

15th April 2020

Our ref: GE18606/SA02/200415



Wayne Smith
Bellway Homes Limited (Wessex)
Embankment Way
Castleman Business Centre
Ringwood
Hampshire
BH24 1EU

Dear Wayne,

RE: New Barn Lane, North Bersted – Groundwater Monitoring Results

Further to the completion of the groundwater monitoring programme at the above site, we write to provide a summary of the works undertaken and the compiled groundwater monitoring results for the site.

In total we undertook the following exploratory holes/investigation points on the 11th October 2019:

- Construction of 6No. dynamic sampler boreholes to depths of up to 3-5m bgl;
- Installation of groundwater monitoring wells within each borehole to facilitate return monitoring over the 2019-2020 winter period. Three wells (WS01, WS04 and WS05) were installed with a plain section and seal from ground level to 1m bgl and slotted screened section from 1m to 3m bgl or the top of the Chalk. The remaining three wells (WS02, WS03, and WS06) were installed with plain sealed section from ground level to the top of the Chalk and slotted screen section to depths between 4.3m to 5m bgl. The objective of this approach with respect to well installations within different strata was to determine if there is any variation in groundwater conditions within the River Terrace Deposits and underlying Chalk, or whether the geological units were in continuity.

Groundwater monitoring within the borehole standpipes was subsequently undertaken on eleven occasions between October 2019 and March 2020 on the following dates:

- 11th October 2019;
- 24th October 2019;
- 7th November 2019;
- 21st November 2019;
- 12th December 2019;
- 9th January 2020;
- 23rd January 2020;
- 6th February 2020;
- 20th February 2020;
- 5th March 2020;
- 19th March 2020.

Figure 1 presents the site's location and Figure 2 presents the borehole monitoring locations.

The boreholes were positioned to provide a broad coverage of the site.

Geo-Environmental Services Ltd
Unit 7 Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex BN6 9GL
+44(0)1273 832972 www.gesl.net

Environmental Consultants | Geotechnical Engineers | Site Investigations

Geo-Environmental Services Ltd incorporated in England number 3214980 VAT number 679544479



Ground Conditions

The ground conditions encountered during the investigation were broadly consistent with the anticipated published sequence of strata. In summary, ground conditions typically comprised a mantle of Topsoil overlying River Terrace Deposits which in turn overlay undifferentiated chalk of the White Chalk Subgroup.

Topsoil was encountered to a maximum depth of 0.30m bgl and typically consisted of grass over dark brown silty clay with frequent roots and rootlets.

Soils inferred to be River Terrace Deposits were encountered from beneath the Topsoil to depths of between 1.80m bgl and 3.60m bgl. The deposits were of a mixed composition and comprised sandy clay, clayey sand, sandy gravel, sandy gravelly clay and gravelly clay.

Beneath the River Terrace Deposits soils inferred to be of the White Chalk Subgroup were encountered within WS01, WS02, WS03 and WS06, to the base of the exploratory holes, i.e. 5m bgl. The deposits were found to comprise structureless off white putty like weak slightly granular chalk. Within WS02 chalk was found to overlie the River Terrace Deposits, this chalk was considered to be naturally reworked chalk.

For more detailed descriptions of the ground conditions, reference should be made to the exploratory hole logs enclosed in Appendix A.

Obstructions

No obstructions were encountered within the intrusive investigation works undertaken. The presence of obstructions elsewhere on site cannot be completely discounted.

Groundwater Encountered During Drilling

Groundwater was encountered within the exploratory holes during the investigation as detailed in Table 1 below.

Location	Depth of monitoring well installation (m bgl) and response zone strata	Groundwater depth during drilling after 20 minutes (m bgl)	Groundwater depth at the end of Fieldworks (m bgl)
WS01	1.80 River Terrace Deposits	3.00	1.50
WS02	5.00 Chalk	2.00	1.30
WS03	5.00 Chalk	Dry	1.52
WS04	3.00 River Terrace Deposits	Dry	1.56
WS05	3.00 River Terrace Deposits	Dry	1.65
WS06	4.30 Chalk	3.10	2.50

Table 1 Summary of Ground Depths During the Investigation (11th October 2019)

Groundwater Monitoring Results

The results of the groundwater monitoring are summarised in Table 2.

Location and response zone strata	Minimum depth to groundwater (m bgl)	Maximum depth to groundwater (m bgl)
WS01 River Terrace Deposits	0.23	1.50
WS02 Chalk	0.00	1.30
WS03 Chalk	0.33	1.52
WS04 River Terrace Deposits	0.03	1.56
WS05 River Terrace Deposits	0.10	1.65
WS06 Chalk	0.37	2.50

Table 2 Summary Of Groundwater Monitoring (October 2019 to March 2020)

The full results of the groundwater monitoring are presented within Appendix B.

Closure

We trust we have interpreted your request correctly and provide sufficient information for your current requirements. If you have any questions or queries in relation the information provided at this stage, please contact the undersigned.

Yours sincerely
For and on Behalf of Geo-Environmental



SHAUN ARMITAGE BSc (Hons), FGS
Senior Consulting Engineer
shaun.armitage@gesl.net

Enc Figure 1 – Site Location Plan
 Figure 2 – Exploratory Hole Location Plan

Appendix A – Exploratory Hole Logs
Appendix B – Groundwater Monitoring Results



Figures





Project:	Newbarn Lane, North Bersted, PO21 5DN			Title	Site Location Plan	
Client:	Bellway Homes Ltd (Wessex)			Geo-Environmental Services Ltd Unit 7 Danworth Farm, Cuckfield Road Hurstpierpoint, West Sussex BN6 9GL +44(0)1273 832972 www.gesl.net		
Ref No:	GE18606	Revision:	0			
Drawn:	FG	Date:	08/10/2019			
Figure:	1	Scale:	Not To Scale			



Geo-Environmental



Geo-Environmental



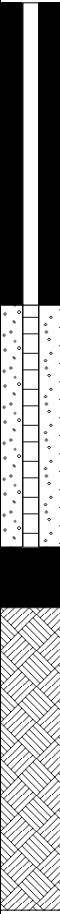
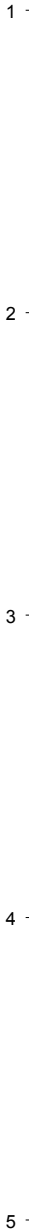
Project:	Newbarn Lane, North Bersted, PO21 5DN			Title	Exploratory Hole Locations	
Client:	Bellway Homes Ltd (Wessex)			Geo-Environmental Services Ltd Unit 7 Danworth Farm, Cuckfield Road Hurstpierpoint, West Sussex BN6 9GL +44(0)1273 832972 www.gesl.net  Geo-Environmental		
Ref No:	GE18606	Revision:	0			
Drawn:	FG	Date:	14/10/2019			
Figure:	2	Scale:	Not To Scale			



APPENDIX A

Exploratory Hole Logs

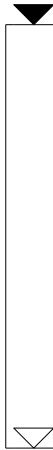
 Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net		Borehole Log				Borehole No. WS01 Sheet 1 of 1	
Project Name: New Barn Lane, North Bersted		Project No. GE18606		Co-ords: 491730E - 100939N		Hole Type WLS	
Location:				Level:		Scale 1:25	
Client: Bellway Homes (Wessex)				Dates: 11/10/2019		Logged By FG	

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30		Grass over dark brown silty CLAY with frequent roots and rootlets and occasional flint gravel TOPSOIL		
		0.50	PP	2.0kg/cm2	0.70		Firm to stiff brown slightly sandy CLAY with frequent rootlets and occasional flint gravel RIVER TERRACE DEPOSITS		
		1.00	PP	1.8kg/cm2	1.10		Firm to stiff brown and grey mottled slightly sandy CLAY with occasional flint gravel RIVER TERRACE DEPOSITS		
		1.40	PP	2.2kg/cm2	1.50		Firm to stiff orange brown and grey mottled slightly sandy laminated CLAY RIVER TERRACE DEPOSITS		
					1.80		Firm to stiff orange brown and grey mottled very sandy CLAY with frequent flint gravel RIVER TERRACE DEPOSITS		
					3.00		Recovered as structureless off white putty like weak slightly granular CHALK. WHITE CHALK SUBGROUP		
							Flint cobbles		
							End of Borehole at 3.00m		

Casing		Water Strikes (mbgl)		Chiselling (mbgl)		Remarks
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to	
		3.00	3.00			



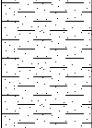
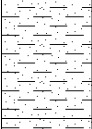
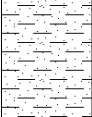
 Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net		Borehole Log				Borehole No. WS02 Sheet 1 of 1	
Project Name: New Barn Lane, North Bersted		Project No. GE18606		Co-ords: 491774E - 100899N		Hole Type WLS	
Location:				Level:		Scale 1:25	
Client: Bellway Homes (Wessex)				Dates: 11/10/2019		Logged By FG	

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30		Grass over dark brown silty CLAY with frequent roots and rootlets TOPSOIL	1	
		0.50	PP	1.6kg/cm2			Firm brown slightly sandy CLAY with frequent rootlets. Sand is fine RIVER TERRACE DEPOSITS		
					0.80				
		1.00	PP	2.0kg/cm2			Firm brown and grey mottled slightly gravelly CLAY with occasional rootlets. Gravel is fine to medium sub angular to sub rounded of flint RIVER TERRACE DEPOSITS		
					1.10		Firm brown and grey mottled gravelly CLAY. Gravel is fine to medium sub angular to sub rounded of chalk RIVER TERRACE DEPOSITS		
					1.40		Firm to stiff orange and grey mottled slightly sandy CLAY. Sand is fine RIVER TERRACE DEPOSITS	2	
		1.50	PP	2.2kg/cm2					
					1.70		Firm to stiff orange and grey mottled sandy CLAY with frequent chalk gravel RIVER TERRACE DEPOSITS		
		2.00	PP	2.3kg/cm2					
					2.20		Light brown and off white gravelly medium SAND. Gravel is fine to coarse sub angular to sub rounded of chalk RIVER TERRACE DEPOSITS		
				2.70		Recovered as structureless off white putty like weak slightly granular CHALK RE-WORKED WHITE CHALK SUBGROUP	3		
				3.20		Light grey slightly clayey gravelly fine SAND. Gravel is fine to medium sub angular to sub rounded of chalk RIVER TERRACE DEPOSITS			
				3.70		Recovered as structureless off white putty like weak slightly granular CHALK WHITE CHALK SUBGROUP			
				5.00		End of Borehole at 5.00m		5	

Casing		Water Strikes (mbgl)		Chiselling (mbgl)		Remarks
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to	
		3.40	2.00			



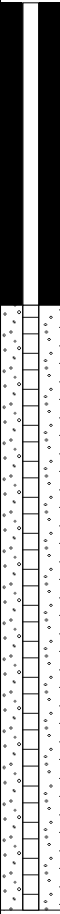
 Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net		Borehole Log				Borehole No. WS03 Sheet 1 of 1	
Project Name: New Barn Lane, North Bersted		Project No. GE18606		Co-ords: 491664E - 100946N		Hole Type WLS	
Location:				Level:		Scale 1:25	
Client: Bellway Homes (Wessex)				Dates: 11/10/2019		Logged By FG	

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.25			Grass over dark brown silty CLAY with frequent roots and rootlets TOPSOIL	1
		0.50	PP	2.4kg/cm2	0.70			Stiff brown slightly sandy CLAY with frequent rootlets. Sand is fine RIVER TERRACE DEPOSITS	
		1.00	PP	2.5kg/cm2	1.10			Stiff brown and occasionally grey mottled slightly sandy CLAY. Sand is fine RIVER TERRACE DEPOSITS	
		1.50	PP	2.3kg/cm2				Firm to stiff orange and grey mottled sandy CLAY with occasional flint and chalk gravel RIVER TERRACE DEPOSITS	
		2.00	PP	2.3kg/cm2	2.30			<u>Flint cobbles</u>	
		2.50	PP	1.8kg/cm2	2.70			Firm to stiff light brown and grey mottled slightly sandy CLAY. Sand is fine RIVER TERRACE DEPOSITS	
		3.00	PP	1.5kg/cm2	3.00			<u>Flint and chalk cobbles</u>	
					3.20			Recovered as structureless off white/light brown putty like very weak granular CHALK with occasional flint gravel WHITE CHALK SUBGROUP	
								Recovered as structureless off white putty like weak slightly granular CHALK with rare flint gravel WHITE CHALK SUBGROUP	
					5.00			End of Borehole at 5.00m	

Casing		Water Strikes (mbgl)		Chiselling (mbgl)		Remarks
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to	



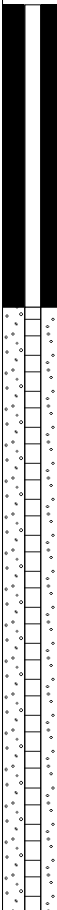
 Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net		Borehole Log				Borehole No. WS04 Sheet 1 of 1	
Project Name: New Barn Lane, North Bersted		Project No. GE18606		Co-ords: 491730E - 100892N		Hole Type WLS	
Location:				Level:		Scale 1:25	
Client: Bellway Homes (Wessex)				Dates: 11/10/2019		Logged By FG	

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30		 Grass over dark brown silty CLAY with frequent roots and rootlets TOPSOIL	1	
		0.50	PP	2.0kg/cm2	0.80		 Firm to stiff brown slightly sandy CLAY with frequent rootlets. Sand is fine RIVER TERRACE DEPOSITS		
		1.00	PP	1.8kg/cm2	1.40		 Firm to stiff brown slightly sandy CLAY RIVER TERRACE DEPOSITS		
					2.10		 Orange and grey mottled slightly clayey fine SAND RIVER TERRACE DEPOSITS	2	
					2.30		 Light brown and grey mottled slightly clayey gravelly fine SAND. Gravel is fine to medium sub angular to sub rounded of chalk RIVER TERRACE DEPOSITS		
					2.90		 Brown and occasionally grey mottled slightly clayey fine SAND RIVER TERRACE DEPOSITS		
					3.00		 Light brown clayey fine SAND with frequent chalk gravel RIVER TERRACE DEPOSITS	3	
							 Light brown very gravelly fine SAND. Gravel is fine to coarse sub angular to sub rounded of flint RIVER TERRACE DEPOSITS		
							End of Borehole at 3.00m		
									4
								5	

Casing		Water Strikes (mbgl)		Chiselling (mbgl)		Remarks
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to	



 Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net		Borehole Log			Borehole No. WS05 Sheet 1 of 1	
Project Name: New Barn Lane, North Bersted		Project No. GE18606		Co-ords: 491657E - 100881N		Hole Type WLS
Location:				Level:		Scale 1:25
Client: Bellway Homes (Wessex)				Dates: 11/10/2019		Logged By FG

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30		 Grass over dark brown silty CLAY with frequent roots and rootlets TOPSOIL		
		0.50	PP	1.8kg/cm2			 Firm brown slightly sandy CLAY with occasional rootlets RIVER TERRACE DEPOSITS		
		1.00	PP	1.5kg/cm2	1.10		 Firm orange and grey mottled very sandy CLAY. Sand is fine RIVER TERRACE DEPOSITS	1	
		1.50	PP	0.5kg/cm2	1.60		 Firm orange grey and orange mottled slightly sandy CLAY RIVER TERRACE DEPOSITS		
		2.00	PP	2.2kg/cm2			 Firm orange grey and orange mottled sandy CLAY RIVER TERRACE DEPOSITS	2	
		2.50	PP	1.5kg/cm2	2.60		 Firm orange grey and orange mottled sandy CLAY RIVER TERRACE DEPOSITS		
					3.00		End of Borehole at 3.00m	3	
								4	
								5	

Casing		Water Strikes (mbgl)		Chiselling (mbgl)		Remarks
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to	



 Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net		Borehole Log				Borehole No. WS06 Sheet 1 of 1	
Project Name: New Barn Lane, North Bersted		Project No. GE18606		Co-ords: 491730E - 100829N		Hole Type WLS	
Location:				Level:		Scale 1:25	
Client: Bellway Homes (Wessex)				Dates: 11/10/2019		Logged By FG	

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.25		 Grass over dark brown silty CLAY with frequent roots and rootlets and occasional flint gravel TOPSOIL		
		0.50	PP	2.3kg/cm2			 Firm brown slightly sandy CLAY with frequent rootlets. Sand is fine RIVER TERRACE DEPOSITS		
					0.75				
		1.00	PP	2.2kg/cm2			 Firm orange brown and grey mottled slightly sandy CLAY. Sand is fine RIVER TERRACE DEPOSITS	1	
					1.10				
		1.40	PP	1.5kg/cm2			 Firm orange and grey mottled very sandy CLAY. Sand is fine RIVER TERRACE DEPOSITS		
					1.65				
					2.20				
					2.40		 Light brown and grey mottled slightly clayey fine SAND RIVER TERRACE DEPOSITS	2	
							 Light grey/ off white sandy fine to medium sub angular to sub rounded chalk GRAVEL. Sand is medium RIVER TERRACE DEPOSITS		
							 Firm light grey slightly sandy slightly gravelly CLAY. Gravel is fine to medium sub angular to sub rounded of chalk and sand is fine RIVER TERRACE DEPOSITS		
		3.00	PP	1.0kg/cm2		3.00		 Firm light grey sandy CLAY. Sand is fine RIVER TERRACE DEPOSITS	3
				3.50					
				3.60		 Light brown slightly clayey sandy fine to coarse sub angular to sub rounded flint and chalk GRAVEL. Sand is fine RIVER TERRACE DEPOSITS			
						 Recovered as structureless off white putty like very weak slightly granular CHALK WHITE CHALK SUBGROUP	4		
					5.00		End of Borehole at 5.00m	5	

Casing		Water Strikes (mbgl)		Chiselling (mbgl)		Remarks
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to	
		3.10	3.10			Borehole collapsed to 4.3m bgl



The background of the page features a series of overlapping, wavy blue shapes that create a sense of movement and depth. These shapes are in various shades of blue, from a light, airy blue to a more solid, medium blue. They are positioned primarily on the right side of the page, with some extending towards the center.

APPENDIX B

Groundwater Monitoring Results

Project: New Barn Lane, North B
Ref: GE18606
Client: Bellway Homes (Wessex)

Location	Date	GWL (m bgl)
WS01	11/10/19	1.50
WS02	11/10/19	1.30
WS03	11/10/19	1.52
WS04	11/10/19	1.56
WS05	11/10/19	1.65
WS06	11/10/19	2.50
WS01	24/10/19	0.53
WS02	24/10/19	0.60
WS03	24/10/19	0.90
WS04	24/10/19	0.81
WS05	24/10/19	0.80
WS06	24/10/19	1.04
WS01	07/11/19	0.32
WS02	07/11/19	0.30
WS03	07/11/19	0.50
WS04	07/11/19	0.40
WS05	07/11/19	0.60
WS06	07/11/19	0.62
WS01	21/11/19	0.33
WS02	21/11/19	0.35
WS03	21/11/19	0.55
WS04	21/11/19	0.66
WS05	21/11/19	0.40
WS06	21/11/19	0.63
WS01	12/12/19	0.30
WS02	12/12/19	0.39
WS03	12/12/19	0.45
WS04	12/12/19	0.46
WS05	12/12/19	0.39
WS06	12/12/19	0.64
WS01	09/01/20	0.30
WS02	09/01/20	0.48
WS03	09/01/20	0.47
WS04	09/01/20	0.60
WS05	09/01/20	0.33
WS06	09/01/20	0.75
WS01	23/01/20	0.30
WS02	23/01/20	0.32
WS03	23/01/20	0.50
WS04	23/01/20	0.52
WS05	23/01/20	0.34
WS06	23/01/20	0.61
WS01	06/02/20	0.33
WS02	06/02/20	0.40
WS03	06/02/20	0.50
WS04	06/02/20	0.46
WS05	06/02/20	0.25
WS06	06/02/20	0.57

Project: New Barn Lane, North B
Ref: GE18606
Client: Bellway Homes (Wessex)

Location	Date	GWL (m bgl)
WS01	20/02/20	0.24
WS02	20/02/20	0.00
WS03	20/02/20	0.38
WS04	20/02/20	0.03
WS05	20/02/20	0.22
WS06	20/02/20	0.37
WS01	05/03/20	0.23
WS02	05/03/20	0.00
WS03	05/03/20	0.33
WS04	05/03/20	0.08
WS05	05/03/20	0.10
WS06	05/03/20	0.44
WS01	19/03/20	0.30
WS02	19/03/20	0.10
WS03	19/03/20	0.68
WS04	19/03/20	0.63
WS05	19/03/20	0.53
WS06	19/03/20	0.70
Max values		2.50
Min Vaules		0.00

Project: New Barn Lane, North Bersted
Ref: GE18606
Client: Bellway Homes (Wessex)



Location	Depth of monitoring well installation (m bgl) and response zone strata	Date & Depth (m bgl)												Max Value	Min Value
		Groundwater depth during drilling after 20 minutes 11/10/2019	Groundwater depth at the end of Fieldworks 11/10/2019	24/10/19	07/11/19	21/11/19	12/12/19	09/01/20	23/01/20	06/02/20	20/02/20	05/03/20	19/03/20		
WS01	1.80 River Terrace Deposits	3.00	1.50	0.53	0.32	0.33	0.30	0.30	0.30	0.33	0.24	0.23	0.30	3.00	0.23
WS02	5.00 Chalk	2.00	1.30	0.60	0.30	0.35	0.39	0.48	0.32	0.40	0.00	0.00	0.10	2.00	0.00
WS03	5.00 Chalk	Dry	1.52	0.90	0.50	0.55	0.45	0.47	0.50	0.50	0.38	0.33	0.68	1.52	0.33
WS04	3.00 River Terrace Deposits	Dry	1.56	0.81	0.40	0.66	0.46	0.60	0.52	0.46	0.03	0.08	0.63	1.56	0.03
WS05	3.00 River Terrace Deposits	Dry	1.65	0.80	0.60	0.40	0.39	0.33	0.34	0.25	0.22	0.10	0.53	1.65	0.10
WS06	4.30 Chalk	3.10	2.50	1.04	0.62	0.63	0.64	0.75	0.61	0.57	0.37	0.44	0.70	3.10	0.37