
Date Started:	04/10/2016				Orientatior	n:				d		int Dat			21/11/	
Date Completed:	10/10/2016				Inclination					90 d	0	nal Dep				5.00
Date completed.	10,10,2010		Depth				ling (oring	and h Si				TCR	Ifmin		
:	Stratum Description	Legen	d (Thick ness) (m)		Depth (m)	Туре	Dia (mm)	-		Test	Test Resu	ılt Units	SCR	lfave	Weter	N L
rough, with frequent [Lewes Nodular Cha					40.00 - 40.50	RC	102						100 56	NIDO 20		
	Rinded nodular flint fragments (upto: 100mm). Possible flint band.)		40.30 - 40.40	D	102						40	80		
40.00-40.10m	Rinded nodular flintfragments (upto 90mm). Possible flint band.				40.00 40.40											
	Drillino disturl:Jed recovered non-intact.	gf40).50 f-	80.36											1	
probably rubbed cha	re loss. Flint gravel at 40.85m Ik away.		po.35)											NR		
Very weak, medium	density, greyish white CHALK.	-+-4	0.85 ⊳	80.01												
Fracture set 1: horizo	ontal to 20 degrees medium spaced															
	undulating slighUy rough, with s. Fracture set 2: one 50 degree															
fracture, undulating s	lighUy rough, with frequent black				40.50 40.00		100						77			
	3: one vertical fracture, undulating equent black specks. Locally with		f-		40.50 - 42.00	RC	102						28 21			
thin grey laminations	(marl wisps), rare Zoophycos		f- f-													
burrows, and rare or (Grade: A3)	ange staining (sponge beds).															
[Lewes Nodular Cha																
	rilling disturl:Jed, recovered non-intact. rilling disturl:Jed, recovered non-intact.															
- 11.00 - 4 1.00 III.D	ากการ ฉางเนก.ขอน, าออบขอาอิน กอการกาได้อีโ.		f- f-											NI		
41.90-42.00m	: Rinded nodular flint fragments (up to		f-											120		
	BOmm). Possible flint band.													220		
			f- f-													
12 10 - 12 EEm · F	nilling disturt: led recovered per intert		f-										100			
42.40 - 42.65m : L	orilling disturl:Jed, recovered non-intact.				42.00 - 43.00	RC	102						100			
													54			
			f-													
			f- f-													
			p4.65)		42.80 - 43.00	с										
													<u> </u>		.	
			f- f-													
			[
													100			
					43.00 - 44.00	RC	102						67 67			
			f- f-										0/			
			f-													
			f-													
			r- f-													
					44.22 - 44.46	c										
													93 93			
			f-										93			
			[
					44.00 - 45.50	RC	102									
				1												

Groundwater levels may be subject to seasonal, tidal and other fluctuations and should not be taken as constant.

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

•barn	B	SOR	REI		LE L	00	3					N		hole N 8-RC	
ritchies						_			_					t 10 o	
roject Name:	Amersham Tunnel to Calvert				Survey Gri Co-ordinat	,	em:			9868 9.95 m		le Typ ecked			RO+ JMe,
roject No:	1G063-AAZ.								19540)5.46 m	nN Ap	prove	d By:		PI
lient:	High Speed 2 (HS2) Ltd				Ground Le	evel:			12	20.86 m	OD Sca	ale:			1:
gineer:	High Speed 2 (HS2) Ltd										Lo	g Sta	tus:		FI
te Started:	04/10/2016				Orientation	n:				d	eg. Pri	nt Dat	e:		21/11/2
ate Completed:	10/10/2016				Inclination:					90 d	ea. Fir	nal De	oth:		75.0
	10, 10, 2010				1		-				0				1
:	Stratum Description	Legend	Depth (Thick- ness) (m)	Level (m)	Depth (m)	Type	1	Ŭ	Blows (mins)		ng Test Resu	lt Units	TCR SCR RØD		Weter B
Fracture set 1: horizo 110/500/1100mm), u requent black speck racture, undulating s pecks. Fracture set specks. Fracture set lightly rough, with fri- hin grey laminations purrows, and rare or: Grade: A3) [Lewes Nodular Cha Medium strong, very (Lewes Nodular Cha Very weak, medium Fracture set 1: horizo 110/500/1100mm), requent black speck racture set 1: horizo 10/500/1100mm), requent black speck racture set 4: horizo 10/500/1100mm), requent black speck racture, undulating s purrows, and rare or: Grade: A3) Lewes Nodular Chal 46.75 - 46.BOR Medium strong, very ewes Nodular Chal	high density CHALK. Chalk Rock. Ik FonmationI density, greyish white CHALK. ontal to 20 degrees medium spaced undulating slightly rough, with s. Fracture set 2: one 50 degree slightly rough, with frequent black 3: one vertical fracture, undulating equent black specks. Locally with (marl wisps), rare Zoophycos ange staining (sponge beds). Ik Fonmation] : Rinded nodular nint fragments {up10 g0mm). Possible nint band. I high density CHALK. Chalk Rock.		-45.50 	75.36 75.16 74.06 73.86	45.50 - 47.00 46.26 - 46.48	RC C	102					-	93 67 67	110 500 1100	0 8 0 8 0 8 0 8 0 8 0 8 0 8 0 8 0 8 0 8
racture set 1: horizo 10/500/1100mm), equent black speck acture, undulating s becks. Fracture set ghtly rough, with fri in grey laminations irrows, and rare or brade: A3) ewes Nodular Chal rilling disturbed. Me	ontal to 20 degrees medium spaced undulating slightly rough, with s. Fracture set 2: one 50 degree slightly rough, with frequent black 3: one vertical fracture, undulating equent black specks. Locally with (marl wisps), rare Zoophycos ange staining (sponge beds).		- - - - f1.00) - - - - - - - - - - - - - - - - - -	72.86	47.00 - 48.50	RC	102						100 70 70		50505050505050505050505050505050505050
	glauconitic pebbles (up to 20mm)	f.	-												C
	to 30mm). No natural fractures	5	50.50)		43.00 - 53.50						2.SE006	m/s		NOP	
	k. (Grade undetenmined)				48.26 - 48.36	D				Head					
ewes Nodular Chal	k Fonmation]														0
	re loss. Acoustic televiewer log nd between 48.5 to 48.9m. Flint lk away.	r. F. F.	-•0.50 - - -	72.36											
	u			70.86	48.50 - 50.00	RC	102						0 0 0	NR	

Office: BAM Ritchies, Glasgow Road, Kilsyth, Glasgow G65 9BL

•barn	E	BOR	REI	HO	LE L	00	3						Μ	L038	hole N 8-RC	004	
ritchies Project Name:	Amersham Tunnel to Calvert				Survey Gr Co-ordinat	id Syst				SGB 59.95 r	nF		e Type cked	e:	t 11 of	15 RO JMe	
Project No:	1G063-AAZ.				CO-orumat	63.)5.46 r			roved	•			, Ci Mc
•	High Speed 2 (HS2) Ltd				Ground Le	امري				20.86 n		Scal		Бу.			:25
	High Speed 2 (HS2) Ltd				GIUUIIU LE				14	20.00 11			Stat	116.			NA
0	04/10/2016				Orientation					d	مما	-	t Date			21/11/2	
	10/10/2016				Inclination:					90 d	•		al Dep			75.	
	10,10,2010	1 1	Depth				ing C	oring	andh Si		-			TCR	lf min		
Si	tratum Description	Legend	(Thick- ness) (m)	Level (m)	Depth (m)	Туре	1	-	Blows (mins)	Test	Test	Result	Units	SCR RØD	lfa∨e (mma)x	Weter B	We ack
Fracture set 1: horizor (770/1600/4500mm), t trenuent blackysne ka	ensity, light greyish white CHALK. tal to 20 degrees widely spaced undulating slightly rough, with ୋମିଂସନ୍ଥାନ୍ଥରେ,ବ୍ୟାନଧାମଣା ନିକ୍ର କ୍ୟୁମ୍ୟନ୍ତ to	L L	(0.30) 50.30 50.34	70.56	50.18 - 50.50	с										0000	00,00,00
frequent with depth thi	lack specks. With rare becoming in grey laminations (marl wisps) e staining (sponge beds). (Grade:		-													0,00,0	00,00
New Pit Chalk Forma	tion sible on televiewer. Possibly Upper				50.00 - 51.50	RC	102							93 85 85		d	00,00
New Pit Chalk Forma Very weak, medium d	tion ensity, light greyish white CHALK. ntal to 20 degrees widely spaced		- - - -													0000	202,00
(770/1600/4500mm), u frequent black specks. vertical, closely to wide	undulating slightly rough, with Fracture set 3: ten 70 degrees to ely spaced, undulating slightly															d	20,20
frequent with depth thi and locally with orange	lack specks. With rare becoming in grey laminations (marl wisps) e staining (sponge beds). (Grade:		- - -													0000	00,00
A1) [New Pit Chalk Forma	tion]															0 0 0	202,002
																000	3,66,6
			-											97		000	2,20,0
					51.50 -53.00	RC	102							92 92		000	8,56,6
																0000	0,00,0
																000	0,00,0
																000	
																d d	2000 C
53.40-53.42m:	Thickly laminated greenish grey marl seam.		-													d	200 200
					53.60 - 53.84 53.00 - 54.50		102							100 93 93			
			- - -														
5425-54 10m·U	eavy orange staining (sponge beds).		-														
04.20°04.40m.∏	aary orango daning (sporige boos).																
Very thinly bedded are	eenish grey marl seam. Possibly		54.75 54.80	66.11 66.06													
Lower Glynde Marl? New Pit Chalk Forma			- -	00.06													
	ured along borehole axis.																
Explanation of symbo	hay be subject to seasonal, tidal and ils and abbreviations given in 'Key to on appended 'Borehole Infonmation \$	Explorate			nould not be t	aken a	as con	stant.									
	, Glasgow Road, Kilsyth, Glasgow G659B												BAM				

•barn	E	BORE	HO	LE L	00	G				M	L03	hole N 8-RC t 12 of	004	
Project Name: Project No: Client:	Amersham Tunnel to Calvert 1G063-AAZ. High Speed 2 (HS2) Ltd			Survey Gr Co-ordinat Ground Le	es:	em:	4965 1954	OSGB 559.95 m 105.46 m 120.86 m	E N	Hole Typ Checked Approvec Scale:	By:			
Engineer: Date Started:	High Speed 2 (HS2) Ltd 04/10/2016			Orientatior				de		Log Stat Print Dat				IN/
Date Completed:	10/10/2016			Inclination				90 de	•	Final Dep				.00
	Stratum Description	Legend (Thick ness) (m)	- Level (m)	Depth (m)	Samp Type		Coring and h S Rec Blows % (mins)	Situ Testii 5 Test 1	ng Test R	esult Unit	TCR SCR sRପ୍ରଧ	lfmin Ifave Df(mma)x	Weter B	W ac
Fracture set 1: horizo (770/1600/4500mm), frequent black specks vertical, closely to win rough, with frequent b	density, light greyish white CHALK. Intal to 20 degrees widely spaced undulating slightly rough, with s. Fracture set 3: ten 70 degrees to dely spaced, undulating slightly black specks. With rare becoming is grup (begingting)			54.50 - 56.00	RC	102					100			
	nin grey laminations (marl wisps) ge staining (sponge beds). (Grade: ation]			55.40 - 55.72	с						78 78			
				56.00 -57.50	RC	102					100 87 87			
58.28-58.33m :	Nodular flint fragments (up to 50mm).			57.50 - 59.00 58.10 - 58.42	RC C	102					100 73 73	60 1000 2500		
Pit Marl 2? <u>New Pit Chalk Form</u> Very weak, medium of Fracture set 1: horizo (770/1600/4500mm), frequent black specks	sh grey marl seam. Possibly New ation Jensity, light greyish white CHALK. Intal to 20 degrees widely spaced undulating slightly rough, with s. Fracture set 3: ten 70 degrees to dely spaced, undulating slightly	59.36 59.42		59.00 - 60.50	RC	102					100 76 76			
frequent black specks vertical, closely to wid Stratum depths mea Groundwater levels Explanation of symb Further details given	s. Fracture set 3: ten 70 degrees to	Exploratory H Sheer.					Istant.					ehole Lc		

I	BOREF	10	LE L	00	G						1L03		004	
Amersham Tunnel to Calvert			-	-	em:					Hole Typ	be:	et 13 01	R	0+1
1G063-AAZ.			Co-ordinate	es:							-			ie, PN
High Speed 2 (HS2) Ltd			Ground Le	evel:).			1:
High Speed 2 (HS2) Ltd										Log Sta	tus:		F	FIN
04/10/2016									-					
10/10/2016			Inclination:						0	Final De			75	5.0 T
Stratum Description	Legend (Thick- ness)	Level (m)	Depth (m)		1	-		u Testi Test	-	esult Units	SCR	Ifave	Weter	в
t black specks. With rare becoming thin grey laminations (marl wisps) nge staining (sponge beds). (Grade: nation]					(MH)		(THYNS)	Iest			100 73 73			
			62.00 - 63.50	RC	102						100 85 85			
			63.08 - 63.36	5 C										
			63.50 - 65.00	RC	102						100 81 81			
t	Amersham Tunnel to Calvert 1G063-AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd 04/10/2016 10/10/2016 Stratum Description t black specks. With rare becoming thin grey laminations (marl wisps) nge staining (sponge beds). (Grade:	Amersham Tunnel to Calvert IG063-AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd 04/10/2016 10/10/2016 Stratum Description Legend (Thick-ness) (m) t black specks. With rare becoming thin grey laminations (marl wisps) nge staining (sponge beds). (Grade: nation]	Amersham Tunnel to Calvert IG063-AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd O4/10/2016 10/10/2016 Stratum Description Legend Depth Ress, With rare becoming thin grey laminations (marl wisps) nge staining (sponge beds). (Grade: nation] (m) (m) (m) (m) (m) (m) (m) (m	Amersham Tunnel to Calvert IG063-AAZ. High Speed 2 (HS2) Ltd Orientation Orientation Stratum Description Eagend TThick Image 1 Imag	Amersham Tunnel to Calvert Survey Grid Syst Co-ordinates: High Speed 2 (HS2) Ltd 04/10/2016 Orientation: 10/10/2016 Inclination: Stratum Description Level (m) Orientation: tblack specks. With rare becoming thin grey laminations (mari wisps) nge staining (sponge beds). (Grade: Inclination] Orientation: black specks. With rare becoming thin grey laminations (mari wisps) nge staining (sponge beds). (Grade: Inclination] Orientation: Co-ordinates: Stratum Description Correct Cor	Co-ordinates: 1G083-AAZ. High Speed 2 (HS2) Ltd 04/10/2016 10/10/2016 Stratum Description Legen Depth Indination: Stratum Description Legen Depth (m) (m) Type (Rift) 10 ack specks. With rare becoming (m) (m) Type (Rift) 60.50 - 62.00 RC 102 (C) (C) (C) (C) (C) (C) (C) (C)	Amersham Tunnel to Calvert IG063-AAZ. High Speed 2 (H52) Ltd High Speed 2 (Amersham Tunnel to Calvert Survey Grid System: O 16063-AAZ. 19540 High Speed 2 (HS2) Ltd Ground Level: 12 04/10/2016 Orientation: 12 10102016 Inclination: 12 Stratum Description Legend (Thick) Level Sampling: Coring andh Sit 1012016 Inclination: 10 10 10 10142016 Inclination: 10 10 10 10 10142016 Inclination: 10 10 10 10 10 10 10142016 Inclination: 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10	Ameraham Tunnel to Calvert Euco-ordinates: C	Amersham Tunnel to Calvert Survey Grid System: 05GB 10063-AAZ. 195405.40 mN High Speed 2 (HS2) Ltd Ground Level: 120.86 mN 10102016 Orientation: deg. 10102016 Inclination: 0.46 mN Statum Description Level Inclination: 0.46 mN Italian Description Level Deprintion: Text Reserves Italian Description Level Level Deprintion: Text Reserves Italian Description Level Level Deprintion: Text Reserves Italian Description Level Level Level Level Level Italian Description <td>Amersham Turnel to Calvert Co-ordinates: Co-</td> <td>BOREHOLE LOG Mutor Americham Tunnel to Calvert Survey Grid System: OSGB Hole Type: 1G633-AAZ 195405.46 mN Approved By: Tradeshold mN Approved By: High Speed 2 (HS2) Lid Ground Level: 120.86 mO Scale: Log Bittat: Od/102016 Coreintation: 90.462, Final Depth: Stratum Description Level (min) Depth Scale: Log Bittat: Chick specks. With rare becoming this graph and this specific in and twispel graph annators (martwispel g</td> <td>Americham Tunnel to Calver: Survey Grid System: OSGB ML0308-RC 100636-Ad2 199306.46 mN Checked 9g: 199306.46 mN Checked 9g: High Speed 2 (HS2) Lid Ground Level: 120.86 mOD Scale: Log V0102016 Orientation: 90.66 g. Print/Date: Log Print/Date: Statum Description Level Orientation: 90.66 g. Print/Date: ScR ////////////////////////////////////</td> <td>BOREHOLE LOG Multiple Second System: OSGB Multiple Second Second Event Multiple Second Second Second Event Multipl</td>	Amersham Turnel to Calvert Co-ordinates: Co-	BOREHOLE LOG Mutor Americham Tunnel to Calvert Survey Grid System: OSGB Hole Type: 1G633-AAZ 195405.46 mN Approved By: Tradeshold mN Approved By: High Speed 2 (HS2) Lid Ground Level: 120.86 mO Scale: Log Bittat: Od/102016 Coreintation: 90.462, Final Depth: Stratum Description Level (min) Depth Scale: Log Bittat: Chick specks. With rare becoming this graph and this specific in and twispel graph annators (martwispel g	Americham Tunnel to Calver: Survey Grid System: OSGB ML0308-RC 100636-Ad2 199306.46 mN Checked 9g: 199306.46 mN Checked 9g: High Speed 2 (HS2) Lid Ground Level: 120.86 mOD Scale: Log V0102016 Orientation: 90.66 g. Print/Date: Log Print/Date: Statum Description Level Orientation: 90.66 g. Print/Date: ScR ////////////////////////////////////	BOREHOLE LOG Multiple Second System: OSGB Multiple Second Second Event Multiple Second Second Second Event Multipl

ritchies						3					Shee	t 14 of	15	
Project Name:	Amersham Tunnel to Calvert			Survey Gr Co-ordinat		em:		OSGB 559.95 i	тE	Hole Ty Checke			RC JMe	O+R le, C
Project No:	1G063-AAZ.							405.46 ı		Approve	-			PM
lient: ngineer:	High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd			Ground Le	vel:			120.86 ו	nOD	Scale: Log Sta	atue.			1:2 FIN
ate Started:	04/10/2016			Orientation	:			(deg.	Print Da		:	' 21/11/	
Date Completed:	10/10/2016			Inclination:				90 0	deg.	Final De	epth:		75	5.00
	Stratum Description	Legend Depth (Thick- ness)	Level (m)	Depth (m)			oring and h Rec Blow		-	esult Uni	TCR SCR ts RQD	lfave	Weter I	V Bac
Fracture set 1: horiz (770/1600/4500mm), frequent black speck vertical, closely to w rough, with frequent frequent with depth	density, light greyish white CHALK. ontal to 20 degrees widely spaced , undulating slightly rough, with s. Fracture set 3: ten 70 degrees to idely spaced, undulating slightly black specks. With rare becoming thin grey laminations (marl wisps) nge staining (sponge beds). (Grade: nation]			65.00 - 66.50 65.60 - 65.96	RC	102					100 96 96	60 1000 2500		
requent thin grey la 1: horizontal closelv		66.50	54.36	66.77 - 66.92 66.50 - 68.00	C	102					100	50 200 550		
CHALK. Fracture se spaced (90/1200/15 vith frequent black s grey laminations (m sponge beds). (Gra New Pit Chalk Form			53.26								80			
				68.00 - 69.50 68.95 - 69.30		102					100 95 95			
Stratum depths me	asured along borehole axis.													

•barn ritchies	BOF	REI	HO	LE L	00	3						ML	_038	nole N 3-RC 15 of	004	
Project Name: Amersham Tunnel to Calvert Project No: 1G063-AAZ.				Survey Gri Co-ordinat	es:	em:		49655 19540)SGB 59.95 r)5.46 r	nN	Cheo Appr	Type cked oved	By:		JM I	O+RC e, CB PMcG
Client: High Speed 2 (HS2) Ltd Engineer: High Speed 2 (HS2) Ltd				Ground Le	vel:			1:	20.86 n	nOD	Scale Log	e: Statu	JS:			1:25 FINAL
Date Started: 04/10/2016 Date Completed: 10/10/2016				Orientatior Inclination:					d 90 d	•		t Date I Dep		:		/2017 5.00m
	Legend	Depth (Thick-	Level			1	-	andh Si	tu Testi	na			TCR	lf min If ave		Well/
Stratum Description	Legend	(m)	(m)	Depth (m)	Туре	(^{Dia})	Rec %	Blows (mins)	Test	Test R	esult	Units	RQD	(mnna)x	Weter	Backfill
Very weak to weak, high density, light greyish white CHALK. Fracture set 1: horizontal closely to widely spaced (90/1200/1550mm), undulating slightly rough, with frequent black specks. Locally with frequent thin grey laminations (marl wisps) and orange staining (sponge beds). (Grade: A1) [New Pit Chalk Formation]			_	69.50 - 71.00	RC	102							100 100 100			
				71.00 -72.50	RC	102							100 93	90 1200 1550		
		- - - - - - - - - - - - - - - - - - -	48.36	71.85-72.15	с							_	80			
Weak, medium density, greyish white CHALK with frequent thin grey laminations (marl wisps) and Zoophycos burrows. Fracture set 2: two 20 to 40 degree fractures, undulating and planar smooth, with greenish grey staining. Fracture set 3: three 70 to 80 degree fractures, undulating slightly rough, with frequent black specks, no infill. (Grade: A2) [New Pit Chalk Formation]		-		72.50 - 74.00	RC	102							100 67 67			
74.10-74.50m: Weak, high density, greenish grey locally darl< grey marly CHALK		- - - - - - - - - - - - - - - - - - -		74.30 - 74.62 74.00 - 75.00	C RC	102							100 60 60	100 300 600		
		_														
Borehole Terminated at 75.00m		75.00	45.86									F				
Stratum depths measured along borehole axis. Groundwater levels may be subject to seasonal, tidal an Explanation of symbols and abbreviations given in 'Key Further details given on appended 'Borehole Information' Office: BAM Ritchies, Glasgow Road, Kilsyth, Glasgow G65 S	to Explorat n Sheer.			nould not be t	aken a	as con	istant.					вами	RBor	ehole Lo	00.061	<u>141201[.]</u>

-barn ritchies		BOREHOLE LOG							Borehole No: ML043-RC004 Sheet 1 of 14						
Project Name: Amersham Tunnel to Calvert Project No: 1G063-AAZ.					Survey Grid System: Co-ordinates:				OSGB 493221.20 mE 198983.21 mN			Hole Type: Checked By: Approved By:		RC	
ient: ngineer: ate Started:	High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd 16/11/2016				Ground Le					31.41 m d	OD	Scale: Log Star	us:		1 Fl 21/11/2
ate Completed:	22/11/2016				Inclination	:				90 d	eg.	Final De	oth:		65.
	Stratum Description	Legend (Depth Thick- ness) (m)	Level (m)	Depth (m)	Sampl Type	1	Rec	and h Si Blows (mins)		-	Result Unit	TCR SCR s Rପ୍ଟା	lfmin lfave Ot(mnna)k	water E
Topsoil]	pish brown slightly sandy gravelly bangular to rounded fine to coarse of coarse. In slightly sandy gravelly CLAY. Grave unded fine to coarse of flint. Sand is	1 <i>i</i>	0.10	131.31	0.20-0.40	В									
		:tI:	1.10>		0.60-0.80	В									
	on: Creamishwhit-CHALKwith flets-+-	-==""='- ^1-	1.20	130.21	1.00 -1.20	В									
otary open hole)		- 1-	-												
			-												
		- - - -	-												
			-												
		- 1-	- 												
		- I- I- I- I-													
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Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

-barn ritchies		BOREHO	LE LOG			ML04	hole No: 3-RC004 t 2 of 14
Project Name: Amersham Tunnel to Calvert Project No: 1G063 -AAZ. Client: High Speed 2 (HS2) Ltd Engineer: High Speed 2 (HS2) Ltd			Survey Grid System: Co-ordinates: Ground Level:	49322 1989	DSGB 21.20 mE 83.21 mN 31.41 mOD	Hole Type: Checked By: Approved By: Scale: Log Status:	RO+RG DI PMcC 1:25 FINA
Date Started: Date Completed:	16/11/2016 22/11/2016		Orientation: Inclination:		deg. 90 deg.	Print Date: Final Depth:	21/11/2013 65.60n
	Stratum Description	Legend (Thick- ness) (m) (m)	1 1 1	oring and h Si Rec Blows % (mins)	itu Testing Test Test	Result Units	
(Rotary open hole)	: Creamish white CHALK with flints.						

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

-barn ritchies	BO	BOREHOLE LOG									Borehole No: ML043-RC004 Sheet 3 of 14				
Project Name: Amersham Tunnel to Calvert Project No: 1G063 -AAZ. Client: High Speed 2 (HS2) Ltd Engineer: High Speed 2 (HS2) Ltd Date Started: 16/11/2016				Survey G Co-ordina Ground L Orientatio	ates: .evel: on:	em:		49322 19898	DSGB 21.20 n 33.21 n 31.41 m d	mN nOD deg.	Hole Typ Checked Approve Scale: Log Sta Print Da	pe: d By: ed By: atus: atus:		RO+RC DE PMcG 1:25 FINAL 21/11/2017	
Date Completed: 22/11/2016 Stratum Description	Lege	Depth (Thick ness)	- Level (m)	Inclination Depth				andh Sit		ing	Final De	TCR	If min If ave	65.60m Ve water ck	
Drillers description: Creamish white CHALK with flin (Rotary open hole)		(m) (m) (m) (m) (m) (m) (m) (m)		(m)	Type			(HRXS)	Test						
Stratum depths measured along borehole axis.		f- f- t- t- t- t- t- t- f-													

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

Further details given on appended 'Borehole Infonmation Sheer.

Office: BAM Ritchies, Glasgow Road, Kilsyth, Glasgow G65 9BL

BAM R Borehole Log 06/0412017

-barn ritchies		BOF	RE	HO	LEL	.00	G				Ν	/L04	ehole N 3-RC et 4 of	004
Project Name:	Amersham Tunnel to Calvert				Survey G Co-ordina		em:	49322)SGB 21.20 n		Hole Ty Checke	d By:		RO+R D
Project No: Client: Engineer:	1G063 -AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd				Ground L	evel:			33.21 r 31.41 n		Approve Scale: Log Sta			PMc0 1:25 FINA
Date Started: Date Completed:	16/11/2016 22/11/2016				Orientation Inclination				d 90 d	-	Print Da Final De	ite:		21/11/201 65.60r
	Stratum Description	Legen	Depth (Thick ness) (m)	- Level (m)	Depth (m)	Sampl	1	andh Si Blows (mins)	tu Testi Test	ing Test F	Result Uni		lfmin Ifave (mna)	Ve water I sk
Drillers description: (Rotary open hole)	Creamish white CHALK with flints.		f- f- r-											
			f- f- f- f- f-											
		-	f= r= r= r=											
			r- f- f- f r-											
			r- r- r- f- f-											
		_	F- F- F- F-											
		_	f= f= f= r=-											
		-	t= t= f= f= f=											
		-	r r r r											
			F= F= F= F= F=											
			f- f- f- f- f-											
			r- r- r- r-											
		-	f- f- t-											
			r- r- r- r-											
			f= f= f= t=											
			r- r- f- f- f-											
			f f f f											
Stratum depths mea	asured along borehole axis.		f-											

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

Project Name: Amersh		BOREHOLE LOG							Borehole No: ML043-RC004 Sheet 5 of 14				
-	peed 2 (HS2) Ltd			Survey Gri Co-ordinate Ground Le	es:	4932 1989	DSGB 21.20 mE 83.21 mN 31.41 mOD	Hole Type: Checked By: Approved By Scale:	: PMc0 1:25				
Engineer: High S Date Started: 16/11/2 Date Completed: 22111/2		Depth	I	Orientation Inclination:		coring and h S	deg. 90 deg. itu Testing	Log Status: Print Date: Final Depth:	FINA 21/11/201 65.60n R Ifmin R Ifave J (mma): water web				
Drillers description: Creamisl (Rotary open hole)	h white CHALK with flints.	ness) (m) 	(m)	Depth (m)	Type (mm	, Rec Blows (mins)	Test	Result Units R&					
Stratum depths measured al	long borehole axis.		06.41										

•barn	E	SOR	RE	HO	LE L	00	3					M	1L04	hole N 3-RC et 6 of	:004
Project Name:	Amersham Tunnel to Calvert				Survey Gri Co-ordinat		em:)SGB 21.20 n		Hole Typ Checked	be:	<u></u>	RO+
Project No:	1G063-AAZ.								19898	83.21 n	nN	Approved	d By:		PM
Client:	High Speed 2 (HS2) Ltd				Ground Le	vel:			1:	31.41 m	nOD	Scale:			1:2
Engineer:	High Speed 2 (HS2) Ltd										,	Log Stat	tus:		FIN
Date Started:	16/11/2016				Orientation	1:				d	leg.	Print Dat	te:		21/11/20
Date Completed:	22111/2016				Inclination:					90 d	•	Final Dep	pth:		65.6
•			Depth		1	Sampli	ina, C	oring	andh Si				TCR	lfmin	
	Stratum Description	Legend	(Thick	- Level (m)	Depth (m)	Туре	1		Blows (mins)			esult Units			Weter
with frequent black	a density, light greyish white CHALK specks and locally orange staining. contal to 30 degrees, closely spaced anar smooth to undulating slighUy	f: f: c.	-										83		
clay. Fracture set 3: smooth to undulating	cally infilled (<3mm) with soft brown 70 degrees to vertical, planar g slightly rough, clean. (Grade: B3)	r. r. f.	- - -		25.00 - 25.60	RC	102						0		
Recovered a angular fine to co Gravel is weak,	nation] Drilling disturbed, recovered non-intact. ss: light greyish white silty subangular to oarse GRAVEL with occasional cobbles. medium density, light greyish white with frequent black specks. 0-25.60m :Assumed zone of core loss.		- - - - - -												
25.60 - 26.74m : Recovered a angular fine to cc density, light g 26.27 - 26.85m : Recovered a angular fine to cc	Drilling disturbed, recovered non-intact. as: light greyish white silty subangular to parse GRAVEL. Gravel is weak, medium reyish white with frequent black specks. Drilling disturbed, recovered non-intact. as: light greyish white silty subangular to carse GRAVEL with occasional cobbles. medium density, light greyish white with frequent black specks.				26.22 - 26.27 25.60 - 27.10	D RC	102						83 8 0		
	5-27.10m : Assumed zone of core loss. Drilling disturbed, recovered non-intact.	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	- - - - - - - - - -												
Recovered a angular fine to co	Drilling disturbed, recovered non-intact. as: light greyish white silty subangular to oarse GRAVEL with occasional cobbles. medium density, light greyish white with frequent black specks.		- - - - - - -;:95) -											NIDO 80 250	
			-		27.10 - 28.60	RC	102						80 0 0		
28.30	0-28.60m : Assumed zone of core loss.	4 4 4 4	- - -			l									
Recovered a angular fine to co	Drilling disturbed, recovered non-intact. as: light greyish white silty subangular to oarse GRAVEL with occasional cobbles. medium density, light greyish white with frequent black specks.	6. 6. 6. 6. 6. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7.	- - - - - -										00		
29.10 - 29.40m : Nr	atural gamma log shows slight elevation	f-	-		28.60 - 29.60	RC	102			1			80		
	in readings with peak at 29.2m. n : Rinded nodular ffint fragments (up to 2mm).		-										0		
29.89 - 30.14m :	Drilling disturbed, recovered non-intact.	r. r. f.	- - -		29.73 - 29.89 29.60 -30.10	C RC	102						32 32		
				l			!	1		i i					

•barn	E	BORE	НО	LE L	.00	G				N	1L04	hole N 3-RC et 7 of	004	
Project Name:	Amersham Tunnel to Calvert			Survey G		em:		OSGB		ole Typ			R	O+RC
Project No:	1G063-AAZ.			Co-ordina	tes:			3221.20 3983.21		heckec pprove	•		F	DD PMcG
Client:	High Speed 2 (HS2) Ltd			Ground Le	evel:			131.41 ı		cale:	<i></i> ,			1:25
Engineer:	High Speed 2 (HS2) Ltd									og Sta				FINAL
Date Started: Date Completed:	16/11/2016 22111/2016			Orientation Inclination					U	rint Da inal De			21/11/ 65	/2017 5.60m
		Dep				ling, C	oring and h				TCR			
	Stratum Description	Legend (Thiones) (Thiones) (m	s) (m)	Depth (m)	Туре	(Ria)) Rec Bloy	(S) Test	Test Res	ult Unit	SCR SRØ4D		Weter	Well Backfi
Recovered as angular fine to co	Drilling disturlled, recovered non-intact. s: light greyish white silty subangular to arse GRAVEL with occasional cobbles. nedium density, light greyish white with frequent black specks.			30.10 -31.60	RC	102					57 33	NIDO BO 250		აი ფი ფი ფი ფი ფი ფი ფი
Assumed zone of co	re loss. Very weak chalk										20	NR		\$6°\$°°\$°°\$°°\$°°\$°
with frequent black s Fracture set 1: horizz (NI/100/150mm), pla rough, dean locally in Fracture set 2: 30 to (50/300/600mm), pla rough, dean. Fractur planar slightly rough, occasional orange st [New Pit Chalk Form 31.65 - 32.31m : 1 Recovered a: angular fine to co Gravel is weak, r 32.39 - 32.50m : 1 Recovered a: angular fine to co density, light gr			5 99.76	31.60 -33.10 32.45 - 32.54		102					87 30 0			कुए
32.90	- 33. 10m : Assumed zone or Core loss. 34.40 - 34.70m : Drilling disturlled.		;)	33.10 - 34.10 34.10 - 34.60		102					100 34 10 100 60 28	NIDO 100 150		o Seo Seo Seo Seo Seo Seo Seo Seo Seo Se
34.81 - 35.35m : L	Drilling disturtied, recovered non-intact.			34.71 -34.81										80.80.80
			Ι	30.00 - 40.00				Fallino Head	1.1E00	5 m/s				~9

Stratum depths measured along borehole axis.

Groundwater levels may be subject to seasonal, tidal and other fluctuations and should not be taken as constant.

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

•barn	E	BOR	EHO	LE L	00	3					N	1L04	hole I 3-RC et 8 of	004	ļ
Project Name:	Amersham Tunnel to Calvert			Survey Gr Co-ordinat		em:			SGB 1.20 n		ole Typ hecked	be:	5100		۱+O۶
Project No: :lient:	1G063-AAZ. High Speed 2 (HS2) Ltd			Ground Le				19898	33.21 n 31.41 m	nN A	oprove	-			PM 1:2
ngineer: ate Started:	High Speed 2 (HS2) Ltd 16/11/2016			Orientation	ו:				d		og Sta rint Da			21/1 ⁻	FIN 1/20
Date Completed:	22111/2016		anth	Inclination		ing C	oring	andh Sit	90 d	•	inal De	pth:	If as in	-	65.6
	Stratum Description	Legend (T	epth hick-Level ess) (m) m)	Depth (m)	Type	1	Rec	Blows (mins)		Test Res	ult Unit	SCR	Ifave		r Ba
															9°0 3°0 3°0 3°0 3°0 3°0
															9 බහි මේ මේ මේ මේ මේ මේ
density, light greyish	covered non-intact. Very weak, low white CHALK with frequent black		2.60 93.81	37.23 - 37.47 37.10 - 37.60	C RC	102						100 60 50		_	ං පිං පිං පිං පිං පිං පිං පිං පිං පිං පි
norizontal closely sp clean. Fracture set 2 smooth to slighUy ro New Pit Chalk Form	range staining. Fracture set 1: aced, undulating slighUy rough, 2: 70 degrees to vertical, undulating nugh, clean. (Grade: A3) nation] Drilling disturbed, recovered non-intact.		30)	37.60 -39.10	RC	102						87 0 0	NIDO 30		0 20 20 20 20 20 20 20 20 20 20 20
Assumed zone of co	pre loss.		92.51 92.51										NR		000000
with frequent black staining. Fracture se spaced (80/130/250) slighUy rough, clear vertical, planar smoo	density, light greyish white CHALK specks and occasional orange t 1: horizontal to 30 degrees closely , planar smooth to undulating b. Fracture set 3: 70 degrees to that to undulating slighUy rough, strength close to fractures. (Grade: mation]		92.31	39.10 - 40.10	RC	102						100 0 0			විර වර වර වර විර විර විර විර

•barn ritchies	E	ORE	HO	LE L	00	3					ML04	hole N 3-RC et 9 of	004
roject Name:	Amersham Tunnel to Calvert			Survey Gr Co-ordinat	-	em:		OSGB 221.20 1	nF	Hole Ty Checke			RO
roject No:	1G063-AAZ.						198	983.21 i	mΝ	Approv	-		Ρ
lient: ngineer:	High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd			Ground Le	evel:			131.41 r	nOD	Scale: Log St	atus:		1 FI
ate Started:	16/11/2016			Orientatior	n:			(leg.	Print D			21/11/2
ate Completed:	22111/2016			Inclination:				90 0	0	Final D			65.
:	Stratum Description	Depth Legend (Thick ness)	- Level (m)	Depth		1	oring and hard hard hard hard hard hard hard har		ing Test F	Result Un	TCR SCR ts RØD	lfmin Ifave Ifmmax	Weter
		(m)	+ ``	(m)	Туре	(mm)	Rec Blows % (mins)				,	
											100		
				40.10 - 40.60	RC	102					0		
41.00-	41.05m : Heavy dark orange staining.												
				41.07 - 41.33	с								
				40.60 - 42.10	RC	102					100 37		
											37		
												80	
												130 250	
		_TT											
	42.72 - 42.B4m : Drilling disturbed.			42.10 - 43.60	RC	102					100 43		
											43		
Recovered as: lig	Drilling disturbed, recovered non-intact.												
medium density	ine to coarse GRAVEL. Gravel is weak, , light greyish white with frequent black			44.13 - 44.30	с						100		
specks. Matrix	k is soft grey clay. Possible marl seam?			43.60 - 45.10	RC	102					100 32 21		
					-								
44.53 - 44.66m : D	Prilling disturbed, recovered non-intact.												
		<u> </u>											
Stratum depths mea	sured along borehole axis.												
	may be subject to seasonal, tidal and	other fluctuation	ns and s	hould not be	taken a	as con	stant.						
		Exploratory Ho											

•barn ritchies	BORE	но	LE L	00	3					N	L04	hole N 3-RC t 10 o	004	
Project Name: Amersham Tunnel to Calvert			Survey Gr Co-ordinat	-	em:		49322	9SGB 21.20 r		Hole Typ Checked	By:			O+RC DE
Project No: 1G063-AAZ. Client: High Speed 2 (HS2) Ltd Engineer: High Speed 2 (HS2) Ltd			Ground Le	evel:				33.21 r 31.41 n		Approved Scale: Log Sta	-			PMcG 1:25 FINAI
Date Started: 16/11/2016 Date Completed: 22111/2016			Orientation					d 90 d	•	Print Dat Final De	e:		21/11	
Stratum Description	Legend Depth (Thick- ness) (m)	Level (m)	Depth (m)	Sampl Type	1	Rec	andh Si Blows (mins)	tu Testi Test	ing Test R	tesult Unit	TCR SCR RØD	lfmin Ifave (mna)x	Weter	We Back
45.88 - 46.36m : Drilling disturbed, recovered non-intact. 46.60 - 47.06m : Drilling disturbed, recovered non-intact. Locally with darl< yellow staining.		-	45.10 - 46.60	RC	102						100 52 31			
47.57 - 48.30m : Drilling disturbed, recovered non-intact.			47.12 - 47.26 46.60 - 48.10	C RC	102						100 23 16	80 130 250		
48.30 - 48.78m : Drilling disturbed, recovered non-intact														
Recovered as: light greyish white silty subangular to angular fine to coarse GRAVEL. Gravel is weak, medium density, light greyish white with frequent black specks.														
48.78 - 50.37m : Drilling disturbed, recovered non-intact.			48.10 - 49.60	RC	102						73 0 0			
Assumed zone of core loss. Very weak chalk.		62.21										NR		
Very weak, medium density light greyish white CHALK with frequent black specks and locally orange staining. Fracture set 1: horizontal to 30 degrees closely spaced (80/130/250mm), planar smooth to undulating slighUy rough, clean. Fracture set 2: 30 to 70 degrees medium	49.60	61.81											-	
Stratum depths measured along borehole axis. Groundwater levels may be subject to seasonal, tidal and Explanation of symbols and abbreviations given in 'Key the Further details given on appended 'Borehole Information' Office: BAM Ritchies, Glasgow Road, Kilsyth, Glasgow G65 9	o Exploratory Ho Sheer.		hould not be t	taken a	l as con	lstant.		<u> </u>	<u> </u>		I R Bor	<u> </u>	<u> </u>	<u> </u>

•barn	E	BOF	RE	HO	LE L	00	G			ML04	hole N 3-RC(t 11 of	004
Project Name: Project No: Client: Engineer:	Amersham Tunnel to Calvert 1G063-AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd				Survey Gr Co-ordinat Ground Le	es:	tem:	493221 198983	GB .20 mE 3.21 mN 1.41 mOD	Hole Type: Checked By: Approved By: Scale: Log Status:		RO+RC DD PMcG 1:25 FINAL
Date Started: Date Completed:	16/11/2016 22/11/2016				Orientatior Inclination				deg. 90 deg.	Print Date: Final Depth:	:	21/11/2017 65.60m
	Stratum Description	Legen	Depth d (Thick ness) (m)	- Level (m)	Depth (m)	Samp Type	-	ring and h Situ Rec Blows % (mins)	-	Result Units	If min 1 V:,. (mm)	water B:;'
slightly rough, clean brown clay. Fracture smooth to undulating	ugate, planar smooth to undulating rarely infilled (<3mm) with soft set 3: 70 degrees to vertical, planar g slightly rough, clean. Locally with r laminations (marl wisps). (Grade:				49.60 - 50.60	RC	102	,		70 100 20 13		
	nation] Drilling disturbed, recovered non-intact. xtremely closely spaced drilling induced fractures.				50.50 - 50.60 50.60 -51.10	D RC	102			100		
51.52 - 51.62m :	Drilling disturbed, recovered non-intact.									0		
51.86 - 52.0Bm : :	Drilling disturbed, recovered non-intact.				51.10 -52.60	RC	102			100 49 40	80	
					52.60-52.90	C					130 250	
					52.60 - 54.10	RC	102			100 43 43		
54.41 - 54.65m : Recovered a angular fine 10 cc density, light g 54.65 - 54.85m : Recovered a angular fine 10 cc	Drilling disturbed, recovered non-intact. Drilling disturbed, recovered non-intact. s: light greyish white silty subangular 10 parse GRAVEL. Gravel is weak, medium reyish white with frequent black specks. Drilling disturbed, recovered non-intact. s: light greyish white silty subangular 10 parse GRAVEL with occasional cobbles. medium density, light greyish white with				54.10 -55.60	RC	102			100 65 45		
Groundwater levels Explanation of sym	asured along borehole axis. may be subject to seasonal, tidal and bols and abbreviations given in 'Key to n on appended 'Borehole Infonmation S	Explora			hould not be t	aken a	as cons	tant.				
Office: BAM Ritchie	es, Glasgow Road, Kilsyth, Glasgow G659B	L								BAM R Bor	ehole Lo	og 06/041201

•barn	E	BOR	Eł	HO	LE L	00	3						ML04	ehole N 3-RC et 12 of	004	
Project Name:	Amersham Tunnel to Calvert				Survey Gri Co-ordinat		em:			SGB 1.20 n	ηE	Hole T Check				۹+C ا
Project No:	1G063-AAZ.								19898	3.21 n	ηN		ed By:		F	РM
Client:	High Speed 2 (HS2) Ltd				Ground Le	vel:			13	1.41 m	OD	Scale:				1:2
Engineer:	High Speed 2 (HS2) Ltd											Log S	tatus:		F	FIN
Date Started:	16/11/2016				Orientation	:				d	eg.	Print D	ate:		21/11/	/20
Date Completed:	22111/2016				Inclination:					90 d	eg.	Final	Depth:		65	5.6
			Depth			Sampl	ing, C	oring ar	ndh Sit	u Testi	ng		TCF	Ifmin		Γ
S	tratum Description	Legend	Thick hess) (m)	- Level (m)	Depth (m)	Туре	Dia	Rec E			0	esult Ui	SCF nits RØ	Ifave	Weter I	۱ Ba
	rilling disturlled, recovered non-intact.			-											1	
	light greyish white silty subangular to rse GRAVEL with occasional cobbles.															
Gravel is weak, m	edium density, light greyish white with	r r -														
54 85 - 55 50m · C	frequent black specks. rilling disturlled, recovered non-intact.	TT-														
Recovered as.	light greyish white silty subangular to	TTT-														
	rse GRAVEL. Gravel is weak, medium yish white with frequent black specks.															
density, light gre	yish while with hequent black specks.															
		TT-														
			2													
		Fr Fr E														
													100			
					55.60 -57.10	RC	102						100 33			
		T T											32			
		TT			56.46 - 56.66	с										
		TTT-												80		
														130 250		
														200		
			-													
		T_T_														
		TT-														
		The party of the p														
57.51 - 57.68m : Di	illing disturlled, recovered non-intact.															
													100			
		T T			57.10 -58.60	RC	102						100 45			
		fr fr											34			
			-													
		h h														
		TTT-														
Very weak locally wea	k, medium to high density, light	F	8.41	73.00												
greyish white CHALK	with frequent black specks, and															
	and abundant shell fragments. ntal to 20 degrees, closely spaced	Fr Fr														
(55/110/260mm), und	ulating slighUy rough, clean rarely															
infilled (<3mm) with so	oft orangish brown and soft	r r														
	acture set 2: 30 to 70 degrees, ugh, clean rarely infilled (<1mm)	T TT														
with soft orangish bro	wn clay. Fracture set 3: 80 degrees	T T														
	slighUy rough, with frequent black	Fr Fr			59.04 - 59.20	с										
	ng, rarely infilled (<1mm) with soft th thin interwoven grey laminations	THE PL											100			
(marl wisps). (Grade:	A3/4)				58.60 - 60.10	RC	102						60 33			
[Holywell Nodular Cha	aik Fonmationj					-										
		T T														
		TT-														
		TT-														
		Fr Fr														
		+														
Stratum denths moor	sured along borehole axis.															L
•	•	other fluct	ation	e and d	hould not be t	akon -	16 00r	etant								
	nay be subject to seasonal, tidal and obles and abbreviations given in 'Key to					aren a	as con	oldi II.								
	on appended 'Borehole Information S		y 110	100												
		1001.														
r unifier details given																

•barn		BOF	RE	HO	LE L								ML04 Shee	ehole N 3-RC et 13 of	004 f 14	
Project Name:	Amersham Tunnel to Calvert				Survey Gr Co-ordinat		em:			SGB 1.20 m	ηE	Hole T Check			RC	+F ב
Project No: lient:	1G063 -AAZ. High Speed 2 (HS2) Ltd				Ground Le	evel:				3.21 m 31.41 m		Approv Scale:	ed By:			РМс 1:25
ngineer:	High Speed 2 (HS2) Ltd											Log S			F	=IN/
ate Started: Date Completed:	16/11/2016 22/11/2016				Orientatior Inclination					d 90 d	•	Print D Final D			21/11/ 65	/20 [,] 5.60
Ş	Stratum Description	Legend	Depth (Thick-	Level	5.4	Sampl	1	-	indh Sit	u Testi	ng	Result Ur	TCR	lfmin Ifave		_ w
	·		ness) (m)	(m)	Depth (m)	Туре	(mm))	Blows (mins)	Test	l est l	result Ur	nits Real) (rnma):	Weter	вас
		, r , r	-													
			-													
			-													
			-													
	rilling disturl:Jed, recovered non-intact. tured zone, evidence of two 50 degree		-													
1 000 <i>1019 mgmy m</i> ao	clay filled fractures.	T T	_		60.10 -61.60	RC	102						100 27			
		TT	-		00.10 -01.00		102						27			
		TT	_													
		TT	-													
		T T	_													
			-													
			-													
			-													
			-		61.75 -62.01	с										
			Ē		01.75-02.01											
			-													
		T T	-													
		T T	-		61.60 -63.10	RC	102						100 BO			
62.40	- 62.45m : Heavy dark yellow staining.	TT											63	55 110		
		TT	5											260		
		T T	-													
		T T	=													
		T P	_													
		I I I	-													
			-													
			_													
		T T	-													
			-													
		ГГ	_										100			
		T T	-		63.10 -64.60	RC	102						40 33			
		T T	_													
		T T	_													
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			_													
			-													
		T T	Ē													
	sured along borehole axis.	other fl	tuoti-	0 00-	hould not be	tokor -		otor*								
	may be subject to seasonal, tidal and only one subject to seasonal, tidal and only only to and abbreviations given in 'Key to					акеп а	as cor	เรเสทโ.								
	on appended 'Borehole Information S															

•barn ritchies	E	BORE	НО	LE L	.00	G						ML	orehole 043-R(eet 14 c	2004	
Project Name: Project No: Client: Engineer: Date Started:	Amersham Tunnel to Calvert 1G063-AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd 16/11/2016			Survey Gi Co-ordina Ground Lo Orientation	tes: evel:	em:		49322 19898	OSGB 21.20 33.21 31.41 (mN mOD	Chec Appro Scale Log	Type: cked B oved E	y: 3y:	R	O+RC DD PMcG 1:25 FINAL
Date Completed:	22111/2016	Duri		Inclination		ling (oring	andhS		deg.	Fina	I Depth			5.60m
	Stratum Description	Legend (Thir ness (m)	k-Level	Depth (m)	Type				Test		Result l		CR Ifmir CR Ifave 20,D (mma)x		Well, Backfi
greyish white CHALI locally orange stainin Fracture set 1: horiz (55/110/260mm), un infilled (<3mm) with greenish grey clay. If undulating slighUy m with soft orangish br to vertical, undulating specks, orange stain brown clay. Locally w (marl wisps). (Grade I[HolyWell Nodular C Assumed zone of cc	halk Formation]	-Es5.60) 66.01 65.81	64.60 - 65.60 65.05 - 65.33		102						4	90 15 35 NR	_	
		r., r., r., r.,													
		F F F													
		F- F- F-													
		F- F- F-													
		r- F- F-													

Amersham Tunne 1G063 -AAZ DD High Speed 2 High Speed 2 (H: 16/11/2016 22/11/2016 2/11/2016 IP IP 16/11/2016 22/11/2016 Do High Speed 2 (H: IP IP 10/11/2017 RC 18/11/201 RC 18/11/201 10.00 15.00 15.00 15.00 15.00 36.10 36.10 36.10 36.10 36.10 36.10 36.10 36.10 36.10 54.10 54.10 54.60 65.60 65.60 65.60 65.60 65.60 2000 1000 1000 1000 1000 1000 <tr< th=""><th>2 (HS2) Ltd HS2) Ltd to 16/11/2016 Insulated digg 16/11/2016 Insulated digg 16/11/2016 Connacchio 3 Connacchio 3 Connacc</th><th>ging tools 105 Geoboo (146)</th><th>Drill Bit Drag bit PCD Hole Diameter M Dia.Imml Dia.Imml 146 146 146 Chisellin II</th><th>s: 49 rel: nation Ria Crew B. Reeves B. Reeves B. Reeves B. Reeves Course (Itres) water</th><th>3221.20 mE (0 8983.21 mN / 131.41 mOD deg. 90 deg. I Loaaer I.Soley B.Reeves A. Barnard 25.00 168 65.60 146 46 Added Records Ref</th><th>Sheet 1 of 1 Hole Type: RO+R Checked By: Approved By: PMc Log Status: FIN/ Date: 21/11/20 Final Depth: 65.60 Remarks ina Diameter by Deoth ml Remarks emarks Colour Drillino Flush Details Colour 0 Polymer No returns</th></tr<>	2 (HS2) Ltd HS2) Ltd to 16/11/2016 Insulated digg 16/11/2016 Insulated digg 16/11/2016 Connacchio 3 Connacchio 3 Connacc	ging tools 105 Geoboo (146)	Drill Bit Drag bit PCD Hole Diameter M Dia.Imml Dia.Imml 146 146 146 Chisellin II	s: 49 rel: nation Ria Crew B. Reeves B. Reeves B. Reeves B. Reeves Course (Itres) water	3221.20 mE (0 8983.21 mN / 131.41 mOD deg. 90 deg. I Loaaer I.Soley B.Reeves A. Barnard 25.00 168 65.60 146 46 Added Records Ref	Sheet 1 of 1 Hole Type: RO+R Checked By: Approved By: PMc Log Status: FIN/ Date: 21/11/20 Final Depth: 65.60 Remarks ina Diameter by Deoth ml Remarks emarks Colour Drillino Flush Details Colour 0 Polymer No returns
16/11/2016 22/11/2016 Troe Start IP 16/11201 RO 17/111201 RC 18/111201 Bolin 11-Drillina F Deoth <ml< td=""> Casinahi 10.00 15.00 15.00 15.00 15.00 15.00 15.01 54.10 54.10 54.10 65.60 65.60 65.60 65.60 65.60 0.00</ml<>	End Plan 016 16/112016 Insulated digg 016 17/1112016 Cornacchio 3 016 22/1112016 Cornacchio 3 aPrò ress Cornacchio 3 a Prò ress Start of shift 1 Depth Water (m) Rema 28.91 start of shift 3.027 End of shill 3.027 End of shill 3.227 End of shill 3.28.82 start of shift 28.82 start of shift End of shill And shift 28.82 start of shift End of shill End of shill Ant of shift End of shill Remarks Remarks	nt Barre ging tools 105 105 Geoboo (146) arks Deoth - 25.00 65.60 From (t	Inclination: oratory Hole Inform Drill Bit Drag bit PCD Hole Diameter M Dia.Imml 146 146 146	Ria Crew B. Reeves B. Reeves B. Reeves Water Olume (Itres) Details	deg. 90 deg. <u>Loaaer</u> I.Soley B.Reeves A. Barnard Casi Deoth <ml dia.rmn<br="">25.00 168 65.60 146 Added Records Ref From (m) To (m) F</ml>	Date: 21/11/20 Final Depth: 65.60 Final Depth: 65.60 Remarks Inspection pit Ins
Tvoe Start IP 16/11/201 RO 17/11/201 RC 18/111/201 Bolin 11-Drillina F Deoth <mi< td=""> Casinahi 10.00 10.00 15.00 15.00 15.00 15.00 36.10 36.10 36.10 36.10 54.10 54.10 65.60 65.60 65.60 0.00 Dept Related F</mi<>	016 16/112016 Insulated digg 016 17/112016 Cornacchio 3 016 22/1112016 Cornacchio 3 016 22/1112016 Cornacchio 3 aPrò ress start of shill 1 DepthWater (m) Rema 1 10.63 start of shill 1 28.91 start of shill 1 30.27 End of shill 1 28.88 start of shill 28.82 start of shill 28.83 start of shill 28.84 start of shill 28.85 start of shill 28.86 start of shill<	nt Barre ging tools 105 105 Geoboo (146) arks Deoth - 25.00 65.60 From (t	roratory Hole Inform Drill Bit Drag bit PCD Hole Diameter Hole Diameter 146 146 146 146 Chisellin II	Ria Crew B. Reeves B. Reeves B. Reeves Water Olume (Itres) Details	Loaaer I. Soley B. Reeves A. Barnard Deoth <ml dia.rmn<br="">25.00 168 65.60 146 Added Records Re From (m) To (m) F</ml>	Remarks Inspection pit ina Diameter by Deoth ml Remarks emarks
IP 16/111201 RO 17/111201 RC 18/111201 Bolir 11-Drillina F Deoth <ml< td=""> Casinahi 10.00 15.00 15.00 15.00 36.10 36.10 36.10 54.10 54.10 54.10 65.60 65.60 65.60 65.60 Dept Related R</ml<>	016 16/112016 Insulated digg 016 17/112016 Cornacchio 3 016 22/1112016 Cornacchio 3 016 22/1112016 Cornacchio 3 aPrò ress start of shill 1 DepthWater (m) Rema 1 10.63 start of shill 1 28.91 start of shill 1 30.27 End of shill 1 28.88 start of shill 28.82 start of shill 28.83 start of shill 28.84 start of shill 28.85 start of shill 28.86 start of shill<	arks Deoth (146) From (1 From (1 From (1 From (1)	B Drag bit PCD Hole Diameter Hole Diameter ml Dia.Imml 168 146 n) To (m) V Chisellin iE Chisellin iE	B. Reeves B. Reeves B. Reeves r bv Deoth Remarks olume (Iltres)	I. Soley B. Reeves A. Barnard	Inspection pit ina Diameter by Deoth nl Remarks emarks Drillino Flush Details Returns (%) Flush Colou 0 Polymer- No returns
Depth <ml< th=""> Casinami 10.00 10.00 15.00 15.00 36.10 36.10 54.10 54.10 65.60 65.60 65.60 0.00</ml<>	I DepthWater (m) Remain 0 8.57 End of shift 1 10.63 start of shift 0 28.47 End of shift 1 28.91 start of shift 1 30.27 End of shift 1 30.27 End of shift 2 28.88 start of shift 2 28.32 End of shift 2 28.32 End of shift 2 28.82 start of shift 28.82 start of shift End of shill Start of shift Remarks Remarks	25.00 65.60 From (r	ml Dia.Imml 168 146 n) To (m) V Chisellinit	Remarks Water Olume (Itres) Details	Death <ml< th=""> Dia.rmn 25.00 168 65.60 146 Added Records Re From (m) To (m)</ml<>	nl Remarks emarks Drillino Flush Details Returus (%) Flush Colou 0 Polymer- No returns
36.10 36.10 36.10 36.10 54.10 54.10 54.10 54.10 65.60 65.60 65.60 65.60 0.00 Dept Related R	0) 28.47 End of shill 0) 28.91 start of shift 0) 30.27 End of shill 1) 28.88 start of shift 1) 28.82 End of shill 28.82 End of shill End of shill 28.82 End of shill End of shill 28.82 End of shill End of shill Remarks Remarks End of shill		Chisellini	olume (Iltres)	R (From (m) To (m) F	Drillino Flush Details Returns (%) Flush Colou 0 Polymer- No returns
Dept Related R	Remarks Remarks		Chisellini	Details	From (m) To (m) F	Drillino Flush Details Returns (%) Flush Colou 0 Polymer- No returns
	Remarks	From (i			From (m) To (m) F	Returns (%) Flush Colour 0 Polymer- No returns
water Strikes rci(m) Ilme (mine) Depth (m) So		Mo Type Pipe ID Fron	ilorino Installation F (m) To (m) Di (mm)	Pioe Work Pipe Type Remarks	From (m) To (m)	Backfill Details legend Desaiption
		SP 1 0.0 SP 1 30.		Plain Slotted	0.00 0.10 0.10 0.50 0.50 30.00 30.00 40.00 40.00 65.60	909 Upstanding cover 906 Concrete 903 Bentonite 902 Gravel 903 Bentonite
slue Casino (m ater (r	(mi SWPen(mm Blows1 Pen1(mr		etration Test Results		lows5 Fen5(mml Blow	vs6 Pen6(mml Hammer E. Ra
		Reason for			Reason for Hole Termination: Reached scheduled depth	Reason for Hole Termination: Reached scheduled depth

-barn ritchies		BOF	RE	HO	LE L	.00	3					N	/L04	hole N 3-RC et 1 of	007
Project Name:	Amersham Tunnel to Calvert				Survey Gi Co-ordina		em:			9.41 r	nE	Hole Ty Checked	pe:		RO
Project No:	1G063-AAZ.								19904	17.51 r	nN	Approve	d By:		Р
client:	High Speed 2 (HS2) Ltd				Ground Le	evel:			13	30.68 r	nOD	Scale:			1
ngineer:	High Speed 2 (HS2) Ltd											Log Sta	itus:		FI
ate Started:	14/12/2016				Orientation	n:				d	leg.	Print Da	te:		21/11/2
ate Completed:	21/12/2016				Inclination	:				90 d	leg.	Final De	pth:		56.
			Depth			Samp	ling, C	oring	and h Si	tu Test	ing		TCR	Ifmin	
	Stratum Description	Legen	d (Thick ness) (m)	- Level (m)	Depth (m)	Туре	(Rifa)	Rec	Blows (mins)	Test	Test R	esult Unit	SCR s RØ4D		water
requent rootlets. Sa ocsoill	brown slightly sandy CLAY with and is fine to medium.	<u> Willie</u>	- 0.20	130.48											
low angular flint cob ine to coarse of flint	n slightly sandy gravelly CLAY with ble content. Gravel is subangular t.		- -(0.30)												
Clay with flints]	ntly sandy gravelly SILT with low	XXX	0.50	130.18											
subangular flint cob	ble content. Gravel is angular to	$\times \times $	E		0.50 -0.70	LB									
subangular fine to c	oarse of flint and chalk.	* * * ×	F												
[Clay with flints]		*×·×·×	E (0.70)												
		× * × * × × ×	E ^(0.70)												
		× * *	E												
		×*× ×	F		1.00-1.20	LB									
Drillers description:	Structureless CHALK with flints.	× × ×	- 1.20	129.48											
Rotary open hole)			f-												
		—	f- f-												
			r												
			r- r-												
		_													
			f- f-												
		_	f- r-												
			r-												
			r-												
			f-												
			r- f-												
			r-												
		_	r-												
			f_												
			f- f-												
			r- r-												
			r-												
			HS.BO)												
			f- f-												
			f- r-												
			r- r-												
			r-												
			f-												
			f- f-												
		_	r-												
			r- r-												
			r-												
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			e												
			1 - f - e												
			r												
		-	r												
			f-												
						i					1			1	1

-barn ritchies		BOF	۶EI	HOI	E L	.00	3						ML04	ehole N 43-RC et 2 of	007
Project Name:	Amersham Tunnel to Calvert				Survey Gi Co-ordina		em:		49312	DSGB 29.41 n			ked By:		RO+R D
Project No: Client: Engineer:	1G063-AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd				Ground Le					47.51 n 30.68 n		Scale Log S	Status:		PMc 1:25 FINA
Date Started: Date Completed:	14/12/2016 21/12/2016		Denth	I	Orientation Inclination	ו:	"	· - ring s		d 90 d	leg.	Print I Final	Date: Depth:		21/11/201 56.30
	Stratum Description	Legend	Depth d (Thick- ness) (m)	- Level (m)	Depth (m)	Type	1	Rec		itu Testi Test	ng Test R	≀esult U	Jnits RQ	R Ifmin R Ifave D Ifmina)x	
(Rotary open hole)	Structureless CHALK with flints.			123.68											

-barn ritchies		BOREHO	LE LOG		Borehole No ML043-RC0 Sheet 3 of 1	07
Project Name:	Amersham Tunnel to Calvert		Survey Grid System:		Hole Type:	RO+RC
Project No:	1G063 -AAZ.		Co-ordinates:	493129.41 mE 199047.51 mN	Checked By: Approved By:	DE PMcG
Client: Engineer:	High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd		Ground Level:	130.68 mOD	Scale: Log Status:	1:25 FINAL
Date Started:	14/12/2016		Orientation:	deg.	Print Date: 2	1/11/2017
Date Completed:	21/12/2016	Depth	Inclination:	90 deg. , Coring and h Situ Testing	Final Depth:	56.30m
	Stratum Description	Legend (Thick- Level ness) (m) (m)			t Result Units Road (mma) k	vater ck
Drillers description: (CHALK. (Rotary open hole)	f- f- r-				
		r- r- r-				
		t- t- t-				
		1- 1- 1-				
		r- r-				
		f- f- f-				
		f r				
		r- r- r-				
		f- f- f-				
		r r r				
		r- r- r-				
		f- f-				
		r				
		r- r- f- f-				
		f				
		tf8.00)				
		f- f- f-				
		r				
		r r r-				
		f- f- f-				
		r				
		t				
		6				
		r- r- r-				
		f				
		f= f= f=				
		£- f- f-				
		r- r- r-				
		r r r				
		:00 115.68				
	asured along borehole axis. may be subject to seasonal, tidal	and other fluctuations, and	should not be taken as a			
Explanation of symb	ools and abbreviations given in 'Ke	ey to Exploratory Holes'	Shoulu hol de laken as c	onotalit.		
Further details giver	n on appended 'Borehole Informat	tion Sheer.				

•barn	B	SOF	RE	HO	LE L	00	G					Ν	1L04	hole N 3-RC	007	
Project Name:	Amersham Tunnel to Calvert				Survey Gr	id Syst	em:		о	SGB	L	lole Ty		et 4 of	12 RC	—)+
					Co-ordinat	es:			49312	9.41 n		Checked				
Project No:	1G063-AAZ.									7.51 n		pprove	d By:			ΡN
Client:	High Speed 2 (HS2) Ltd				Ground Le	evel:			13	80.68 n		icale:				1:
Engineer: Date Started:	High Speed 2 (HS2) Ltd 14/12/2016				Orientatior					d		.og Sta				FIN
Date Completed:	21/12/2016				Inclination:					d 90 d	•	Print Da Final De			/1/12 56	
			Depth				ina C	orina	andh Sit		· ·		TCR	lf min		
	Stratum Description	Legend	(Thial	Level (m)	Depth (m)	Туре			Blows	Test	Test Re	sult Unit	SCR	lfave	Weter f	E
density, light greyish fragments (up to 30r grey marl burrows. F degrees medium to v occasional black spe clay. Fracture set 2: (20/150/200mm), un and smooth, with oc infilled (0/1/2mm) wi 80 degrees, undulati	ally very weak, low locally medium white CHALK with rare bivalve mm), rare black specks, and rare rracture set 1: horizontal to 20 widely spaced, planar smooth, with acks, infilled (2/2/15mm) with brown 30 to 60 degrees closely spaced dulating and planar, slightly rough casional black specks, occasionally th brown clay. Fracture set 3: 70 to ing and planar slightly rough, with ecks, no infill. (Grade: C4) iation]				15.00 - 16.30	RC	120						100 22 12			
15.00 - <i>15.35m : L</i>	Drilling disturbed, recovered non-intact.		f r-													
			r													
			r- r-		16.21 - 16.28	D	100									
16.30	0- 16.50m : Assumed zone of core loss.		f- f-													
	16.50- 16.65m : Drilling disturbed.		f- r-													
18.00- 18.70m : S	Drilling disturbed, recovered non-intact. Spike visible on natural gamma log with peak at 18.25m. 3 no. 70 degree fractures, very closely		r- r- r- r- r- r- r- r- r- r-		16.30 - 17.80	RC	120						87 19 14	NI 100 210		
	mooth, inti/led (up to 20mm) with brown		f- f-													
	clay.		r- r-													
			r										100			
			r- f-		17.80 - 19.30	RC	120						0			
			f- f-													
			r- r-													
			r- r-		18.90 - 19.00	D										
			r f-													
			f- f-													
			r-													
19.30	0- 19.35m : Assumed zone of core loss.		r- r-													
			r- f-													
			f- f- r-													
			r- r-													
			r- r-													
			r- f-													
			\vdash													
Stratum denths mer	asured along borehole axis.	I	L													1
	may be subject to seasonal, tidal and o	other flu	ctuatior	ns and s	hould not be t	aken a	as con	stant.								

•barn ritchies	E	BOF	RE	HO	LE L	00	3				Μ	L04	hole N 3-RC et 5 of	007	
Project Name: Project No: Client: Engineer: Date Started: Date Completed:	Amersham Tunnel to Calvert 1G063-AAZ. High Speed 2 (HS2) Ltd High Speed 2 (HS2) Ltd 14/12/2016 21/12/2016				Survey Gr Co-ordinat Ground Le Orientation	es: vel:	em:	49312 19904	DSGB 29.41 m 47.51 m 30.68 m de 90 de	nE (nN / nOD (eg. (Hole Typ Checked Approved Scale: Log Stat Print Dat Final Dep	By: I By: us: e:		F F 21/11/	D+RC DE PMcG 1:25 TNAL 2017 .30m
	Stratum Description	Legen	Depth d (Thick ness) (m)	- Level (m)	Depth (m)	Samp Type	1	ing and h S Rec Blows % (mins)	itu Testii Test	ng Test Re	sult Units	TCR SCR Rଷ୍ଟ୍ରପ	lfmin lfave l(mma)x	Weter	Ve ck
20.80	0-20.90m:Assumed zone of COTC loss.		f- f-		19.30 - 20.BC	RC	120					97 3 0			
21.00	- 31.03m : Band of brown clay (30mm).		F- F- F- F-		20.BO - 22.3() RC	120					93 3 0			
22.30)- 22.40m : Assumed zone of COTE loss.		f- f- f- f- f-		22.51 - 22.59	D	100						NI 100 210		
22 50, 22 70m; Er	equent orange staining (sponge beds).		f- f- f-		22.30 - 23.BC	RC	120					93 15 9			
	. ,		f- f- f-									100			
greyish white CHALl orientated, very dos slighUy rough, with f (>3mm) with grey da Fracture set 2: 30 to (20/150/200mm), un	xtremely weak, low density, light K. Fractures are randomly ely spaced, undulating smooth and irequent black specks, locally infilled ay. Some distinct fracture sets. b 60 degrees dosely spaced idulating and planar, slightly rough ccasional black specks, occasionally		-24.40 	106.26	24.35 - 24.44 23.BO - 25.05	D RC	100 120					4 0			
Groundwater levels Explanation of syml	asured along borehole axis. may be subject to seasonal, tidal and o bols and abbreviations given in 'Key to n on appended 'Borehole Information S	Explora			nould not be t	aken a	is consta	ant.	· · · · · ·						-
Office: BAM Ritchie	es, Glasgow Road, Kilsyth, Glasgow G65 9Bl	L									BAM	R Bor	ehole Lo	og 06/04	4120 ⁻

•barn ritchies	E	BOF	REI	HO	LE L	00	3					Μ	L043	nole N 3-RC et 6 of	007
roject Name:	Amersham Tunnel to Calvert				Survey Gr Co-ordinat		em:			SGB 9.41 n		Hole Typ Checked	e:		RO+I
roject No:	1G063-AAZ.								19904	17.51 n	nN /	Approved	d By:		PM
lient:	High Speed 2 (HS2) Ltd				Ground Le	vel:			1:	30.68 n	nOD S	Scale:			1:2
ngineer:	High Speed 2 (HS2) Ltd										I	Log Sta	tus:		FIN
ate Started:	14/12/2016				Orientation	:				d	eg.	Print Dat	e:		21/11/20
ate Completed:	21/12/2016				Inclination:					90 d	eq.	Final De	oth:		56.30
			Depth			Sampl	ing C	orina	and h Si		<u> </u>			If min	
	Stratum Description	Legend		Level (m)	Depth (m)	Туре		Rec	Blows (mins)	Test	Test Re	esult Unit	SCR sRC26	lfave Df(rnma)k	Weter E
New Pit Chalk Éorm] 25.05 - 25.60m : L Recovered a	th brown day. (Grade: C4) nation] Drilling disturbed, recovered non-intact. Is: angular to subangular fine to coarse Vis very weak, low density, light greyish white.	1	>- >-	105.23											
New PitChalk Form Drilling disturbed. Ex greyish white CHAL	tremely weak, low density, light . Fractures are randomly	1	j§:47 >- >-25.70	105.21 104–98	25.05-26.30 25.69-25.79	RC D	120 100						100 5 0	NI 80 200	
slightly rough, with fr (>3mm) with grey da Fracture set 2: 30 to	ely spaced, undulating smooth and equent black specks, locally infilled y. Some distinct fracture sets. 60 degrees dosely spaced		052	104-90	20100 20110	-	100								
and smooth, with occ nfilled (0/1/2mm) wi	dulating and planar, slightly rough casional black specks, occasionally th brown day. (Grade: C4) bt, matigh"'-	irr=ir ə -2	- ,	404.00											
Soft greyish green si	ilt marl with rare orange staining.	= ⊅-2	0.30	104.38											
New Pit Marl 1?			f- f-												
New Pit Chalk Form	ation] Drilling disturbed, recovered non-intact.														
	as: angulart0 subangular fine t0 coarse														
	/is very weak, low density, light greyish														
	tremely weak, low density, light	-	f- f-												
	K. Fractures are randomly		f-												
rientated, very dose	ely spaced, undulating smooth and				00.00.07.00	DO.	100						93		
	equent black specks, locally infilled				26.30-27.80	RU	120						51 51		
	 y. Some distinct fracture sets. o 60 degrees dosely spaced 														
	dulating and planar, slightly rough		f- f-												
	casional black specks, occasionally		f-												
	h brown day. (Grade: C4)														
lew Pit Chalk Form	ation] Drilling disturbed, recovered non-intact.														
Recovered a	/is angulart0 subangular fine t0 COarse //is very weak, low density, light greyish white.		f- f-												
ery weak locally we	ak, medium density, light greyish		f-												
	re grey marl burrows, thin grey														
	sps) and rare orange staining ture set 1: horizontal to 20 degrees,														
	to medium spaced (20/120/320mm),		He.oo)											NI 120	
	g, smooth and slighUy rough, with		f-											350	
	s, infilled (<2mm) with brown clay 70 degrees dosely to widely spaced														
	dulating slightly rough, with frequent														
ack specks, locally	orange staining, rarely infilled					50	100						100		
	ge or brown clay/silt. Fracture set 3:		f-		27.80-29.30	RC	120						55 37		
	I, undulating slighUy rough, with ecks, rarely infilled (0/1/4mm) with		f- f-												
own day. (Grade: I	B3/4)														
lew Pit Chalk Form	ation]														
)-26.40m:Assumed zone of core Joss. Il developed thick grey mart lamination														
20.07 20.0Dm. We	(6mm).		f-		28.96-29.16	с	100								
27.80-27.93m	: Locally withorange staining (sponge		f-												
	bed).														
			f-												
			f-												
					29.60-29.90	С	100								
00.00															
29.90 - 30.15m : E	Drilling disturbed, recovered non-intact.														

•barn ritchies	E	BOF	RE	HO	LE L	00	3					N	1L04:	hole N 3-RC t 7 of	007
Project Name:	Amersham Tunnel to Calvert				Survey Gri		em:			SGB		Hole Typ			RO+I
Project No:	16063 -447				Co-ordinate	es:				29.41 n 17.51 n		Checked			PM
Project No: Client:	1G063 -AAZ. High Speed 2 (HS2) Ltd				Ground Le	vel.				47.51 r 30.68 n		Approve Scale:	u ВУ:		PIM 1:25
Engineer:	High Speed 2 (HS2) Ltd				2704.14 20							Log Sta	tus:		FIN
Date Started:	14/12/2016				Orientation	:				d	leg.	Print Da	te:		21/11/20
Date Completed:	21/12/2016				Inclination:					90 d	leg.	Final De	pth:		56.30
s	stratum Description	Legend	Depth (Thick- ness) (m)	Level (m)	Depth (m)	Sampl Type	1	Rec	andh Si Blows (mins)	tu Testi Test	ing Test R	esult Unit	TCR SCR s Rଷ୍ଟପ	lfmin Ifave (mna)x	Weter I
closely to very slightly rough, with f	: Non-systematic fractures, extremely v closely spaced (15/30/50mm), planar requent black specks, orange staining, <2mm) with brown clay. (Grade: 8415)		-	-	29.30 - 30.80	RC	120						100		
30.80-	30.90m : Assumed zone of COTE loss.		-										61 61	NI	
31.95 - 33.00m : Di	rilling disturbed, recovered non-intact.				31.40 -31.70 30.80 - 32.30	C RC	100 120)					93 75 53	150 180	
rare orange and pink Fracture set 1: horizo widely spaced, planar smooth, with frequent	lensity, greyish white CHALK with sh red staining (sponge beds). ntal to 20 degrees medium to r and undulating, slightly rough and black specks, orange staining,		- - - - - - - - - - - - - - - - - - -	98.38											
30 to 60 degrees med (60/400/1300mm), un locally infilled (0/2/5m 70 degrees to vertical frequent black specks	m) with brown day. Fracture set 2: dium to widely spaced dulating and planar slightly rough, m) with brown day. Fracture set 3: , planar slightly rough, with b, orangish brown staining, rarely rown and orange day. (Grade: ation]		-		32.30 - 33.80	RC	120						100 9 9		දී රිජි රිජි රිජි රිජි රිජි ර
			-		33.80 -34.14	с	100								හිදු හිදු හිදු හිදි හිදි
					33.80 - 35.30	RC	120						100 54 54		හිද සිදු සිදු සිදු සිදු සිදු දි
	illing disturbed, recovered non-intact.		-												200

•barn ritchies	E	BORE	HÜ	LE L	00	Ĵ				ſ	ML04 Shee	3-RC		
Project Name:	Amersham Tunnel to Calvert			Survey Gri	id Syst	em:		OSGB		Hole Ty				20+
				Co-ordinate	es:		4	93129.41	mE	Checke	d By:			
roject No:	1G063-AAZ.						1	99047.51		Approve	ed By:			P№
lient:	High Speed 2 (HS2) Ltd			Ground Le	evel:			130.68 (Scale:				1:
ngineer:	High Speed 2 (HS2) Ltd									Log St				FIN
ate Started:	14/12/2016			Orientation					•	Print Da			21/1	
Date Completed:	21/12/2016		1	Inclination:					-	Final D	-			56.3
\$	Stratum Description	Legend (Thick ness)	k- Level (m)	Depth		-	Rec Blo % (m	Ih Situ Tes ows Test	ting Test R	esult Ur	ICR SCF its RØ	Ifmin Ifave Df(mnna)k	Weter	Ва
		(m)	+	(m)										0
														00
														0
35.30-	35.42m : Assumed zone of core loss.	TT-												O.
														0
														0
														00
				35.70 -35.86	с	100								00
				30.10 00.00	C				1					5 0
									1		91			0
				35.30 - 36.80	RC	120					89			0
											89			O.
														o.
36.35m : We	Il developed thin grey mart lamination.													0
														0
														00
														01
26.00	26 OFm Assumed Table of some loss													0
36.80-	36.95m : Assumed zone of core loss.													C O
														O.
														d
		- P- P-E												0
														o d
												NI		04
		(12.80)	36.80 - 38.30	RC	120					90 12	170 300		00
37.55 - 37.60m : Di	rilling disturtJed, recovered non-intact.										12			000
				32.50-43.00				Falling		mi	5			0
								Head						0
														0
														O.
									1					0
														0
38.30-	38.42m: Assumed zone of core loss.													0
														00
														00
														0
														0
									1					O.
				38.30 - 39.80	RC	120			1		92 39			d'
				39.07 - 39.14	D	100			1		39			0
														o c
	rilling disturtJed, recovered non-intact.								1					06
39.35 - 39.80m : I	Non-systematic fractures, very closely htly rough, with frequent black specks,								1					204
	locally infilled {<2mm) with brown clay.													0
									1					00
									1					0
39.80-	40.00m : Assumed zone of core loss.	F							1					O.
		Fr F							1					00
							1	1	1	1	1	1	1	1

Further details given on appended 'Borehole Infonmation Sheer.

Explanation of symbols and abbreviations given in 'Key to Exploratory Holes'

•barn ritchies	E	BOF	RE	HO	LE L	00	3					N	/L04	hole N 3-RC et 9 of	007	
Project Name:	Amersham Tunnel to Calvert				Survey Gr Co-ordinat	-	em:		49312)SGB 29.41 r		Hole Ty	d By:			D+R D
Project No: Client:	1G063-AAZ. High Speed 2 (HS2) Ltd				Ground Le	evel:				47.51 r 30.68 r		Approve Scale: Log Sta	-			PMc 1:25 FINA
Engineer: Date Started: Date Completed:	High Speed 2 (HS2) Ltd 14/12/2016 21/12/2016				Orientation					c 90 c	•	Print Da Final De	ite:		21/11	
Date Completed.			Depth				ing, C	oring	andh Si		<u> </u>		TCF	lfmin Ifave		w
	Stratum Description	Legend	d (Thick ness) (m)	- Level (m)	Depth (m)	Туре	(Ria)	Rec	Blows)	Test	Test R	esult Unit		l(mma)x	Weter	
Recovered	: Drilling disturlled, recovered non-intact. as: slightly sandy slightly silty angular f0 fine f0 coarse GRAVEL. Gravel is weak, medium density, light greyish white.					50	100									50 260 260 260 260
					39.80 - 41.30	RC	120						87 0 0			9 0 5 0 5 0 5 0 5 0 5 0 5 0 5 0 5 0 5 0
41.3	30-41.40m : Assumed zone of core loss.															0000
Recovered	: Drilling disturlled, recovered non-intact. as: angular10 subangular fine 10 coarse Gravel is vety weak, medium density, light greyish white.				41.82 - 42.10	с	100						93			90 96 96 96 96 96 96
42.07 - 42.17m : F	Frequent subrounded and rounded chalk intraclasts (up to 30mm).				41.30 - 42.80	RC	120						93 25 21			දී රජි රජි රජි රජි රජි රජි රජි රජි
43.66-43.74m:F	Frequent subrounded and rounded chalk intraclasts (up 10 40mm).				42.80 - 44.30	RC	120						100 69 59			
<i>44.10-44.</i> 15n	n : Frequent thin dark greyish green marl laminations.															
	30-44.35m: Assumed zone of core loss. : Drilling disturlled, recovered non-intact.															
44.77- 44.BOm	: Drilling disturlled, recovered non-intact.															
	easured along borehole axis.							L							<u> </u>	<u> </u>
Explanation of syr	Is may be subject to seasonal, tidal and on mbols and abbreviations given in 'Key to ren on appended 'Borehole Information S	Explora			hould not be	aken a	is cor	nstant								
Office: BAM Ritch	nies, Glasgow Road, Kilsy1h, Glasgow G65 9Bl	L										BAN	VI R Bo	rehole L	og 06/0)412(

•barn	E	BORI	EHO	LE L	00	G						ML	043	nole N 3-RC 10 of	007	
Project Name:	Amersham Tunnel to Calvert			Survey Gr Co-ordinat		em:			SGB 9.41 r	nE		e Type: ecked B	y:		RC	O+R D
Project No:	1G063-AAZ.							19904	17.51 r	nN	Арр	roved E	By:		F	PMc
Client:	High Speed 2 (HS2) Ltd			Ground Le	evel:			13	30.68 r	nOD	Sca	le:				1:25
Engineer:	High Speed 2 (HS2) Ltd										Log	Status	:		F	FINA
Date Started:	14/12/2016			Orientation	า:				c	•	Prir	nt Date:			21/11/	/201
Date Completed:	21/12/2016			Inclination	:				90 c	leg.	Fina	al Depth	n:		56	6.30r
	Stratum Description	Legend (Th	pth ick- Level		Samp	ling, C	oring a	ndh Si	tu Testi	ing			CR	lfmin Ifave		We
	Stratum Description) `ne	n)	Depth (m)	Туре	11011		Blows (mins)	Test	Test F	Result	t Units F	202D		Weter I	
	density, greyish white CHALK with is in the interval is the in	45	10 85.58	45.01 - 45.09 44.30 - 45.80	D RC	100 120										
Fracture set 1: horizo	ontal to 20 degrees medium to	45														
	r and undulating, slightly rough and black specks, orange staining,	45	24 85.44										97			
	nm) with brown day. Fracture set 2:											4	41			
	dium to widely spaced											;	35			
	ndulating and planar slightly rough, nm) with brown day. Fracture set 3:															
70 degrees to vertical	l, planar slighUy rough, with															
	s, orangish brown staining, rarely prown and orange day. (Grade:															
B3/4)	Sowin and Grange day. (Grade.	l p p		45.80 - 46.08	с	100										
New Pit Chalk Forma				+5.00 - +0.00		100										
	sity, light greyish white locally gritty nin greenish grey laminations (marl															
wisps, burrows and z	coophycos streaks), and rare orange															
	s). Fracture set 1: horizontal to 20 spaced to widely spaced															
(10/320/920mm), und	ulating and planar, slightly rough												_			
	quent black specks, rare grey and onally infilled (0/2/10mm) with soft			45.80 - 47.30	RC	120							00 78			
	set 2: 30 to 60 degrees, very dosely	T T										6	55			
	ced (10/350/1210mm), undulating bugh and smooth, with frequent	fr r-														
	onally infilled (0/2/5mm) with brown															
	70 degrees to vertical, undulating															
	ough and smooth, with frequent with orange staining, locally infilled															
(0/2/4mm) with brown	n day. (Grade: C3/4)															
[Holywell Nodular Ch 45.10 - 45.16m : D	alk Formation] Irillin disturbed recovered non-intact.															
Very thinly bedded gr	reenish grey marl seam. Gun															
Gardens Main Marl? Hol ell Nodular Ch	alk Formation															
Very weak, high dens	sity, light greyish white locally gritty	() (9.	14)													
	nin greenish grey laminations (marl coophycos streaks), and rare orange		,													
staining (sponge bed	s). Fracture set 1: horizontal to 20	' l'														
	spaced to widely spaced dulating and planar, slightly rough															
and smooth, with free	quent black specks, rare grey and			47.30 - 48.80	RC	120							90 52			
	onally infilled (0/2/10mm) with soft set 2: 30 to 60 degrees, very dosely												52			
spaced to widely spa	ced (10/350/1210mm), undulating			48.11 -48.46	c	100										
	ough and smooth, with frequent onally infilled (0/2/5mm) with brown			40.11 -40.40	C	100										
	70 degrees to vertical, undulating															
	ough and smooth, with frequent with orange staining, locally infilled															
(0/2/4mm) with brown	n day. (Grade: C3/4)	T T														
[Holywell Nodular Ch 45 65 - 45 72m · Fre	alk Formation] quent interwoven thin darlr green marl															
	equent subrounded and rounded chalk															
47.30 - 47.55m · D	intraclasts (up to 40mm). rilling disturbed, recovered non-intact.															
48.50 - 48.65m : D	rilling disturbed, recovered non-intact.															
	- 48.80m : Assumed zone of core loss. rilling disturbed, recovered non-intact.															
													92			
												6	58			
				48.80 - 50.30	RC	120							'			
		r r														
			1													
Stratum depths mea	sured along borehole axis.	I		-!			· · · · ·					II				
	may be subject to seasonal, tidal and	other fluctua	tions and s	should not be	taken a	as cor	nstant.									
		Exploratory														

Client: High Speed 2 (HS2) Ltd Ground Level: 130.68 mOD Scale: 1 Engineer: High Speed 2 (HS2) Ltd Log Status: FII Date Started: 14/12/2016 Orientation: deg. Print Date: 21/11/2 Date Completed: 21/12/2016 Inclination: 90 deg. Final Depth: 56.3	•barn ritchies	E	BOF	REI	HO	LE L	00	G						ML	043	nole N 3-RC 11 of	007	
Status 14/12/2016 Orientation: og, Unitable Complete: 21/12/2016 Total Complete: 21/12/2016 Total Complete: 21/12/2016 Total Complete: 21/12/2016 Total Complete: 0.000, Unitable Complete: Total Complete: Unitable Complete: 0.000, Unitable Complete: Total Complete: Unitable Complete: 0.000, Unitable Complete: Unitable Complete:	Project No: 1G0 Client: Higt	63 -AAZ. n Speed 2 (HS2) Ltd				Co-ordina	ites:	em:		49312 19904	9.41 m 7.51 m	۱N	Chec Appro Scale	ked I oved :	By: By:		I	D PMc 1:2
Sintem Description Law Type Web Rec: Bows Tail Text Recur Units Rec: Bows Bows Bows	Date Started: 14/1	2/2016										•	Print	Date	:		21/11	/20
Statund de verkoed trick grey met lamination (Bmm).	Stratun	n Description	Legend	(Thick- ness)	Level (m)			Dia	Rec	Blows	u Testir Test	ng Test R	esult L	Jnits	TCR SCR RØD	lfave	Weter	W Bac
53.80 - 54.39m : (3 no.) Conjugate 60 degree fractures. planar slightly rough, milled (-2mm) with brown clay. Thicktylas-mtm atted ""g-reg Sht groes - n=-Slitymca: 11,	Recovered as: suba Gravel is weak, me	ngular fine t0 medium GRAVEL. dium density, light greyish white.													65			
53.80 - 54.39m : (3 no.) Conjugate 60 degree fractures, plenar slightly rough, intilded (-2nm) with brown clay. 53.31 - 53.36 D 100 100 File 53.30 - 54.39m : (3 no.) Conjugate 60 degree fractures, plenar slightly rough, intilded (-2nm) with brown clay. 53.31 - 53.36 D 100 100 File 53.30 - 54.60 RC 120 100 100 100 Statum classes, were dated in green signed and rare or ange stating (sponge beds). Fracture set 1: horizontal to 20 Example Example Example Example Stratum depths measured along borehole axis. Groundwater levels may be subject to seasonal, itidal and other fluctuations and should not be taken as constant. Stratum classes and should not be taken as constant.																		
53.80 - 54.39m : (3 no.) Conjugate 60 degree fractures, planar slightly rough, inti/led (<2mm) with brown clay.						51.60 - 53.30	RC	120							74	200		
planar slightly rough, inti/led (<2mm) with brown clay.						53.31-53.36	D	100										
[Holywell Nodular Chalk Formation] 54.38 - 54.39m : Thick/ Laminated re "sh reen si mark. Very weak, high density, light greyish white locally gritty CHALK locally with thin greenish grey laminations (marl wisps, burrows and zoophycos streaks), and rare orange staining (sponge beds). Fracture set 1: horizontal to 20 degrees, very dosely spaced to widely spaced Stratum depths measured along borehole axis. Groundwater levels may be subject to seasonal, tidal and other fluctuations and should not be taken as constant.						53.30 - 54.60	RC	120							52			
Groundwater levels may be subject to seasonal, tidal and other fluctuations and should not be taken as constant.	[Holywell Nodular Chalk F 54.38 - 54.39m : Thick/ lar Very weak, high density, lig CHALK locally with thin gre wisps, burrows and zooph staining (sponge beds). Fr	ormation] <u>minated</u> re "sh reen si marl.] pht greyish white locally gritty eenish grey laminations (marl ycos streaks), and rare orange acture set 1: horizontal to 20		JII - - - - - - - - -	=													
Further details given on appended 'Borehole Information Sheer.	Groundwater levels may l Explanation of symbols and	be subject to seasonal, tidal and abbreviations given in 'Key to l	Explorate			hould not be t	aken a	is con:	stant.									

•barn ritchies	E	BORE	HO	LE L	00	3						Μ	L043	hole N 3-RC t 12 of	007	
Project Name:	Amersham Tunnel to Calvert			Survey Gr Co-ordinat		em:)SGB 29.41 r	nF		e Typ cked			R	O+RC DD
Project No:	1G063-AAZ.				.03.				47.51 r			roved	•		I	PMcG
Client:	High Speed 2 (HS2) Ltd			Ground Le	evel:			1	30.68 r	nOD	Scal					1:25
Engineer:	High Speed 2 (HS2) Ltd										-	Stat				FINAL
Date Started: Date Completed:	14/12/2016 21/12/2016			Orientation Inclination					c 90 c	•		t Date al Dep				1/2017 6.30m
Date Completed.	21/12/2010	Dep	th			lina (Corina	andhS		•				If min	-	
:	Stratum Description	Legend (Thio nes (m	s) Level	Depth (m)	Туре		Rec	Blows (mins)	Test	Test I	Result	t Unit	SCR s RQU	lfmin Ifave D(mna)k	Weter I	Wel Backfi
and smooth, with free black staining, occass brown clay. Fracture spaced to widely spa and planar, slightly rn black specks, occasis clay. Fracture set 3: and planar, slightly rn black specks, locally (0/2/4mm) with brown [Holywell Nodular Ch 55.20-55 55.40 - 56.10m Mytild 55.80 - 55.93m : F greyish white c 56.20 - 56.30m : I Recovered as: sube is weak, medium	dulating and planar, slightly rough equent black specks, rare grey and ionally infilled (0/2/10mm) with soft set 2: 30 to 60 degrees, very closely iced (10/350/1210mm), undulating ough and smooth, with frequent onally infilled (0/2/5mm) with brown 70 degrees to vertical, undulating ough and smooth, with frequent with orange staining, locally infilled n clay. (Grade: C3/4) talk Formation] .70m: With frequent subrounded chalk intraclasts (up 10 30mm). n: Frequent locally abundant Mytiloides irrequent subrounded and rounded light thalk intraclasts (up 10 40mm) within an orangish white chalk matrix. Drilling disturbed, recovered non-intact. angular fine to coarse GRAVEL. Gravel density, light greyish white with orange stainin.			55.17-55.42	c RC	100							100 76 73	NI 200 920		
Stratum denthe moo	sured along borehole axis.															
	may be subject to seasonal, tidal and															

,,.b	a ri ritchies			BO	REH	OLE	IN	FOF	RM	AT		ON	SH	EET			Boreh ML043 Shee		007
Project N Project N Client: Engineer:	0:		1G063 - DD High	m Tunnel AAZ Speed 2 (eed 2 (HS2	HS2) Ltd				Co-c	ey G ordina und L	ates			OSGB 493129.41 199047.51 130.68	mN		ed By: /ed By: Status:		RO+RC PMcG FINAL 21/11/2017
Date Sta Date Cor			14/12/20 21/12/20							ntatio natior					deg. deg.	Final I	Depth:		56.30m
From <ml< td=""><td></td><td></td><td>Tvoe IP</td><td>Start</td><td>End 14/1212016</td><td>Plant</td><td></td><td>elated Explo Barrel</td><td></td><td>ole Inf Il Bit</td><td>form</td><td>Ria</td><td>Crew</td><td></td><td>oaaer</td><td>- La c</td><td></td><td>Remark</td><td>S</td></ml<>			Tvoe IP	Start	End 14/1212016	Plant		elated Explo Barrel		ole Inf Il Bit	form	Ria	Crew		oaaer	- La c		Remark	S
0.00 1.20 15.00	1.20 15.00 56.30)	RO RC	14/1212016 14/1212016 14/1212016	14/12/2016 21/1212016	hsulated diggin; Cornacchio 305 Cornacchio 305	y 10015	T6-146	Dra Pi	ig bit CD		H.G	lover lover	н	Moulsley Glover).Allen	Ro	pection pit taiy open h taiy cored	ole	
Date	Time		Bolir Deoth <ml< td=""><td>11-Drillina Prio Casinami</td><td>ress Depth Water (m)</td><td>Remark</td><td></td><td>Deoth <m< td=""><td></td><td>Diam</td><td>eter</td><td>by Deoth</td><td>narks</td><td>Deoth <m< td=""><td></td><td></td><td>neter bv D</td><td>eoth Remark</td><td></td></m<></td></m<></td></ml<>	11-Drillina Prio Casinami	ress Depth Water (m)	Remark		Deoth <m< td=""><td></td><td>Diam</td><td>eter</td><td>by Deoth</td><td>narks</td><td>Deoth <m< td=""><td></td><td></td><td>neter bv D</td><td>eoth Remark</td><td></td></m<></td></m<>		Diam	eter	by Deoth	narks	Deoth <m< td=""><td></td><td></td><td>neter bv D</td><td>eoth Remark</td><td></td></m<>			neter bv D	eoth Remark	
14/1212016 14/1212016 15/1212016 15/1212016 16/1212016 16/1212016 19/1212016 19/1212016	6 07:30 6 18:00 6 07:30 6 18:00 6 07:30 6 07:30 6 07:30 6 07:30 6 07:30 6 08:00 6 18:00))))))	0.00 22.30 22.30 30.80 30.80 44.30 44.30 56.30	0.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00	Diy 21.50 22.20 23.37 27.75 27.69 27.76 27.60	start of shift End of shill start of shift End of shill start of shift End of shill start of shift End of shill	5	15.00 56.30	1	68 46		Ken		15.00	16			Kellark	5
20/1212016 20/1212016 2111212016	18:00)	56.30 0.00 0.00	15.00 0.00 0.00	27.70 Diy Diy	start of shift End of shill start of shift		From (m)) To	(m)	Vo	lume (Iltres)	wat	er Added Re		Remarks			
21/1212016	5 18:00		0.00	0.00 Related Rer	Diy	End of shill				Chiselli							Flush Detail		
From (m) 1.20 32.50	To (m) 15.00 43.00	Advan	ced SW cas		Remarks due to weak cha	alk		From (m)) To	(m)	Dui	ration (hh:mm)	Tool	From (m) 7.00 15.00	To (m) 15.00 56.30	Returns (70- 70 0		aler	Colour 1v11ite o returns
Dale	Strike(m)	caalrci(n	wate	er Strikes Depth (m) Seale	sd(m) R	emarks	Type	Moni Pipe ID From(i 1 0.00		n) DB (ioe Work Pipe Type Plain	Remarks	From (m) 0.00	<u>To (m)</u> 0.20	Back legen 909		Desa ding cov	ption
							SP S1	1 33.00	0 43.0	0 5	sults	Slotted		0.20 0.50 0.80 30.50 32.50 43.00 45.00	0.50 0.80 30.50 32.50 43.00 45.00 56.30	906 902 904 903 902 903 903 904	Concre Gravel Grout Bentor Gravel Benton Grout	ete nite	
Depth (ml	Туре І	N value	Casino Ci	m ater (m)	SWPen(mm Blo	ws1 PenHmm)	Blows	2 Pen2(mm)	Blows3	Pen3	(mn	n) Blows4	Pen4(mm)	Blows5 Fen	5(mm) Blo	ows6 Per	16(mm)	lammei	E. Ratio%
						Reason for H		rmination	Reach	ed so	che	duled de	poth						
						Reason for Ho	oleTe	rmination:	Reach	ied so	che	duled de	pth						
					sonal, tidal a	and other fluct	tuatio	ns and sho	ould no	t be t	ake	en as cor	nstant.				DAM	P Info	06/04/2017