

5 June 2015

Your ref:
Planning ref:
Our ref: J15109/DB/c01

Jason Shakespeare
BDW Southampton
Tollbar House
Tollbar Way
Hedge End
Southampton
Hampshire
SO30 2UH



Dear Mr Shakespeare,

RE: LAND NORTH OF STATION ORAD, HAYLING ISLAND
RE-PURCHASE GROUND INVESTIGATION LETTER REPORT FOR THE
PROPOSED RESIDENTIAL REDEVELOPMENT

Further to instruction from BDW Southampton, we have carried out a pre-purchase site walkover, desk study and ground investigation at the above site. This letter provides our report on the works carried out and is provided in accordance with our standard term conditions and limitations.

Scope of Work

A site walkover survey, pre-purchase desk study and pre-purchase ground investigation has been carried out to provide information to assist with the design of new spread foundations, pavements, soakaways and floor slabs and to facilitate inspection of soils and recovery of a samples for laboratory geotechnical and contaminated land testing.

In accordance with current best practice the desk study has been used to guide the scope of the ground investigation and the findings of both the desk study and the ground investigation have been used to formulate a conceptual model for the site and facilitate a preliminary qualitative risk assessment. This assessment has been used as the basis of a discussion of the implications of any identified issues of potential concern with regards to ground contamination in order to determine the requirement for further assessment or remedial action as part of the redevelopment of this site for residential purposes.

Site Description

The northern part of the site comprises a roughly rectangular and sensibly level agricultural field that measures approximately 200m by 150 m and at the time of investigation was lain fallow with remnants of various previous crops including oil seed and maize, with variable weeds and grass coverage. The southern part of the site comprises a further rectangular area with maximum dimensions of approximately 40 m by 30 m, which is currently occupied by long rough grass together with various stockpiles of discarded building materials and a series of concrete filled trenches that would appear to the foundations to a development that was started but not completed.

The eastern site boundary is formed by a shallow ditch, beyond which are the variable site boundaries of the adjoining residential properties, comprising fences, hedges and open garden areas. The western boundary is formed by a mature hedge, beyond which is a small commercial / light industrial business estate formed on the former station and railway sidings of the Hayling Island railway terminus.

The northern boundary to the site is formed by further areas of open agricultural land, whilst the southern boundary to the site is more complex. The eastern part of the southern boundary is formed by a shallow ditch, beyond which is a former commercial yard area which, at the time of investigation was in the early stages of being redeveloped through the construction of five new houses together with areas of hardstanding for car parking and areas of private domestic garden.

The central southern part of the site boundary is formed by the extent of the adjoining builder's merchants building and security fenced yard area. The central western part of the site boundary is formed by Station road itself, which also has a heavily overgrown access gateway into the southern part of the site where the stockpiled discarded building materials are located. The western part of the southern site boundary is formed by the extent of rear gardens to adjoining residential properties, with this boundary formed of a mixture of hedges, recent and older sections of fencing.

The site is sensibly level and absent of mature vegetation other than the various remnant crops and grass. There are a number of substantial mature and semi-mature trees within the various parts of the southern, eastern and western site boundaries.

Site History and Environmental Site Setting Summary

A review of publically available historical maps indicates that the site has not been previously developed and has been in use as open agricultural land since at least 1896, the date of the first map studied. By that time the railway is shown to have been present to the west of the site, in the area now occupied by the light industrial / commercial buildings, whilst the area now occupied by the builder's merchants to the south is shown to have been occupied by the town gasworks.

The gas works to the south is shown to have undergone several periods of expansion and the construction of several fairly substantial gas holders on the site to the south before subsequent closure of the gas works. The site was subsequently used as a coal yard and transport depot, until 1981, when the site was closed and the existing builder's merchants is understood to have taken over the premises. It is understood that the former gas works site included the usual structures including retorts, purifiers, condensers, coal stores, tar tanks in addition to the gas holders.

Information provided by the British Geological Survey indicates the site to be underlain by River Terrace Deposits overlying clay soils of the London Clay Formation. Data searches have indicated the site to be located within an area of concern with regards to the potential ingress of radon gas, although a requirement for radon protection is confirmed as not being required. This slightly anomalous recommendation for not radon requirement would need to be confirmed by the NHBC or other Building Control service in due course. Information provided by the Environment Agency indicates the site and the surrounding area to be underlain by a Secondary 'A' Superficial Aquifer but that the site is not shown to be located within the source protection zone of any registered abstraction wells.

Development Proposals

It is understood that consideration is being given to the construction of a residential housing development incorporating a range of residential houses with areas of hardstanding for car parking, access roads and areas of private domestic gardens.

Preliminary Conceptual Site Model Summary and Risk Assessment

The historical use of the site as open agricultural land is not considered to be of concern with regards to potential ground contamination although the former railway sidings to the west and the former town gas works to the south present the potential for offsite sources of ground contamination that could potentially migrate onto site. In particular there is considered to be a potential risk that potentially mobile groundwater or soil gas contaminants could migrate northwards from the former gas works site to the south.

Ground Investigation Sampling Strategy

The ground investigation has comprised a series of 12 small diameter boreholes drilled across the site to depths of up to 5.00 m below ground level.

The location of the boreholes has been selected to provide an acceptable pre-purchase coverage of the site together with a more detailed focus upon the ground conditions along the southern site boundary, including the installation of four combined soil gas and groundwater monitoring standpipes along this southern site boundary.

Combined soil gas and groundwater monitoring standpipes have been installed in a further two boreholes located remote from the southern site boundary to act as a control and facilitate an assessment of the groundwater flow regime across the site.

The soils encountered in the boreholes were inspected by a Chartered Geologist and representative soil samples were recovered for subsequent laboratory testing for geotechnical properties and for contaminated land soil analyses to determine the presence of a wide range of potential soil contaminants. Soil samples were screened for the presence of VOCs by means of headspace testing using a PID. Following headspace screening, samples for soil contamination testing were placed into appropriate brown glass jars with Teflon coated lids that were provided by the MECRTS accredited soils testing laboratory before being placed into a chilled cool box for courier collection and transportation directly to the testing laboratory.

For this investigation the analytical suite of testing was selected to comprise routine metallic contaminants, polyaromatic hydrocarbons (PAHs) speciated hydrocarbons (TPH CWG) and screening for the presence of asbestos carried out as part of the second phase of investigation. For budgetary reasons it has not been possible to analyse every soil sample recovered from every borehole although a total of 8 soil samples have been submitted for laboratory analyses from locations across the site at a range of depths within the near surface soils.

Ground Conditions

The records of the exploratory holes and a site plan are enclosed. The ground conditions have been found to comprise a significant depth of topsoil between 0.40 m and 0.65 m, which is consistent with the cultivation of the land and use of a plough as part of the current and historical agricultural land use; at the time of investigation the site was planted with a seedling maize crop. The topsoil has been locally recorded as made ground due to the presence of occasional brick and tile fragments and occasional organic matter, the latter of which is likely to have been added to the topsoil to improve its fertility.

Underlying the topsoil a soft brickearth type silty clay has been encountered to depths of between 0.95 m and 1.5 m below ground level, beneath which a generally medium to coarse sand with variable gravel content has been encountered to depths of less than about 4.00 m, whereupon stiff grey clay soils of the London Clay have been encountered and proved to the maximum depth of investigation at 4.50m below ground level.

Groundwater was encountered in each exploratory hole at depths of about 1.50 m, although subsequent limited groundwater monitoring has indicated a groundwater rest level at a depth of less than about a metre. Monitoring carried out during the morning and during the afternoon at times consistent with a high and low tide on a non-peak spring tide indicate that the groundwater is tidally influenced, with a variation of between 0.05m and 0.12 m. Assessed groundwater flow direction is to the northeast. The monitoring suggests that the groundwater is under a sub-artesian pressure, with the groundwater level higher than the base of the overlying (confining) clay.

Limited soil gas monitoring carried out to date has not indicated any elevated concentrations of potentially hazardous or noxious soil gasses.

Soil geotechnical and contaminated land laboratory testing has been carried out together with groundwater contaminated land testing of samples recovered from the monitoring standpipes installed along the southern boundary of the site with the former gas works, with the results of these analyses discussed below. No visual or olfactory indications of ground contamination were however identified as part of the field work phase of ground investigation.

Foundation Design Discussion

Whilst the near surface firm and soft clay soils of the Brickearth may normally be considered as a suitable founding stratum for wide and lightly loaded spread foundations, at this site it is considered that these soils will not provide a suitable founding stratum for a number of reasons;

Foundations would normally be required to be installed at a minimum depth of 1.25m below ground level in medium plasticity clay soils following the removal of the near surface layer of topsoil, in order to allow for the use of 'restricted' future planting in accordance with the NHBC guidelines (Table 3 of Chapter 4.2) or 0.90 m if no planting were to be allowable. Locally the depth below existing ground level to the base of these clay soils has been encountered at 0.95 below ground level, with more than half of the boreholes indicating the base of the clay soils to be encountered at a depth of 1.20 m below existing ground level or less, such that spread foundation would necessarily bypass these soils. Normal practice is to ensure that a minimum of 300mm of founding strata is anticipated to be present below the base of the proposed foundations, which would require the base of the clay to extend below 1.20 m or 1.55m respectively, which cannot be consistently achieved on the basis of the ground investigation information obtained to date for this site.

Whilst founding within the near surface clay soils could potentially present a viable solution to selected plots, it will not provide a site wide solution strategy and will require plot specific ground investigation to confirm the extent of any locations where a sufficient depth of post topsoil removal clay soils remain. Foundations to any one plot or set of linked plots and structures would require to be formed within a single founding stratum to mitigate the risk of differential settlements.

It is therefore considered that the near surface clay soils at this site will not provide a suitable founding stratum for spread foundations. Whilst the underlying granular soils may normally be expected to provide a suitable founding stratum, the limited groundwater monitoring carried out to date has indicated that groundwater is present within these granular soils is under a sub-artesian pressure, such that the groundwater level in the gravel is higher than the top of the gravel, consequently, upon excavating into the granular soils, groundwater would be expected to be encountered and rise above the base of the excavation. It is expected that groundwater would not be able to be dealt with by sump pumping as the falling head permeability testing would suggest that these soils are readily permeable and the water ingress is not from localised perched waters of limited volume.

There is a potential that during the typically dryer summer months of the excavation into the granular soils could become viable, although this would require confidence to be gained as part of a long term groundwater monitoring programme including at least one full annual cycle. The ground water regime at this site is further complicated by the tidal influence upon ground water levels, which could also further limit the opportunities for the possible formation of dry excavation into the granular soils even in the traditionally drier summer months.

On the basis of the above it is considered that shallow spread foundations are unlikely to be viable other than for selected plots at certain times of the year and at certain tidal conditions, such that spread foundations are not considered to present a suitably robust site wide strategy for the development of this site.

As an alternative to spread foundations, consideration could be given to the use of piled foundations, vibro ground improvement or raft foundations, the relative advantages of which are discussed below;

Raft foundations could be a viable alternative, although it is understood that they have been considered on other BDW Southampton developments in similar geological settings and have been discounted as an acceptable alternative to vibro ground improvement.

Vibro ground improvement by means of stone columns would have the effect of improving the shallow bearing capacity of the near surface soils and facilitating a shallow ring beam type foundation design at a depth of potentially as shallow as 0.60 m below ground level in locations remote from trees. A foundation at this depth would not be expected to encounter groundwater complications and could potentially be designed on the basis of an assumed net allowable bearing capacity of 125 kPa, although detailed discussions would need to be held with prospective vibro ground improvement contractors to confirm the finalised design of vibro ground improvement units.

The eastern and western site boundaries are lined with a range of semi-mature and mature trees. Whilst we have not carried out a detailed zone influence assessment of these trees, it is likely that some units will be located in the vicinity of trees and as such will require precautions to mitigate the effects of trees. Even with ground improvement, foundations would need to be deepened in the vicinity of trees, such that should a seasonal and tidal constraint for the excavation of foundations to any such plots not be acceptable, then recourse to a piled foundation solution would be locally required. Further ground investigation by means of deep cable percussion boreholes would be required to inform a piled foundation solution for this site.

Road Pavement Design

MEXE cone assessment of CBR values has been carried out and indicates a low CBR value of between 2% and 4% is provided by the existing soils at this site. Further details CBR testing may be of benefit once proposed road layout and levels are confirmed. This preliminary low CBR value would suggest a requirement for a full capping thickness for adoptable roads.

Surface Water Management Strategy

We have discussed this site with your appointed Civil Engineers. The site has a drainage potential within the granular soils underlying the clay, with preliminary falling head tests suggest a permeability in the mid E-5m/s range. It is however important to note that any discharge to these granular soils would entail a direct discharge to groundwater as there is no partially saturated zone over the groundwater in which to form a soakaway. It is therefore considered likely that the drainage strategy would require an attenuated discharge to the existing ditch networks to mimic the existing green field runoff rate and that traditional soakaways would not be viable at this site

Potable Water Supply

The requirement for protection of underground sections of potable water supplies will need to be confirmed through discussions with the proposed statutory provider of mains water to the site, although precautions are not likely to be required for the development at this site.

Soil Contamination Test Results

Part IIA of the Environmental Protection Act 1990, which was inserted into that Act by Section 57 of the Environment Act 1995, provides the main regulatory regime for the identification and remediation of contaminated land. The determination of contaminated sites is based on a "suitable for use" approach which involves managing the risks posed by contaminated land by making risk-based decisions. This risk assessment is carried out on the basis of a source-pathway-receptor approach. The results of comprehensive laboratory analyses carried out by an MCERTS accredited laboratory on a limited number of soil and groundwater samples recovered from this site are enclosed.

The significance of the measured soil concentrations of any chemicals of concern has been assessed in relation to the available SGVs together with the revised and updated values that have been adopted by

the Chartered Institute of Environmental Health (CIEH)¹. Whilst the values that have been adopted by the CIEH are not statutory, they are widely accepted as providing a suitable initial screening value against which measured concentrations of potential contaminants can be assessed to determine the requirement for site specific quantitative risk assessment. From a review of the enclosed results it is apparent that elevated concentrations of a wide range of potential soil contaminants, including potential contaminants associated with the identified potential off site sources of ground contamination have not been detected within the selected representative soil samples submitted to laboratory analyses.

Contaminated Land Discussion

The current and historical use of the site as open agricultural land is not considered to pose a risk of ground contamination. The adjoining historical site land uses of a railway sidings to the west and a former gas works to the south present potentially significant sources of off site potentially mobile ground contamination, albeit mitigate by the time that has elapsed since the potentially contaminative activities were carried out on these adjoining areas.

The ground investigation has not identified any visual or olfactory indications of ground contaminants and elevated concentrations of a wide range of potential soil contaminants have not been detected within the selected representative soil and groundwater samples recovered from the site.

As with any site there remains a perhaps limited potential for localized contaminants to be present at this site and as such it is considered that the ground works for the proposed redevelopment at this site should be carried out under a geo-environmental watching brief in order that should any suspicious or contaminated soils be encountered, they can be appropriately investigated by a geo-environmental engineer and appropriately dealt with in consultation with the regulatory authorities. Site workers should be made aware of the perhaps limited potential for contamination to be present and a programme of working should be identified to protect workers handling any soil. The method of site working should be in accordance with guidelines set out by HSE² and CIRIA³ and the requirements of the Local Authority Environmental Health Officer (EHO).

Further Work

Further monitoring of the groundwater would be of benefit to ensure a robust assessment of the seasonal and tidal variations of groundwater at this site.

We would strongly recommend more formal discussions with the local authority contaminated land officer as soon as possible in order to address any concerns with regards to ground contamination at this site as a result of the historical land uses of the adjoining former railway sidings and gas works sites

We trust that this letter provides sufficient information although please do not hesitate to contact me should you have any questions or queries.

Yours sincerely
Wilson Bailey Partnership

Dominic Brightman
BSc MSc DIC FGS CGeol ARSM

Encs

¹ *The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment (2nd Edition) July 2009.*

² *HSE (1992) HS(G)66 Protection of workers and the general public during the development of contaminated land HMSO*

³ *CIRIA (1996) A guide for safe working on contaminated site Report 132, Construction Industry Research & Information Association*

Project Name
Hayling Island

Project No.
J15109

Co-ords: -

Hole Type
WLS

Location:

Level: -

Scale
1:50

Client: BDW Southampton

Dates: 12/03/2015

Logged By
DPB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.25	D					TOPSOIL	
		0.50	D		0.40			Firm locally soft brown silty sandy CLAY	
		1.00	SPT	N=20 (3,5/ 5,5,5,5)	1.00			Pale grey silty sandy CLAY with abundant fine flint gravel	1
		1.00	D		1.30			Pale grey coarse silty SAND with occasional fine flint gravel	
		1.50	D		1.60			Medium dense pale yellowish brown coarse silty SAND with occasional fine to medium flint gravel	
		2.00	SPT	N=13 (2,2/ 3,3,4,3)					2
		2.00	D						
		2.50	D						
		3.00	SPT	N=12 (3,3/ 3,3,3,3)					3
		3.00	D						
		3.50	D						
		4.00	SPT	N=29 (5,5/ 6,7,8,8)	3.80			Stiff dark grey slightly silty CLAY	4
		4.00	D						
		4.45	D		4.45			End of Borehole at 4.45 m	

Remarks: Damp below 1.00m. Groundwater encountered at 2.00m. Sradpipe installed with a response zone from 0.50m to 4.00m. Borehole used for soakage testing - results presented separately.



Project Name
Hayling Island

Project No.
J15109

Co-ords: -

Hole Type
WLS

Location:

Level: -

Scale
1:50

Client: BDW Southapton

Dates: 12/03/2015

Logged By
DPB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								TOPSOIL	
		0.50	D		0.60			Firm pale brown silty sandy CLAY	
		0.75	D		0.95			Pale greyish brown silty coarse SAND with scattered fine flint gravel	1
		1.00	D		1.50			Pale yellowish brown silty fine to medium coarse SAND with scattered fine flint gravel	
		1.50	D		2.00			Soft pale brown silty very sandy CLAY	2
		2.00	D		2.50			Soft pale brown silty very sandy CLAY	
		2.50	D		2.70			Pale yellowish brown silty fine to medium coarse SAND with scattered fine gravel	3
		3.00	D		3.10			Stiff grey sandy silty CLAY	
		3.50	D		3.90				
					4.00			End of Borehole at 4.00 m	4

Remarks: Grdgroundwater encountered at 2.00m. Standpipe installed with a response zone from 0.50m to 3.50m. Borehole used for soakage testing - results presented seperately.



Project Name
Hayling Island

Project No.
J15109

Co-ords: -

Hole Type
WLS

Location:

Level: -

Scale
1:50

Client: BDW Southapton

Dates: 12/03/2015

Logged By
DPB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.25	D					TOPSOIL	
		0.50	D		0.45			Soft pale brown silty sandy CLAY with occasional locally abundant fine to medium coarse flint gravel	1
		1.00	D		1.10			Pale yellowish brown and pale greyish brown fine to medium coarse SAND with scattered medium flint gravel	
		1.50	D		1.60			Pale yellowish brown and orange-brown silty fine to medium coarse SAND with occasional fine flint gravel	2
		2.00	D						
		2.50	D						
		3.00	D						3
		3.50	D						
					3.80			Stiff grey silty CLAY	4
					4.00			End of Borehole at 4.00 m	
									5
									6
									7
									8
									9

Remarks: Groundwater encountered at 1.30m. Standpipe installed with a response zone from 0.50m to 4.00m.

Project Name

Hayling Island

Project No.

J15109

Co-ords: -

Hole Type

WLS

Location:

Level: -

Scale

1:50

Client: BDW Southapton

Dates: 12/03/2015

Logged By

DPB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.50	D		0.60			TOPSOIL	
		1.00	SPT	N=7 (1,1/ 1,1,2,3)	1.30			Soft pale orange-brown and brown silty sandy CLAY	1
		1.00	D		1.50				
		1.50	D		1.50			Pale grey fine to medium coarse SAND with scattered becoming abundant fine to medium flint gravel	
		2.00	SPT	N=26 (2,3/ 4,7,8,7)	2.50			Pale yellowish brown fine to medium coarse SAND with occasional locally abundant fine flint gravel	2
		2.00	D						
		2.50	D						
		3.00	SPT	N=4 (1,2/ 1,0,1,2)	3.50				3
		3.00	D						
		3.50	D						
					4.00			End of Borehole at 4.00 m	4
									5
									6
									7
									8
									9

Remarks: Groundwater encountered at 1.50m. Standpipe installed with a response ozone from 0.50m to 2.50m. Borehole collapsed.

Project Name
Hayling Island

Project No.
J15109

Co-ords: -

Hole Type
WLS

Location:

Level: -

Scale
1:50

Client: BDW Southapton

Dates: 09/04/2015

Logged By
DPB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								TOPSOIL	
		0.50	D		0.40			Firm locally soft orange-brown and brown silty sandy CLAY	
		1.00	D		1.20			Brown very clayey GRAVEL	1
		1.50	D		1.40			Yellowish brown fine silty SAND with occasional fine to medium flint gravel	
		2.00	D						2
		2.50	D						
		3.00	D						3
		3.50	D						
		4.00	D		3.85 4.00			Stiff dark bluish grey fissured CLAY	4
								End of Borehole at 4.00 m	
									5
									6
									7
									8
									9

Remarks: Groundwater encountered at 1.50m. Standpipe installed with a response zone from 1.00m to 4.00m.

Project Name
Hayling Island

Project No.
J15109

Co-ords: -

Hole Type
WLS

Location:

Level: -

Scale
1:50

Client: BDW Southapton

Dates: 09/04/2015

Logged By
DPB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.50	D		0.30			TOPSOIL	
		1.00	SPT	N=24				Soft pale orange-brown and brown silty sandy CLAY	1
		1.00	D	(5,7/ 9,8,4,3)	1.20				
		1.50	D		1.30			Brown clayey GRAVEL	
								Pale yellowish brown silty fine SAND	
					2.00			End of Borehole at 2.00 m	2
									3
									4
									5
									6
									7
									8
									9

Remarks: Groundwater encountered at 1.30m.

Project Name
Hayling Island

Project No.
J15109

Co-ords: -

Hole Type
WLS

Location:

Level: -

Scale
1:50

Client: BDW Southampton

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[illegible]

Remarks: Groundwater encountered at 1.20m.



Project Name
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Project No.
J15109

Co-ords: -

Hole Type
WLS

Location:

Level: -

Scale
1:50

Client: BDW Southapton

Dates: 09/04/2015

Logged By
DPB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.35			TOPSOIL	
		0.50	D					Soft pale brown and orange-brown silty sandy CLAY	
		1.00	D					Orange-brown very clayey silty sandy fine to medium flint GRAVEL	1
		1.50	D		1.30 1.50			Pale yellowish orange-brown silty fine SAND	
					2.00			End of Borehole at 2.00 m	2
									3
									4
									5
									6
									7
									8
									9

Remarks: Groundwater encountered at 1.50m.

Project Name
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Co-ords: -

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WLS

Location:

Level: -

Scale
1:50

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Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.50	D		0.45			TOPSOIL	
		1.00	D					Soft locally firm brown silty sandy CLAY becoming unstable below 1.20m	1
		1.50	D		1.50			Brown and pale grey very clayey silty sandy fine to medium flint GRAVEL	2
		2.00	D		1.70			Pale yellowish brown silty fine SAND with occasional fine flint gravel	2
		2.50	D						3
		3.00	D						3
		3.50	D						4
		4.00	D						4
		4.50	D		4.20			Stiff dark greyish blue silty sandy CLAY	5
					5.00			End of Borehole at 5.00 m	5
									6
									7
									8
									9

Remarks: Groundwater encountered at 1.50m. Standpipe installed with a response zone from 1.00m to 5.00m.

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Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.35			TOPSOIL	
		0.50	D					Firm soft pale brown and orange-brown silty sandy CLAY	
		1.00	D		1.20			Pale grey silty sandy fine to medium flint GRAVEL	1
		1.50	D		1.60			Orange-brown and brown silty fine SAND	
					2.00			End of Borehole at 2.00 m	2
									3
									4
									5
									6
									7
									8
									9

Remarks: Groundwater encountered at 1.60m.

Project Name
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Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								TOPSOIL	
		0.50	D		0.40			Soft locally firm pale brown silty sandy CLAY	
		1.00	D						1
		1.50	D		1.30			Pale orange-brown and pale grey silty sandy fine to medium flint GRAVEL	
					1.50			Pale grey and pale yellowish brown silty fine SAND	
		2.00	D						2
		2.50	D						
					3.00			End of Borehole at 3.00 m	3
									4
									5
									6
									7
									8
									9

Remarks: Groundwater encountered at 1.50m.

Project Name
Hayling Island

Project No.
J15109

Co-ords: -

Hole Type
WLS

Location:

Level: -

Scale
1:50

Client: BDW Southampton

Dates: 09/04/2015

Logged By
DPB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.25			TOPSOIL	
		0.50	D					Firm pale brown silty sandy CLAY	
		1.00	D		1.00			Pale grey very silty sand clayey fine to medium flint GRAVEL	1
		1.50	D		1.20			Pale yellowish brown silty SAND with scattered fine flint gravel	
		2.00	D						2
		2.50	D						
					3.00			End of Borehole at 3.00 m	3
									4
									5
									6
									7
									8
									9

Remarks: Groundwater encountered at 1.20m.

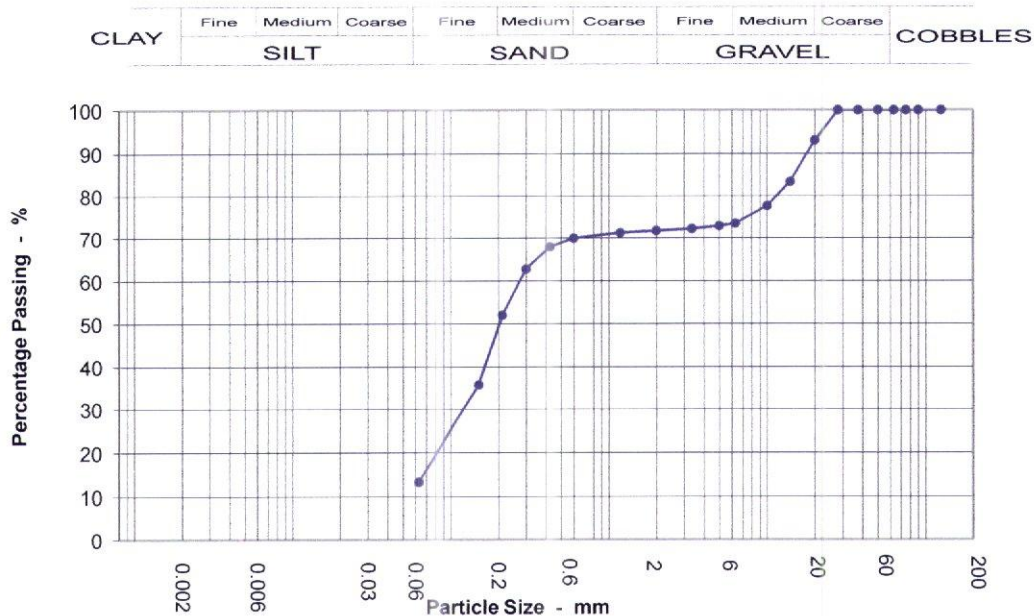
Project Name: Hayling Island				Samples Received: 13/04/2015					
Client: Wilson Bailey Geotechnical & Environmental				Project Started: 24/04/2015					
Project No: -				Our job/report no: 18731					
				Testing Started: 06/05/2015				Date Reported: 09/05/2015	

Borehole No:	Sample No:	Depth (m)	Description	Moisture content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 0.425 mm (%)	Remarks
BH5	-	1.00	Brown, grey and orange brown slightly sandy silty CLAY with rare fm sub-angular gravel	27	56	22	34	98	
BH6	-	1.00	Brown and greyish brown slightly sandy silty CLAY with rare fine gravel	22	47	18	29	99	
BH8	-	1.00	Brown slightly sandy silty CLAY with rare fine gravel	24	48	21	27	99	
BH9	-	1.50	Brown and orange brown slightly sandy silty CLAY with rare fine gravel	25	53	21	32	99	
BH9	-	4.50	Grey slightly sandy silty CLAY	27	53	22	31	100	
BH11	-	1.00	Brown and orange brown slightly sandy silty CLAY with rare fm sub-angular gravel	22	44	20	24	98	
BH12	-	1.00	Brown and greyish brown slightly sandy silty CLAY with rare fine gravel	25	40	20	20	98	

	Summary of Test Results								Checked and Approved Initials: K.P Date: 08/05/2015
	BS 1377 : Part 2 : Clause 4.4 : 1990 Determination of the liquid limit by the cone penetrometer method.								
	BS 1377 : Part 2 : Clause 5 : 1990 Determination of the plastic limit and plasticity index.								
	BS 1377 : Part 2 : Clause 3.2 : 1990 Determination of the moisture content by the oven-drying method.								
Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU Test Results relate only to the sample numbers shown above. Approved Signatories: K.Phaure (Tech Mgr) J.Phaure (Lab Mgr) All samples connected with this report, incl any on 'hold' will be stored and disposed off according to Company policy. Acopy of this policy is available on request.									

MSF-11/R2

K4 SOILS 	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Our Report No:	18731
		Project No:	-
Location	Hayling Island	Borehole / Trial Pit No:	BH12
		Depth	2.00 m
Visual Soil Description	Brown and orange brown clayey very gravelly SAND (gravel is fmc and sub-angular to rounded)	Sample Type/No	-



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	93		
14	83		
10	78		
6.3	73		
5	73		
3.35	72		
2	72		
1.18	71		
0.6	70		
0.425	68		
0.3	63		
0.212	52		
0.15	36		
0.063	13		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	N/A
Suitable Amount Of Sample Received	Yes

Sample Proportions	
Cobbles	0.0
Gravel	28.2
Sand	58.5
Silt & Clay	13.3

Grading Analysis	
D100	125.0
D60	0.3
D10	
Uniformity Coefficient	N/A

K4 SOILS LABORATORY

Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU.
E-mail: k4soils@aol.com

Approved Signatories:

K.Phaure(Tech.Mgr)

J.Phaure(Lab.Mgr)

Test results relate only to the sample numbers shown above

Checked and Approved

Initials: kp

Date: 09/05/2015

All samples connected with this report, incl any on 'hold' will be disposed off according to company policy. A copy of this policy is available on request. Sheet 3/3 MSF-11/R9



2519

Project Name: Hayling Island					K4 SOILS 
Client: Wilson Bailey Geotechnical &		Project no: -			
Our job no: 18731					
Borehole No:	Sample No:	Depth m	Description	pH	Sulphate content (g/l)
BH8	-	1.00	Brown slightly sandy silty CLAY with rare fine gravel	7.9	1.12
BH9	-	1.50	Brown and orange brown slightly sandy silty CLAY with rare fine gravel	7.7	0.48
BH11	-	1.00	Brown and orange brown slightly sandy silty CLAY with rare fm sub-angular gravel	7.9	0.14
Summary of Test Results BS 1377 : Part 3 : Clause 5 : 1990 Determination of sulphate content of soil and ground water : gravimetric method					Checked and Approved Initials : kp
Date 09/05/2015					



Dominic Brightman
Wilson Bailey Geotechnical & Environmental Ltd
Carters Cottage
Sherrington
Wiltshire
BA12 0SN



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russell.jarvis@qtsenvironmental.com

QTS Environmental Report No: 15-30539

Site Reference: Hayling Island

Project / Job Ref: None Supplied

Order No: None Supplied

Sample Receipt Date: 13/04/2015

Sample Scheduled Date: 14/04/2015

Report Issue Number: 1

Reporting Date: 17/04/2015

Authorised by:

Russell Jarvis
Director

On behalf of QTS Environmental Ltd

Authorised by:

Kevin Old
Director

On behalf of QTS Environmental Ltd



QTS Environmental Ltd
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Lenham Heath
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Tel : 01622 850410



Soil Analysis Certificate

QTS Environmental Report No: 15-30539	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied
Wilson Bailey Geotechnical & Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Hayling Island	TP / BH No	BH5	BH8	BH10	BH12
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	1.00	2.00	3.00	0.50
Reporting Date: 17/04/2015	QTSE Sample No	144453	144454	144455	144456

Determinand	Unit	RL	Accreditation				
Asbestos Screen ⁽⁵⁾	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	6.3	6.5	6.6	6.6
Total Organic Carbon (TOC)	%	< 0.1	MCERTS	1.7	1.8	0.6	0.8
Arsenic (As)	mg/kg	< 2	MCERTS	9	8	5	7
W/S Boron	mg/kg	< 1	NONE	1.2	< 1	< 1	< 1
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.6	0.3	< 0.2	0.3
Chromium (Cr)	mg/kg	< 2	MCERTS	34	24	27	31
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	18	14	9	13
Lead (Pb)	mg/kg	< 3	MCERTS	85	39	18	34
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	19	15	15	21
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	< 3
Zinc (Zn)	mg/kg	< 3	MCERTS	142	57	50	57
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C

Analysis carried out on the dried sample is corrected for the stone content

Subcontracted analysis ⁽⁵⁾



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Soil Analysis Certificate - Speciated PAHs

QTS Environmental Report No: 15-30539	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied
Wilson Bailey Geotechnical & Environmental L	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Hayling Island	TP / BH No	BH5	BH8	BH10	BH12
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	1.00	2.00	3.00	0.50
Reporting Date: 17/04/2015	QTSE Sample No	144453	144454	144455	144456

Determinand	Unit	RL	Accreditation				
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	0.15	< 0.1	< 0.1	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	0.51	< 0.1	< 0.1	< 0.1
Pyrene	mg/kg	< 0.1	MCERTS	0.45	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.23	< 0.1	< 0.1	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	0.35	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.49	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	0.19	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.30	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	0.22	< 0.1	< 0.1	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	0.19	< 0.1	< 0.1	< 0.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	3.1	< 1.6	< 1.6	< 1.6

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C



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Soil Analysis Certificate - TPH CWG Banded

QTS Environmental Report No: 15-30539	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied
Wilson Bailey Geotechnical & Environmental L	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Hayling Island	TP / BH No	BH5	BH8	BH10	BH12
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	1.00	2.00	3.00	0.50
Reporting Date: 17/04/2015	QTSE Sample No	144453	144454	144455	144456

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21	< 21	< 21	< 21	
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	17	< 10	< 10	< 10	
Aromatic (C5 - C35)	mg/kg	< 21	NONE	< 21	< 21	< 21	< 21	
Total >C5 - C35	mg/kg	< 42	NONE	< 42	< 42	< 42	< 42	

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C



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Soil Analysis Certificate - BTEX / MTBE						
QTS Environmental Report No: 15-30539	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Wilson Bailey Geotechnical & Environmental L	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: Hayling Island	TP / BH No	BH5	BH8	BH10	BH12	
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: None Supplied	Depth (m)	1.00	2.00	3.00	0.50	
Reporting Date: 17/04/2015	QTSE Sample No	144453	144454	144455	144456	

Determinand	Unit	RL	Accreditation					
Benzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Toluene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5
Ethylbenzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
p & m-xylene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
o-xylene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
MTBE	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C



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Soil Analysis Certificate - Sample Descriptions

QTS Environmental Report No: 15-30539

Wilson Bailey Geotechnical & Environmental Ltd

Site Reference: Hayling Island

Project / Job Ref: None Supplied

Order No: None Supplied

Reporting Date: 17/04/2015

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
^ 144453	BH5	None Supplied	1.00	16.2	Brown clay with stones
^ 144454	BH8	None Supplied	2.00	18	Brown clay with rubble
^ 144455	BH10	None Supplied	3.00	15	Light brown clay
^ 144456	BH12	None Supplied	0.50	16.8	Brown clay

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample ^{IS}

Unsuitable Sample ^{US}

^ no sampling date provided; unable to confirm if samples are within acceptable holding times



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Soil Analysis Certificate - Methodology & Miscellaneous Information	
QTS Environmental Report No: 15-30539	
Wilson Bailey Geotechnical & Environmental Ltd	
Site Reference: Hayling Island	
Project / Job Ref: None Supplied	
Order No: None Supplied	
Reporting Date: 17/04/2015	

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received



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QTS Environmental Report No: 15-30658

Site Reference: Hayling Island

Project / Job Ref: None Supplied

Order No: None Supplied

Sample Receipt Date: 13/04/2015

Sample Scheduled Date: 16/04/2015

Report Issue Number: 1

Reporting Date: 22/04/2015

Authorised by:

Russell Jarvis
Director

On behalf of QTS Environmental Ltd

Authorised by:

Kevin Old
Director

On behalf of QTS Environmental Ltd



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Water Analysis Certificate						
QTS Environmental Report No: 15-30658	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Wilson Bailey Geotechnical & Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: Hayling Island	TP / BH No	BH1	BH2	BH3	BH4	
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: None Supplied	Depth (m)	1.00	3.00	1.00	3.00	
Reporting Date: 22/04/2015	QTSE Sample No	145066	145067	145068	145069	

Determinand	Unit	RL	Accreditation				
pH	pH Units	N/a	ISO17025	7.1	7.1	7.1	7.1
Total Cyanide	ug/l	< 5	NONE	< 5	< 5	< 5	< 5
Total Organic Carbon (TOC)	mg/l	< 0.1	NONE	44.8	49.7	48.8	51.1
Arsenic (dissolved)	ug/l	< 5	ISO17025	< 5	< 5	< 5	< 5
Boron (dissolved)	ug/l	< 5	ISO17025	111	130	191	198
Cadmium (dissolved)	ug/l	< 0.4	ISO17025	< 0.4	< 0.4	< 0.4	< 0.4
Chromium (dissolved)	ug/l	< 5	ISO17025	< 5	< 5	< 5	< 5
Chromium (hexavalent)	ug/l	< 5	NONE	< 5	< 5	< 5	< 5
Copper (dissolved)	ug/l	< 5	ISO17025	< 5	< 5	< 5	< 5
Lead (dissolved)	ug/l	< 5	ISO17025	< 5	< 5	< 5	< 5
Mercury (dissolved)	ug/l	< 0.05	ISO17025	< 0.05	< 0.05	< 0.05	< 0.05
Nickel (dissolved)	ug/l	< 5	ISO17025	< 5	< 5	< 5	< 5
Selenium (dissolved)	ug/l	< 5	ISO17025	< 5	< 5	< 5	< 5
Zinc (dissolved)	ug/l	< 2	ISO17025	< 2	< 2	5	< 2
Total Phenols (monohydric)	ug/l	< 0.5	NONE	< 0.5	< 0.5	< 0.5	< 0.5

Subcontracted analysis ^(S)
Insufficient sample ^{U/S}
Unsuitable Sample ^{U/S}



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Water Analysis Certificate - Speciated PAH						
QTS Environmental Report No: 15-30658	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Wilson Bailey Geotechnical & Environmental L	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: Hayling Island	TP / BH No	BH1	BH2	BH3	BH4	
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: None Supplied	Depth (m)	1.00	3.00	1.00	3.00	
Reporting Date: 22/04/2015	QTSE Sample No	145066	145067	145068	145069	

Determinand	Unit	RL	Accreditation					
Naphthalene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Acenaphthylene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Acenaphthene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Fluorene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Phenanthrene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Anthracene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Fluoranthene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Pyrene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(a)anthracene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Chrysene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(b)fluoranthene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(k)fluoranthene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(a)pyrene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Indeno(1,2,3-cd)pyrene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Dibenz(a,h)anthracene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(ghi)perylene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Total EPA-16 PAHs	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	



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Water Analysis Certificate - TPH CWG Banded						
QTS Environmental Report No: 15-30658	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Wilson Bailey Geotechnical & Environmental L	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: Hayling Island	TP / BH No	BH1	BH2	BH3	BH4	
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: None Supplied	Depth (m)	1.00	3.00	1.00	3.00	
Reporting Date: 22/04/2015	QTSE Sample No	145066	145067	145068	145069	

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	< 10
Aliphatic >C6 - C8	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	< 10
Aliphatic >C8 - C10	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	< 10
Aliphatic >C10 - C12	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	< 10
Aliphatic >C12 - C16	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	< 10
Aliphatic >C16 - C21	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	< 10
Aliphatic >C21 - C34	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	< 10
Aliphatic (C5 - C34)	ug/l	< 70	NONE	< 70	< 70	< 70	< 70	< 70
Aromatic >C5 - C7	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	< 10
Aromatic >C7 - C8	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	< 10
Aromatic >C8 - C10	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	< 10
Aromatic >C10 - C12	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	< 10
Aromatic >C12 - C16	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	< 10
Aromatic >C16 - C21	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	< 10
Aromatic >C21 - C35	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	< 10
Aromatic (C5 - C35)	ug/l	< 70	NONE	< 70	< 70	< 70	< 70	< 70
Total >C5 - C35	ug/l	< 140	NONE	< 140	< 140	< 140	< 140	< 140



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Water Analysis Certificate - BTEX / MTBE						
QTS Environmental Report No: 15-30658	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Wilson Bailey Geotechnical & Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: Hayling Island	TP / BH No	BH1	BH2	BH3	BH4	
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: None Supplied	Depth (m)	1.00	3.00	1.00	3.00	
Reporting Date: 22/04/2015	QTSE Sample No	145066	145067	145068	145069	

Determinand	Unit	RL	Accreditation					
Benzene	ug/l	< 1	ISO17025	< 1	< 1	< 1	< 1	
Toluene	ug/l	< 5	ISO17025	< 5	< 5	< 5	< 5	
Ethylbenzene	ug/l	< 5	ISO17025	< 5	< 5	< 5	< 5	
p & m-xylene	ug/l	< 10	ISO17025	< 10	< 10	< 10	< 10	
o-xylene	ug/l	< 5	ISO17025	< 5	< 5	< 5	< 5	
MTBE	ug/l	< 10	ISO17025	< 10	< 10	< 10	< 10	



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Water Analysis Certificate - Semi Volatile Organic Compounds (SVOC)					
QTS Environmental Report No: 15-30658	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied
Wilson Bailey Geotechnical & Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Hayling Island	TP / BH No	BH1	BH2	BH3	BH4
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	1.00	3.00	1.00	3.00
Reporting Date: 22/04/2015	QTSE Sample No	145066	145067	145068	145069

Determinand	Unit	RL	Accreditation				
Phenol	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
1,2,4-Trichlorobenzene	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
2-Nitrophenol	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Nitrobenzene	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
0-Cresol	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
bis(2-chloroethoxy)methane	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
bis(2-chloroethyl)ether	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
2,4-Dichlorophenol	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
2-Chlorophenol	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
1,3-Dichlorobenzene	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
1,4-Dichlorobenzene	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
1,2-Dichlorobenzene	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
2,4-Dimethylphenol	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Isophorone	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Hexachloroethane	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
p-Cresol	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
2,4,6-Trichlorophenol	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
2,4,5-Trichlorophenol	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
2-Nitroaniline	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
4-Chloro-3-methylphenol	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
2-Methylnaphthalene	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Hexachlorocyclopentadiene	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Hexachlorobutadiene	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
2,6-Dinitrotoluene	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Dimethyl phthalate	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
2-Chloronaphthalene	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
4-Chloroaniline	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
4-Nitrophenol	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
4-Chlorophenyl phenyl ether	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
3-Nitroaniline	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
4-Nitroaniline	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
4-Bromophenyl phenyl ether	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Hexachlorobenzene	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
2,4-Dinitrotoluene	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Diethyl phthalate	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzofuran	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Azobenzene	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Dibutyl phthalate	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Carbazole	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
bis(2-ethylhexyl)phthalate	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Benzyl butyl phthalate	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Di-n-octyl phthalate	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1



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Soil Analysis Certificate - Methodology & Miscellaneous Information

QTS Environmental Report No: 15-30658

Wilson Bailey Geotechnical & Environmental Ltd

Site Reference: Hayling Island

Project / Job Ref: None Supplied

Order No: None Supplied

Reporting Date: 22/04/2015

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Water	UF	Alkalinity	Determination of alkalinity by titration against hydrochloric acid using bromocresol green as the end point	E103
Water	UF	BTEX	Determination of BTEX by headspace GC-MS	E101
Water	F	Cations	Determination of cations by filtration followed by ICP-MS	E102
Water	UF	Chemical Oxygen Demand (COD)	Determination using a COD reactor followed by colorimetry	E112
Water	F	Chloride	Determination of chloride by filtration & analysed by ion chromatography	E109
Water	F	Chromium - Hexavalent	Determination of hexavalent chromium by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E116
Water	UF	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E115
Water	UF	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E115
Water	UF	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E115
Water	UF	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through liquid:liquid extraction with cyclohexane	E111
Water	F	Diesel Range Organics (C10 - C24)	Determination of liquid:liquid extraction with hexane followed by GC-FID	E104
Water	F	Dissolved Organic Content (DOC)	Determination of DOC by filtration followed by low heat with persulphate addition followed by IR detection	E110
Water	UF	Electrical Conductivity	Determination of electrical conductivity by electrometric measurement	E123
Water	F	EPH (C10 - C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID	E104
Water	F	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E104
Water	F	Fluoride	Determination of Fluoride by filtration & analysed by ion chromatography	E109
Water	F	Hardness	Determination of Ca and Mg by ICP-MS followed by calculation	E102
Leachate	F	Leachate Preparation - NRA	Based on National Rivers Authority leaching test 1994	E301
Leachate	F	Leachate Preparation - WAC	Based on BS EN 12457 Pt1, 2, 3	E302
Water	F	Metals	Determination of metals by filtration followed by ICP-MS	E102
Water	F	Mineral Oil (C10 - C40)	Determination of liquid:liquid extraction with hexane followed by GI-FID	E104
Water	F	Nitrate	Determination of nitrate by filtration & analysed by ion chromatography	E109
Water	UF	Monohydric Phenol	Determination of phenols by distillation followed by colorimetry	E121
Water	F	PAH - Speciated (EPA 16)	Determination of PAH compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E105
Water	F	PCB - 7 Congeners	Determination of PCB compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E108
Water	UF	Petroleum Ether Extract (PEE)	Gravimetrically determined through liquid:liquid extraction with petroleum ether	E111
Water	UF	pH	Determination of pH by electrometric measurement	E107
Water	F	Phosphate	Determination of phosphate by filtration & analysed by ion chromatography	E109
Water	UF	Redox Potential	Determination of redox potential by electrometric measurement	E113
Water	F	Sulphate (as SO4)	Determination of sulphate by filtration & analysed by ion chromatography	E109
Water	UF	Sulphide	Determination of sulphide by distillation followed by colorimetry	E118
Water	F	SVOC	Determination of semi-volatile organic compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E106
Water	UF	Toluene Extractable Matter (TEM)	Gravimetrically determined through liquid:liquid extraction with toluene	E111
Water	UF	Total Organic Carbon (TOC)	Low heat with persulphate addition followed by IR detection	E110
Water	F	TPH CWG (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID for C8 to C35. C5 to C8 by headspace GC-MS	E104
Water	F	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID for C8 to C44. C5 to C8 by headspace GC-MS	E104
Water	UF	VOCs	Determination of volatile organic compounds by headspace GC-MS	E101
Water	UF	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E101

Key

F Filtered
UF Unfiltered

Site Land North of Station Road, Hayling Island, Hampshire

Client BDW Southampton

