SOLMEK

Victoria Hotel, Robin Hoods Bay
Phase 2 Site Investigation Report
S170840
Mr A Fidler

Solmek Ltd
12 Yarm Road
Stockton-on-Tees
TS18 3NA

PHASE 2 SITE INVESTIGATION REPORT

VICTORIA HOTEL, ROBIN HOODS BAY

TABLE OF CONTENTS

APPENDICES

Revision	Date	Prepared By	Signed
Final	Sept 2017	P Finnimore *Geotechnical Engineer*	
		Checked By	
		R Woods *Principal Geotechnical Engineer*	
		Approved By	
		R Woods *Principal Geotechnical Engineer*	

1 INTRODUCTION

1.1 Authorisation

The site investigation described in this report was carried out by Solmek to the instructions of BHD Partnership Ltd on behalf of Mr A Fidler on Victoria Hotel, Robin Hoods Bay.

1.2 Scope of Works

The development is outlined for the construction of an orangery along the southern elevation of the building, the soft landscaping areas are to be retained. A drawing showing the position of the site is included in Appendix A (Figure 1).

A geotechnical assessment was requested. A ground gas assessment and chemical testing was outside the scope of this report.

The fieldwork and testing was generally carried out according to the recommendations of BS5930: 2015 "Code of Practice for Ground Investigations" and where applicable BS EN 1997-2:2007 with soil descriptions to BS EN 14688-1:2002 where applicable. The information provided in this report is based on the investigation fieldwork, and is subject to the comments and approval of the various regulatory authorities.

There may be other conditions prevailing on the site which have not been disclosed by this investigation and which have not been taken into account by this report. Solmek reserve the right to alter conclusions and recommendations should further information be available or provided. Any schematic representation or opinion of the possible configuration of ground conditions between exploratory holes is conjectural and given for guidance only and confirmation of intermediate ground conditions should be considered if deemed necessary.

2 SITE DESCRIPTION AND FIELDWORK

The site is located within the grounds of Victoria Hotel, Station Road, Robin Hoods Bay. The area under investigation is located to the south of the hotel and comprises level tarmac to the north and soft landscaping beer garden to the south which slopes 1-2m from north down to the south.

2.1 Fieldwork

Solmek undertook the fieldwork commencing on 5th September 2017 which comprised:

- 3no small percussive borehole (BH1 to BH3) drilled to a maximum depth of 5.00m below ground level (bgl).
    - The rationale behind the positioning of exploratory borehole was based on the footprint of the proposed building and to therefore obtain an accurate appraisal of soil composition.

Logging of the boreholes was carried out by an experienced geotechnical engineer. Samples were taken for geotechnical analysis. In-situ Standard Penetration Tests (SPT's) and hand shear vanes were undertaken within the underlying deposits during the intrusive works.

Descriptions of the strata encountered in the boreholes together with details of testing, sampling and groundwater are presented in Appendix B of this report.

A plan showing the location of the borehole can be found in Appendix A (Figure 2).

3 GROUND CONDITIONS

A summary of the ground conditions encountered is given below.

3.1 Made Ground

Made ground was proven to a maximum depth of 2.10mbgl. In BH1 and BH2 it comprised brown slightly

gravelly topsoil to 0.60mbgl and 1.40mbgl respectively. In BH2 soft consistency dark brown sandy, slightly organic clay was then proven to 2.10mbgl. In BH3 tarmac was underlain by a brown sandstone gravel sub-base to 0.30mbgl, firm consistency brown sandy, slightly gravelly clay was then encountered to 0.80mbgl.

3.2 Natural Deposits

The underlying natural ground was proven as soft to firm consistency brown to dark brown sandy medium strength clay with bands of sand to depths between 2.70mbgl (BH1) and 4.20mbgl (BH3). In BH1 at the base of this layer a thicker sand band was encountered between 2.70mbgl and 3.10mbgl. Firm consistency grey to brown slightly sandy, slightly gravelly medium to high strength clay was then encountered which was proven to the base of each borehole at 5.00mbgl.

3.3 Groundwater

Groundwater was encountered in BH1 only as seepage at 3.60mbgl.

It should be noted the rapid rate of advancement of the exploratory holes may mask minor seepages and it should be borne in mind that water levels fluctuate with a number of influences including season, rainfall, dewatering and pumping activities. Therefore, water levels significantly higher than those found during this investigation may be encountered.

4 GEOTECHNICAL TESTING AND ANALYSIS

Samples taken from the boreholes underwent a series of geotechnical tests (BS 1377:1990) to aid foundation design and soil description.

In addition to the laboratory testing, in-situ Standard Penetration Tests (SPTs) and hand shear vanes were undertaken at regular intervals during drilling. The geotechnical results are presented in Appendix C.

4.1 Strength and Density

One natural clay sample was subject to quick 38mm undrained triaxial tests a depth of 2.40mbgl (BH2). The test produced shear strength of 87kPa (high strength). However, this should not be used as standalone indicators of soil strength and should not be used to calculate bearing capacities unless accompanied by similar insitu testing results.

Additional, in-situ SPT was undertaken in BH1 only, returning an N-value of 7 within a sand layer at 3.00mbgl indicating loose conditions.

Hand shear vanes were undertaken at regular intervals within all the boreholes, the results ranged between 41kPa to 87kPa indicating medium to high strength clay.

4.2 Moisture Contents

Five samples recovered from the boreholes have been subject to moisture content tests to determine the moisture profile at depths of between 0.80 and 2.60mbgl. Moisture levels were 23% and 28%.

4.3 Atterberg Limit Determinations

Five Atterberg Limit Determination tests were out carried on samples of cohesive material to classify the fine-grained soils. The results were compared to the Casagrande Chart published in BS 5930 and showed the samples to be clay of low to high plasticity.

The Plasticity Indices were between 12 and 24 with equivalent moisture contents recorded above and below the corresponding plastic limits. The cohesive material can be assessed as having a **medium** shrinkage potential in relation to NHBC Guidance Chapter 4.2.

4.4 pH and Sulphate Results

Three samples were tested for acidity and soluble sulphate content to assess whether the material may be

potentially aggressive to building fabric. The results of the testing for pH were between 6.8 and 8.4 indicating slightly acidic to alkaline conditions. The soluble sulphates were between 10 and 63mg/l.

4.5 Foundations

The ground conditions generally comprise made ground to depths of between 0.60mbgl and 2.10mbgl. The underlying natural soils comprise generally medium strength clay with occasional bands of sand to 3.10mbgl and 4.20mbgl where slightly sandy, slightly gravelly high strength clay was encountered.

The use of strip footing foundations should be adopted with a view to founding on competent natural medium strength clay at a minimum depth of 0.90mbgl. The strip foundations should be stepped to 2.10mbgl where deeper made ground is present (BH2).

Based on a conservative shear strength of 53kN/m² a safe bearing capacity of 120kN/m² has been determined for strip foundations 0.60m wide founding on the cohesive material in at 0.90mbgl.

For a pad foundation 1.0m square, using a shear strength of 53kN/m² a safe bearing capacity of 130kN/m² has been determined

Foundations near existing or proposed trees should be deepened and provided with appropriate heave precautions in accordance with NHBC Standards Chapter 4.2 current guidance.

Further advice should be sought from Solmek if unexpected ground conditions are encountered during redevelopment.

Sub-surface concrete should be Design Sulphate Class DS-1, with the site allocated an ACEC Classification of AC-1s. This assumes static groundwater conditions.

4.6 Excavation

Based on the nature of the ground conditions encountered, excavations should be within the capacity of normal earthworks plant. Stability of excavations is expected to be poor in the made ground but will improve in the natural clay. Excavation sides should be designed, constructed and supported in accordance with the recommendations given in CIRIA Report No. 97: "Trenching Practice".

4.7 Groundwater

Groundwater was encountered in BH1 only as seepage at 3.60mbgl.

It should be noted the rapid rate of advancement of the exploratory holes may mask minor seepages and it should be borne in mind that water levels fluctuate with several influences including season, rainfall, dewatering and pumping activities. Therefore, water levels significantly higher than those found during this investigation may be encountered.

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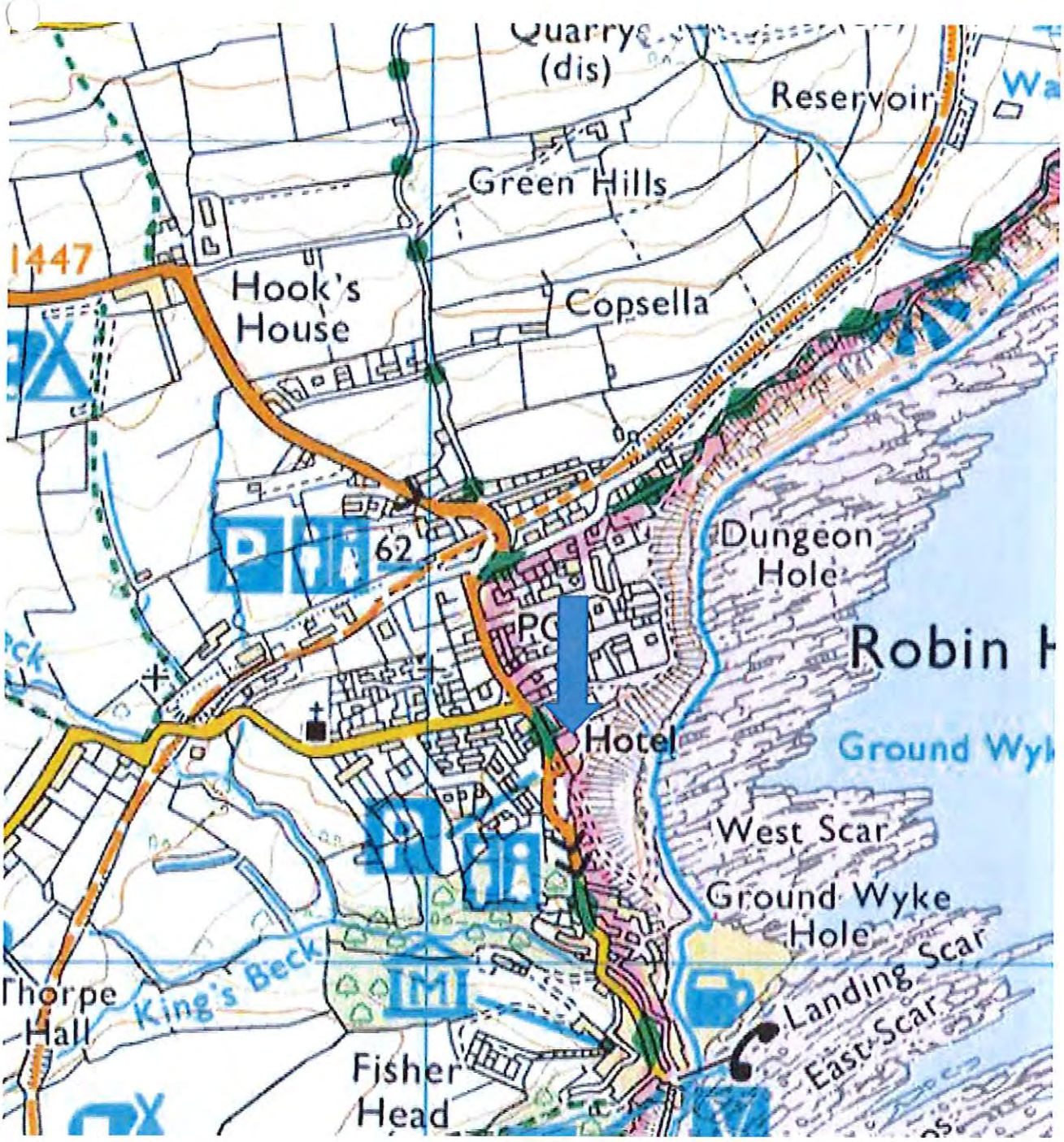
APPENDIX A:
Figures



Title	Date
Site Location Plan	September 2017
Project	**Fig No.**
Victoria Hotel, Robin Hoods Bay	Figure 1
Client	**Scale**
Mr A Fidler	Do Not Scale
Key	

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19 OCT 2017

Solmek Ltd.
12 Yarm Road
Stockton-on-Tees
TS18 3NA

www.solmek.com

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pTitle	Date
Borehole Plan	September 2017
Project	**Fig No.**
Victoria Hotel, Robin Hoods Bay	Figure 2
Client	**Scale**
Mr A Fidler	Do Not Scale
Key	

Solmek Ltd.
12 Yarm Road
Stockton-on-Tees
TS18 3NA

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APPENDIX B:
Borehole Logs

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Borehole Log

Scale 1:50 Sheet 1 of 1

BH1

Contract no:	S170840	**Site:**	Victoria Hotel, Robin Hoods Bay	**Driller:**	SR Drilling Ltd
Client:	Mr A Fidler			**Plant used:**	Mini Rig
Method:	Small Percussive			**Started:**	05/09/2017
				Ended:	05/09/2017
				Backfilled:	05/09/2017

GL (AOD):
Easting:
Northing:
Logged: PF
Status: FINAL

Backfill / Installation	Legend	Depth (m)	Level (m AOD)	Stratum Description	Samples and Insitu Testing		
					Depth (m)	Type	Results
				MADE GROUND: Slightly gravelly topsoil. Gravel is angular to sub angular fine to coarse of sandstone.	0.20	D	
					0.40 - 0.60	D	
		0.60		Soft to firm consistency brown to dark brown sandy medium strength CLAY of intermediate plasticity with occasional bands of sand.	0.80 - 1.00	D	
					1.00	HV	57kPa
					1.40 - 1.60	D	
					1.80 - 2.00	D	
					2.00	HV	48kPa
					2.40 - 2.60	D	
		2.70		Loose brown clayey fine to coarse SAND.	2.80 - 3.00	D	
					3.00 - 3.45	SPT (S)	N=7 (1,1/1,2,2,2)
		3.10		Firm consistency grey to brown slightly sandy slightly gravelly medium to high strength CLAY. Gravel is angular to sub angular fine to coarse of sandstone.	3.40 - 3.60	D	
					3.80 - 4.00	D	
					4.00	HV	62kPa
					4.40 - 4.60	D	
					4.80 - 5.00	D	
		5.00		End of Borehole at 5.000m	5.00	HV	76kPa

Hole Diameter		Casing Depths		General Remarks
Depth Base (m)	Diameter (mm)	Depth Base (m)	Diameter (mm)	Groundwater seepage at 3.60m.

Chiselling		
From (m)	To (m)	Time (hr)

Ground Water				
Depth Strike (m)	Depth Casing (m)	Depth Sealed (m)	Time Elapsed (min)	Water Level (m)
3.60				

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Borehole Log

Scale 1:50 Sheet 1 of 1

BH2

Contract no:	S170840	**Site:**	Victoria Hotel, Robin Hoods Bay	**Driller:**	SR Drilling Ltd
				Plant used:	Mini Rig
				Started:	05/09/2017
Client:	Mr A Fidler			**Ended:**	05/09/2017
Method:	Small Percussive			**Backfilled:**	05/09/2017

GL (AOD):
Easting:
Northing:
Logged: PF
Status: FINAL

Backfill / Installation	Legend	Depth (m)	Level (m AOD)	Stratum Description	Samples and Insitu Testing		
					Depth (m)	Type	Results
				MADE GROUND: Slightly gravelly topsoil. Gravel is angular to sub angular fine to coarse of sandstone.	0.20	D	
					0.40 - 0.60	D	
					0.80 - 1.00	D	
					1.00	HV	49kPa
		1.40		MADE GROUND: Soft consistency dark brown sandy slightly organic clay.	1.40 - 1.60	D	
					1.80 - 2.00	D	
		2.10		Soft to firm consistency brown to dark brown sandy medium strength CLAY of low plasticity with occasional bands of sand.	2.00	HV	41kPa
					2.40 - 2.60	D	
					2.80 - 3.00	D	
					3.00	HV	53kPa
					3.40 - 3.60	D	
					3.80 - 4.00	D	
		4.10		Firm consistency grey to brown slightly sandy slightly gravelly medium to high strength CLAY. Gravel is angular to sub angular fine to coarse of sandstone.	4.00	HV	76kPa
					4.40 - 4.60	D	
					4.80 - 5.00	D	
		5.00		End of Borehole at 5.000m	5.00	HV	87kPa

Hole Diameter		Casing Depths		General Remarks	Chiselling			Ground Water				
Depth Base (m)	Diameter (mm)	Depth Base (m)	Diameter (mm)		From (m)	To (m)	Time (hr)	Depth Strike (m)	Depth Casing (m)	Depth Sealed (m)	Time Elapsed (min)	Water Level (m)
				No groundwater encountered.								

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Borehole Log

Scale 1:50 Sheet 1 of 1

BH2

Contract no:	S170840	Site: Victoria Hotel, Robin Hoods Bay	Driller:	SR Drilling Ltd	GL (AOD):
			Plant used:	Mini Rig	Easting:
			Started:	05/09/2017	Northing:
Client:	Mr A Fidler		Ended:	05/09/2017	Logged: PF
Method:	Small Percussive		Backfilled:	05/09/2017	Status: FINAL

Backfill / Installation	Legend	Depth (m)	Level (m AOD)	Stratum Description	Samples and Insitu Testing		
					Depth (m)	Type	Results
		0.05		MADE GROUND: Black tarmac.	0.10 - 0.30	D	
				MADE GROUND: Brown fine to coarse gravel of sandstone.			
		0.30		MADE GROUND: Firm consistency brown sandy slightly gravelly clay. Gravel is angular to sub angular fine to coarse of sandstone.	0.40 - 0.60	D	
		0.80		Firm consistency brown to dark brown sandy medium strength CLAY of intermediate plasticity with occasional bands of sand.	0.80 - 1.00	D	
					1.00	HV	62kPa
					1.40 - 1.60	D	
					1.80 - 2.00	D	
					2.00	HV	54kPa
					2.40 - 2.60	D	
					2.80 - 3.00	D	
					3.00	HV	72kPa
					3.40 - 3.60	D	
					3.80 - 4.00	D	
					4.00	HV	68kPa
		4.20		Firm consistency grey to brown slightly sandy slightly gravelly medium to high strength CLAY. Gravel is angular to sub angular fine to coarse of sandstone.	4.40 - 4.60	D	
					4.80 - 5.00	D	
		5.00		End of Borehole at 5.000m	5.00	HV	69kPa

Hole Diameter		Casing Depths		General Remarks	Chiselling			Ground Water				
Depth Base (m)	Diameter (mm)	Depth Base (m)	Diameter (mm)	No groundwater encountered.	From (m)	To (m)	Time (hr)	Depth Strike (m)	Depth Casing (m)	Depth Sealed (m)	Time Elapsed (min)	Water Level (m)

2531

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ANALYTICAL TEST REPORT

Contract no:	67126
Contract name:	Victoria Hotel, Robin Hoods Bay
Client reference:	S170840
Clients name:	Solmek
Clients address:	12 Yarm Road Stockton-On-Tees TS18 3NA
Samples received:	08 September 2017
Analysis started:	08 September 2017
Analysis completed	14 September 2017
Report issued:	14 September 2017

Notes:

Opinions and interpretations expressed herein are outside the UKAS accreditation scope.
Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.
Methods, procedures and performance data are available on request.
Results reported herein relate only to the material supplied to the laboratory.
This report shall not be reproduced except in full, without prior written approval.
Samples will be disposed of 6 weeks from initial receipt unless otherwise instructed.

Key:

U UKAS accredited test
M MCERTS & UKAS accredited test
$ Test carried out by an approved subcontractor
I/S Insufficient sample to carry out test
N/S Sample not suitable for testing

Approved by:

Dave Bowerbank
Customer Services Co-ordinator

Chemtech Environmental Limited

SAMPLE INFORMATION

MCERTS (Soils):

Soil descriptions are only intended to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions. MCERTS accreditation applies for sand, clay and loam/topsoil, or combinations of these whether these are derived from naturally occurring soils or from made ground, as long as these materials constitute the major part of the sample. Other materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

All results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.
Analytical results are inclusive of stones.

Lab ref	Sample id	Depth (m)	Sample description	Material removed	% Removed	% Moisture
67126-1	BH1	0.80-1.00	Clay	-	-	18.0
67126-2	BH2	2.40-2.60	Clay	-	-	16.7
67126-3	BH3	1.40-1.60	Clay	-	-	23.5

Chemtech Environmental Limited

SOILS

Lab number			67126-1	67126-2	67126-3
Sample id			BH1	BH2	BH3
Depth (m)			0.80-1.00	2.40-2.60	1.40-1.60
Date sampled			08/09/2017	08/09/2017	08/09/2017
Test	**Method**	**Units**			
pH	CE004 M	units	8.4	6.8	7.6
Sulphate (2:1 water soluble)	CE061 M	mg/l SO_4	63	10	35

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Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE004	pH	Based on BS 1377, pH Meter	Wet	M	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	M	10	mg/l SO_4

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.
For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.
Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

N	No (not deviating sample)
Y	Yes (deviating sample)
NSD	Sampling date not provided
NST	Sampling time not provided (waters only)
EHT	Sample exceeded holding time(s)
IC	Sample not received in appropriate containers
HP	Headspace present in sample container
NCF	Sample not chemically fixed (where appropriate)
IT	Sample not cooled
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
67126-1	BH1	0.80-1.00	N	
67126-2	BH2	2.40-2.60	N	
67126-3	BH3	1.40-1.60	N	

APPENDIX C:
Geotechnical Test Results

Laboratory Report Front Sheet

Site name	Job number
Victoria Hotel, Robin Hoods Bay	S170840

Solmek
12-16 Yarm Road,
Stockton on Tees,
TS18 3NA

UKAS TESTING
7607

Client details:

Reference: S170840
Name: Solmek
Address: 12 Yarm Road,
Stockton-on-tees,
TS18 3NA

FAO: P Finnimore

Date commenced: 08/09/2017

Date reported: 15/09/2017

Observations and interpretations are outside of the UKAS Accreditiation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced in full, without the prior written approval of the laboratory.

Samples will be held at the laboratory for a period of 4 weeks after the report date. After the 15-10-2017 all samples will be disposed of. Should further testing be required then the office should be informed before the above date.

Signature:	Approved Signitories:
	☑ K Watkin (Lab Manager) ☐ U Mazhar (Assistant Lab Manager) ☐ I Nicholson (Technical Manager)

Summary of Classification Tests

Site name	Job number
Victoria Hotel, Robin Hoods Bay	S170840

Solmek
12-16 Yarm Road,
Stockton on Tees,
TS18 3NA

UKAS TESTING
7607

Hole	Depth Top m	Depth Base m	Type	w %	Oven temp. oc	wa %	Pa %	Pr %	wL %	wP %	IP %	IL	Plasticity class	Preparation method
BH1	0.80	1.00		28	105	28	100	0	35-s	20	15	0.533	CI	Tested in natural condition
BH1	1.40	1.60		26	105	27	98	2	39-s	22	17	0.294	CI	Tested after >425µm removed by hand
BH2	2.40	2.60		23	105	25	91	9	31-s	15	16	0.625	CL	Tested after >425µm removed by hand
BH3	0.80	1.00		28	105	28	100	0	34-s	22	12	0.500	CL	Tested after >425µm removed by hand
BH3	1.40	1.60		25	105	25	100	0	50-s	26	24	-0.042	CH	Tested in natural condition

All tests found in Solmek UKAS Schedule of Accreditation are tested to standard unless otherwise indicated

Key	Description		Category	BS Test Code
w	Moisture content			BS 1377:1990 Part 2 Clause 3.2
wa	Equivalent moisture content passing 425µm sieve			BS 1377:1990 Part 2 Clause 3.2
wL	Liquid limit	Single point	-s	BS 1377:1990 Part 2 Clause 4.4
		Four point	-f	BS 1377:1990 Part 2 Clause 4.3
wP	Plastic limit			BS 1377:1990 Part 2 Clause 5.2
Pa	Percentage passing 425um sieve			
Pr	Percentage retained 425um sieve			
IP	Plasticity index			BS 1377:1990 Part 2 Clause 5.4
IL	Liquidity index			BS 1377:1990 Part 2 Clause 5.4
	Suffix indicating test is "Not UKAS Accredited"		*	

Approved by	KW
Approval date	11/09/2017 13:00
Date report generated	
Report Number	

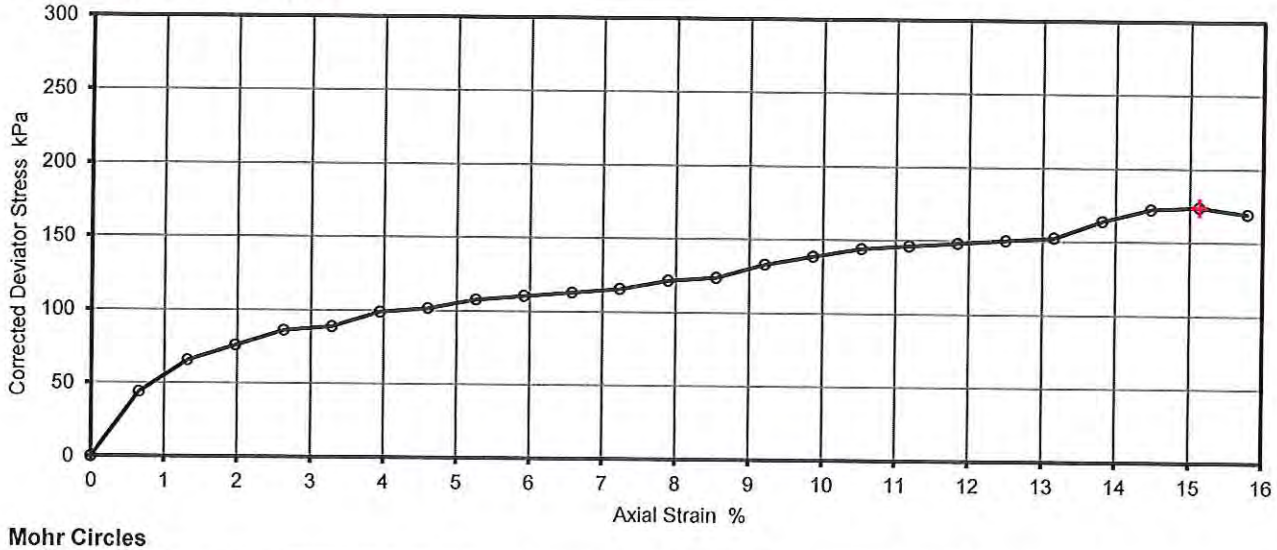
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	S170840
				Borehole/Pit No.	BH2
Site Name	Victoria Hotel, Robin Hoods Bay			Sample No.	
Soil Description				Depth	2.40
Specimen Reference		Specimen Depth	m	Sample Type	
Specimen Description	Firm, brown, slightly gravelly, sandy High CLAY			KeyLAB ID	SLMK2017090814
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	15/09/2017

Test Number	1	
Length	76.0	mm
Diameter	38.0	mm
Bulk Density	1.23	Mg/m3
Moisture Content	22.7	%
Dry Density	1.00	Mg/m3
Rate of Strain	1.0	%/min
Cell Pressure	48	kPa
At failure: Axial Strain	15.1	%
At failure: Deviator Stress, (σ1 - σ3)f	174	kPa
At failure: Undrained Shear Strength, cu	87	kPa ½(σ1 - σ3)f
At failure: Mode of Failure	Compound	

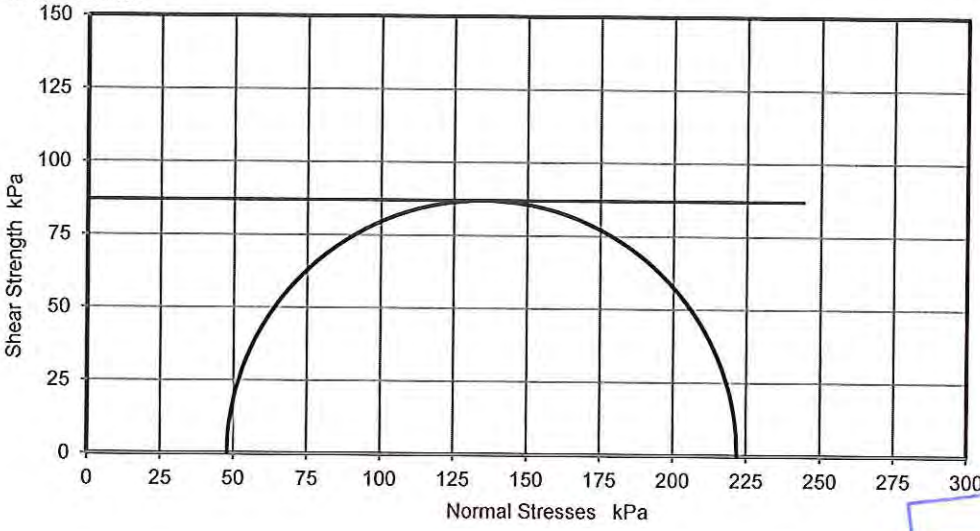
Tracable Equipment Record

Test Frame	TRI-001
Load Ring	TXR-001
Pressure Gauge	GAU-001
Digital Caliper	CAL-004
Balance	BAL-001

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

No of membranes used
1
Total thickness (mm)
0.26

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APPENDIX D:
Notes on Limitations

♠Solmek conditions of offer, notes on limitations & basis for contract (ref: version1/2017)

These conditions accompany our tender and supercede any previous conditions issued. Solmek will prepare a report solely for the use of the Client (the party invoiced) and its agent(s). No reliance should be placed on the contents of this report, in whole or in part by 3rd parties. The report, its content and format and associated data are copyright, and the property of Solmek. Photocopying of part or all of the contents, transfer or reproduction of any kind is forbidden without written permission from Solmek. A charge may be levied against such approval, the same to be made at the discretion of Solmek. Solmek was a trading name of Hymas Geoenvironmental Ltd.

Solmek cannot be held liable and do not warrant, or otherwise guarantee the validity of information provided by third parties and subsequently used in our reports. Solmek are not responsible for the action negligent of otherwise of subcontractors or third parties.

Site investigation is a process of sampling. The scope and size of an investigation may be considered proportional to levels of confidence regarding the ground and groundwater conditions. The exploratory holes undertaken investigate only a small volume of the ground in relation to the overall size of the site, and can only provide a general indication of site conditions. The opinions provided and recommendations given in this report are based on the ground conditions as encountered within each of the exploratory holes. There may be different ground conditions elsewhere on the site which have not been identified by this investigation and which therefore have not been taken into account in this report. Reports are generally subject to the comments of the local authority and Environment Agency. The comments made on groundwater conditions are based on observations made at the time that site work was carried out. It should be noted that mobile contamination, ground gas levels and groundwater levels may vary owing to seasonal, tidal and/or weather related effects. Solmek cannot be held liable for any unrecorded or unforeseen obstructions between exploratory boreholes and trial pits. This includes instances where previous structures on the site (buried man made structures) or the presence of boulder clay (cobbles and/or boulder obstructions) have been anticipated. All types of piling operations should make allowance for obstructions within the construction budget to accommodate this. Unrecorded ancient mining may occur anywhere where seams that have been worked and influence the rock and soil above. Dissolution cavities can occur where gypsum or chalk is present. Rotary drilling is the recommended technique to prove the integrity of the rock.

Where the scope of the investigation is limited via access to information, time constraints, equipment limitations, testing, interpretation or by the client or his agents budgetary constraints, elements not set out in the proposal and excluded from the report are deemed to be omitted from the scope of the investigation.

Desk studies are generally prepared in accordance with RICS guidelines. Environmental site investigations are generally undertaken as 'exploratory investigations' in accordance with the definitions provided in paragraph 5.4 of BS 10175:2001 in order to confirm the conceptual assumptions. You are advised to familiarize yourself with the typical scope of such an investigation. No pumping of water will be undertaken unless a licence or facilities/equipment have been arranged by others.

Where the type, number or/and depth of exploratory hole is specified by others, Solmek cannot and will not be responsible for any subsequent shortfall or inadequacy in data, and any consequent shortfall in interpretation of environmental and geotechnical aspects which may be required at a later date in order to facilitate the design of permanent or temporary works.

All information acquired by Solmek in the course of investigation is the property of Solmek, and, only also becomes the joint property of the Client only on the complete settlement of all invoices relating to the project. Solmek reserve the right to use the information in commercial tendering and marketing, unless the Client expressly wishes otherwise in writing. The quoted rates do not include VAT, and payment terms are 30 days from dispatch of invoice from our offices. Quotes are subject to a site visit.

We have allowed for 1 mobilisation and normal working hours unless otherwise stated. The scope of the investigation may be reviewed following the desk study and/or fieldwork. The presence or otherwise of Japanese Knotweed or other invasive plants can be difficult to identify especially during winter months. If Japanese Knotweed or other invasive species are suspect, it should be confirmed by an ecologist. We have not allowed for acquiring services information, and cannot be responsible for damage to underground services or pipes not shown to us or not clearly shown on plans. Costs incurred will be passed on to you, and in commissioning Solmek you understand and accept that you/your agent have a contractual relationship with Solmek & you accept this. Our rates assume unobstructed, reasonably level and firm access to the exploratory positions and adequate clear working areas and headroom. We have priced on the basis that you or your client have the necessary permissions, wayleaves and approvals to access land. All boreholes and pits are backfilled with arisings except where gas monitoring pipes are installed with stopcock covers. Solmek are not responsible for any uneven surfaces as a result of siteworks and rutting and backfilled excavations may require re-levelling and/or making good by others after fieldwork is complete, and Solmek has not allowed for this. No price has been provided or requested for a return visit to remove pipework and covers. Hourly rates apply to consultancy only and do not include expenses unless otherwise shown. If warranties are required, legal costs incurred will be passed on to you assuming Solmek agree to complete such warranties, modified or otherwise and you understand and agree to pay all costs.

We reserve the right to pursue full payment of the invoice prior to release of any information including reports. We advise you/your client that we may elect to pursue our statutory rights under late payment legislation, and will apply 8% to the base rate for unreasonably late payments. Solmek are exempt from the CIS Scheme. Solmek offer to undertake work only in strict accordance with conditions covered by our current insurances, which are available for inspection. Solmek are not responsible for acts, negligent or otherwise of subcontractors and as a matter of policy cannot indemnify any other parties. Professional indemnity Insurance is limited to ten times the invoice net total except where stated otherwise by Solmek. Solmek give notice that consequential loss as a direct or indirect result of Solmek's activities or omission of the same are excluded.

SOLMEK NOTES ON CONTAMINATION GUIDANCE (REF: VERSION 2/2017)

UK BACKGROUND

Environmental Protection Act 1990: Part 2A Revised Statutory Guidance (April 2012)

This revised document explains how the Local Authority should decide if land, based on a legal interpretation, is contaminated. The document replaces the previous guidance given in Annex 3 of DEFRA Circular 01/2006, issued in accordance with section 78YA of the 1990 Environmental Protection Act.

The main objectives of the Part 2A regime are to *"identify and remove unacceptable risks to human health and the environment"* and to *"seek to ensure that contaminated land is made suitable for its current use"*.

Part 2A uses a risk based approach to defining contaminated land whereby the "risk" is interpreted as *"the likelihood that harm, or pollution of water, will occur as a result of contaminants in, on or under the land"* and by *"the scale and seriousness of such harm or pollution if it did occur"*.

For a relevant risk to exist a contaminant, pathway and receptor linkage must be present before the land can be considered to be contaminated. The document explains that *"for a risk to exist there must be contaminants present in, on or under the land in a form and quantity that poses a hazard, and one or more pathways by which they might significantly harm people, the environment, or property; or significantly pollute controlled waters."*

A conceptual model is used to develop and communicate the risks associated with a particular site.

To determine if land is contaminated the local authority use various categories from 1 to 4. Categories 1 and 2 include *"land which is capable of being determined as contaminated land on grounds of significant possibility of significant harm to human health."*

Categories 3 and 4 *"encompass land which is not capable of being determined on such grounds"*.

PRELIMINARY CONCEPTUAL MODEL

Preliminary Conceptual Models are undertaken in accordance with CIRIA C552. The Preliminary Conceptual Model assesses the consequence and the likelihood of a risk being realised to provide a risk classification, using the tables detailed below.

CONSEQUENCE OF RISK BEING REALISED (Based on C552 CIRIA, 2001)

Classification	Definition	Example
Severe	Short-term (acute) risk to human health, the environment, an element of the development or other aspect with is likely to result in *significant harm*, damage or both.	High concentrations of cyanide on the surface of an informal recreational area. Major spills of contaminants from site into controlled water. High concentrations of explosive gas in the subsurface environment that have a clear unobstructed pathway into buildings.
Moderate	Chronic damage to human health, a plausible chance that an event will occur, although the timeline is not immediate to be in the short-term.	Appreciable concentration of contamination that over the longer-term will cause significant harm i.e. high lead concentration in topsoil. Shallow mine workings that are potentially unstable but may remain in a satisfactory or stable conditions for a number of years.
Mild	Low level pollution of non-sensitive water, a feasible hazardous scenario although the timeline of such occurring can probably be considered in 10's of years.	The effect of high sulphate concentrations on structural concrete. Pollution of non-classified groundwater.
Minor	Harm, although not necessarily significant to human health, or with respect to other aspects of the development, which are considered implausible in terms of occurrence, or will have little consequential impact.	The presence of contaminants at such low concentrations that protective equipment is required during site works. Any damage to structures is minimal and will not be structural in characteristics.

PROBABILITY OF RISK BEING REALISED (C552 CIRIA, 2001)

Classification	Definition
High Likelihood	There is a viable pollutant linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence that the receptor has been harmed or polluted.
Likely	There is a viable pollutant linkage and all elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low Likelihood	There is a viable pollutant linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Unlikely	There is a viable pollutant linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

RISK CLASSIFICATION MATRIX (C552 CIRIA, 2001)

Risk = Probability x Consequence		Consequence			
		Severe	Medium	Mild	Minor
Probability	High likelihood	Very high risk	High risk	Moderate risk	Moderate/low risk
	Likely	High risk	Moderate risk	Moderate/low risk	Low risk
	Low likelihood	Moderate risk	Moderate/low risk	Low risk	Very low risk
	Unlikely	Moderate/low risk	Low risk	Very low risk	Very low risk

HUMAN RECEPTORS

Human exposure to contaminants present in soils can occur via several pathways. Direct exposure pathways include dermal absorption after contact with contaminated ground, inhalation of soil or dust, inhalation of volatised compounds, and inadvertent soil ingestion (or deliberate soil ingestion in the case of some children). Other indirect pathways include human ingestion of plants grown in contaminated soil or contaminated ground or surface water. Contaminants associated with wind blown dust can affect humans on surrounding sites.

VEGETATION

Plants can be affected by soil contamination in a number of ways resulting in growth inhibition, nutrient deficiencies and yellowing of leaves. Contaminants are taken up by plants through the roots and through foliage. Contaminants identified as being highly phytotoxic include boron, cadmium, copper, lead, nickel, and zinc.

To establish if the levels of contaminants present on a site may pose a risk to vegetation the results of the contamination testing are compared to a series of threshold values published in 'Code of Good Agricultural Practice for the Protection of Soil'.

GROUNDWATER AND SURFACE WATER RECEPTORS

The principal pathway by which soil contamination may reach the water environment is through a slow seepage or leaching to groundwater or surface water. The potential for contaminants to migrate along such pathways is dependent on the chemical and physical characteristics of the contaminants and the local hydrogeology. Surface watercourses may also accumulate contamination as contaminated sediments are deposited within the water body.

Where the site investigated overlies major/principal aquifers (and in some cases minor/secondary aquifers depending on certain conditions), groundwater Source Protection Zones and areas in close proximity to groundwater abstractions, contamination test results have been compared with the Water Supply (Water Quality) Regulations 1989 and The Water Supply (Water Quality) Regulations 2000.

Should a surface water receptor, such as a fresh water environment (river, canal, stream, lake etc), or marine environment be considered sensitive in relation to a site, then test results are compared with DEFRA & SEPA Environmental Quality Standards (2004). Many of the Environmental Quality Standards are hardness ($CaCO_3$) depended. Where no hardness values are available, Solmek assume conservative values (of between 0 and 50mg/l).

In the absence of vulnerable ground and surface water environments, Solmek may compare any test results with the Environment Agency Leachate Quality Threshold Values.

DETAILED QUANTITATIVE RISK ASSESSMENT (DQRA)

In line with CLR 11- Model Procedures, a DQRA for groundwater/human health may be required following a Phase 2 investigation and before the preparation of a Phase 3 Remediation Strategy. For human health DQRA, a site specific assessment criteria is undertaken using CLEA Software Version 1.06. For groundwater DQRA, the Environment Agency Remedial Targets Worksheet Version 3.1 is used.

WASTE ACCEPTANCE CRITERIA

The WAC testing relates to materials that are to be exported from a site/development to landfill, and do not directly relate to human health specifically. The WAC test categorises materials as either inert waste, non-reactive hazardous waste, and hazardous waste.

The testing results are generally presented as certificates which can be used by site owners/contractors etc, which should be presented to the accepting waste facility or waste contractor.

CONSTRUCTION MATERIALS

Materials at risk from possible soil contaminants include inorganic matrices such as cement and concrete and also organic material such as plastics and rubbers. Acid ground conditions and high levels of sulphates can accelerate the corrosion of building materials. Where pH and soluble sulphate analysis has been undertaken, Solmek compare the test results with the guidelines presented within BRE Special Digest 1, 2005 (3rd Edition) 'Concrete in Aggressive Ground'. Plastics and rubbers are generally used for piping and service ducts and are potentially attacked by a range of chemicals, most of which are organic, particularly petroleum based substances. Drinking water supplies can be tainted by substances that can penetrate piping and water companies enforce stringent threshold values.

The levels of potential contaminants should be compared to thresholds supplied in the UK Water Industry Research (UKWIR) publication "Guidance for the selection of Water Supply Pipes to be used in Brownfield Sites" (January 2011). A Brownfield Site is defined in the document as "Land or premises that have not previously been used or developed that may be vacant or derelict". It should be noted that Brownfield sites may not be contaminated. The guidance does not apply to Greenfield Sites however water companies may have their own assessment criteria which should be checked by the developer. The table below outlines the pipe material selection threshold concentrations.

	Pipe Material (Threshold concentrations in mg/kg)					
Parameter group	**PE**	**PVC**	**Barrier pipe (PE-AL-PE)**	**Wrapped Steel**	**Wrapped Ductile Iron**	**Copper**
Extended VOC suite by purge and trap or head space and GC-MS with TIC	0.5	0.125	Pass	Pass	Pass	Pass
+ BTEX + MTBE	0.1	0.03	Pass	Pass	Pass	Pass
SVOCs TIC by purge and trap or head space and GC-MS with TIC (aliphatic and aromatic C5-C10)	2	1.4	Pass	Pass	Pass	Pass
+ Phenols	2	0.4	Pass	Pass	Pass	Pass
+ Cresols and chlorinated phenols	2	0.04	Pass	Pass	Pass	Pass
Mineral oil C11-C20	10	Pass	Pass	Pass	Pass	Pass
Mineral oil C21-C40	500	Pass	Pass	Pass	Pass	Pass
Corrosive (Conductivity, Redox and pH)	Pass	Pass	Pass	Corrosive if pH <7 and conductivity >400µS/cm	Corrosive if pH <5, Eh not neutral and conductivity >400µS/cm	Corrosive if pH <5 or >8 and Eh positive
Specific suite identified as relevant following site investigation						
Ethers	0.5	1	Pass	Pass	Pass	Pass
Nitrobenzene	0.5	0.4	Pass	Pass	Pass	Pass
Ketones	0.5	0.02	Pass	Pass	Pass	Pass
Aldehydes	0.5	0.02	Pass	Pass	Pass	Pass
Amines	Fail	Pass	Pass	Pass	Pass	Pass

REQUIREMENTS OF PARTIES WITHIN THE DEVELOPMENT PROCESS

Interested parties involved in the development process may use the data in different ways and there may be varying views and interpretation of the factual data. Local Authority staff may have a view on contamination and human health and the wider environment. The Environment Agency are concerned principally with the protection of Controlled waters. Building insurers, funders and purchasers may be primarily concerned with issues of potential commercial blight. Purchasers are also not always fully informed, and perceptions on issues associated with risk can affect the decision to purchase. Developers and construction organisations will focus on financial aspects of dealing with the contamination in the context of the development and construction programme.

RISKS & LIABILITIES FROM CONTAMINATION

In simple terms, risks associated with contamination may be considered in terms of 1) statutory risks and 2) development related risks. If contamination is severe or forms a potential hazard based on its potential to affect groundwater, surface water or human health, a statutory risk may be present, and as such, if the risk is not reduced, criminal proceedings may be instigated by a government body or local authority.

If the contamination is less severe or not considered to be mobile, it may be considered a commercial liability which could, in theory remain untreated, but which may at a later date affect the value of the property, or, with changing legislation, become a statutory risk. Commercial liabilities could give rise to civil proceedings by third parties if there are grounds for action.