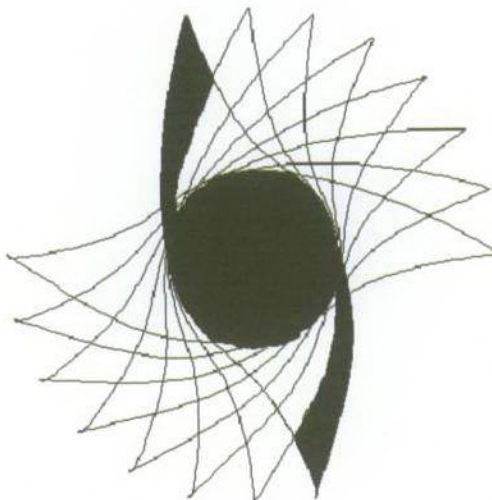

Phase 1 Site Survey

at

**Cherry Lodge Golf Club
Jail Lane
Biggin Hill
Westerham
Kent
TN16 3AX**



on behalf of



Woodland Environmental Limited

**Our ref.: TJ2475AR1
February 2011**



Copyright : Terragen Environmental Consultants Limited

Terragen Environmental Consultants Limited (TGEN) has prepared this report in accordance with the instructions of Powell Associated Limited on behalf of Woodland Environmental Limited (the client) under the terms of our appointment to undertake a Phase 1 site survey, on behalf of the client. The report is for the sole and specific use of the client, and TGEN shall not be responsible for any purpose other than that for which it was prepared and provided. Should the client require to pass copies of the report to other parties for information, the whole of the report should be so copied, but no professional liability or warranty shall be extended to other parties by TGEN in this connection without the explicit written agreement thereto by TGEN.

PREPARED BY	REVIEWED BY
	
Paul Brewer Senior Environmental Consultant <i>BSc (Hons), MSc, MI Soil Sci, CSci</i> <i>(for and on behalf of Terragen Environmental Consultants Limited)</i>	Dr Barry Powell BSc (Hons), PhD, MCIWM Principal Consultant



CONTENTS

1.0 INTRODUCTION	4
2.0 REMIT AND APPROACH.....	4
2.1 Remit	5
2.2 Contaminated Land Investigation Approach	5
3.0 PHASE 1 SITE SURVEY	6
3.1 Site Location, History and Proposed Development Plans	6
3.1.1 Site Location.....	6
3.1.2 Site History	6
3.1.3 Site Walkover	6
3.1.4 Proposed Development Plan	8
3.2 Geology and Ground Conditions	8
3.2.1 Published Geology	8
3.2.3 Other Ground Conditions.....	8
3.3 Controlled Waters	9
3.3.1 Hydrogeology and Groundwater	9
3.3.2 Hydrology and Surface Water Features	10
3.3.3 Flood Risk.....	10
3.4 Environmental Setting	11
3.4.1 Authorisations, Incidents and Registers	11
3.4.2 Landfill and Other Waste Sites	11
3.4.3 Current Land Uses	12
3.4.4 Environmentally Sensitive Land Uses	12
4.0 TIER 1 QRA.....	13
4.1 Potential Sources.....	13
4.2 Potential Receptors	13
4.3 Potential Pathways and SPL	13
4.3.1 Human Health SPL (End-Users)	13
4.3.2 Flora and Fauna SPL	14
4.3.3 Groundwater SPL	14
4.3.4 Surface Water SPL.....	15
4.3.5 Buildings and Construction Materials SPL.....	15
4.4 Preliminary CSM & Risk Assessment.....	16
5.0 CONCLUSIONS AND RECOMMENDATIONS	17
5.1 Additional Works.....	17
5.2 Discovery Strategy.....	17
5.3 Regulatory Approval	17
6.0 LIMITATIONS AND USE OF THIS REPORT	18

APPENDICES

Appendix A	Contaminated Land Investigation Protocol.
Appendix B	Site Location Plan.
Appendix C	London Borough of Bromley Records.
Appendix D	GroundSure Data Report.
Appendix E	Photographic Record – Site Walkover.



1.0 INTRODUCTION

Terragen Environmental Consultants Limited (TGEN) was commissioned by Powell Associates Limited on behalf of Woodland Environmental Limited (the client), via a verbal instruction to proceed dated 02/02/2011, to undertake a Phase 1 site survey at Cherry Lodge Golf Club, Jail Lane, Biggin Hill, Westerham, Kent, TN16 3AX (the site) in order to address the likely requirements of contaminated land conditions expected to be attached by the London Borough of Bromley (the local authority) to any planning permission granted for development at the site.

2.0 REMIT AND APPROACH

We understand that it is proposed to:-

- 4 Re-grade various parts of the existing course to provide a more challenging and aesthetically pleasing environment for playing golf.

A planning application has yet to be submitted. We would anticipate that should the local authority grant permission for the proposed development that a number of conditions will be attached, which must be complied with to be discharged. We would expect a number of conditions to be related to the investigation of and management of potential contamination, which may be similar to the following:-

No development approved by this permission shall be commenced prior to a contaminated land assessment and associated remedial strategy together with a timetable of works, being submitted to the local authority for approval.

a) The contaminated land assessment shall include a desk study to be submitted to the local authority for approval. The desk study shall detail the history of the site's uses and propose a site investigation strategy based on the relevant information discovered by the desk study. The strategy shall be approved by the local authority prior to investigations commencing on site.

b) The site investigation including relevant soil gas, surface and groundwater sampling shall be carried out by a suitably qualified and accredited consultant/contractor in accordance with the quality assured sampling and analysis methodology.

c) A site investigation report detailing all investigative works and sampling on site together with the results of analysis, risk assessment to any receptors and a proposed remediation strategy shall be submitted to the local authority. The local authority shall approve such remedial works as required prior to any remediation commencing on site. The works shall be of such a nature so as to render harmless the identified contamination given the proposed end-use of the site and surrounding environment including any controlled waters.

d) Approved remediation works shall be carried out in full on site under a quality assurance scheme to demonstrate compliance with the proposed methodology and best practice guidance. If during any works contamination is encountered which has not previously been identified then the additional contamination should be fully assessed and an appropriate remediation scheme submitted to the local authority for approval.

e) Upon completion of the works this condition shall not be discharged until a closure report has been submitted to and approved in writing by the local authority. The closure report shall include details of the proposed remediation works and the quality assurance certificates that show that the works have been carried out in full in accordance with the approved methodology. Details of any post remediation sampling and analysis to show the site has reached the required clean-up criteria shall be included in the closure report together with the necessary documentation detailing what waste materials have been removed from the site.



2.1 Remit

Our remit included for a Phase 1 site survey (desk study) to address the likely requirements of the initial phases of a contaminated land condition, as described in paragraph a) above in order to:-

- ↳ Assess the presence and significance of potential sources of contamination at and in the vicinity of the site.
- ↳ Assess the presence and significance of potential sensitive receptors at and in the vicinity of the site.
- ↳ Assess the presence and significance of plausible pathways at and in the vicinity of the site.
- ↳ Assess the potential environmental liabilities and consequences associated with the development of the site.
- ↳ Construct a preliminary conceptual site model (CSM) for the development.
- ↳ Identify requirements for further works, including the design of a Phase 2 site investigation (if deemed necessary).

2.2 Contaminated Land Investigation Approach

Environmental assessors use a Source-Pathway-Receptor (SPR) conceptual site model when assessing the risk posed by a potentially contaminated site. For potential risk to arise each stage of the SPR linkage must be present, plausible and significant. Our approach to the Phase 1 site survey is detailed in Appendix A.



3.0 PHASE 1 SITE SURVEY

The following section comprises a review of the information obtained by TGEN as part of the Phase 1 site survey including:-

- ↳ Geological maps of the local area.
- ↳ Site location plan (presented in Appendix B).
- ↳ A detailed response to our enquiry entailing a comprehensive review of records held by the local authority (presented in Appendix C).
- ↳ GroundSure data report relating to the site and surrounds (presented in Appendix D).
- ↳ Archaeology Data Service, Natural England and MAGIC search records.
- ↳ Interviews with key stakeholders.
- ↳ Site visit(s), site survey(s) and photographic record(s) (presented in Appendix E).

3.1 Site Location, History and Proposed Development Plans

3.1.1 Site Location

The site comprises an irregular shaped plot (circa 44ha in size) in a predominantly rural area to the E of Biggin Hill and circa 6km to the N of Westerham and is centred approximately at National Grid Reference (NGR) TQ 435 587. A site location plan, showing the boundary of the proposed application site, is presented Appendix B.

3.1.2 Site History

The golf club was founded in 1969, before which the area was mainly woodland and undeveloped land.

Mapping from 1895 to 1955 shows a number of unspecified pits (10m to the NE, 200m to the W and 210m to the NE) and a brick works circa 240m to the W. Several pits shown on mapping from 1895 to 1955 are listed as potentially in-filled.

A number of tanks are located within the boundary of the site from 1897 to 1981. Further tanks are shown circa 40m to the NW, 47m to the N and 90m to the W. A gas compound is shown to be located on site since 1981, although this is in-fact immediately beyond the NW boundary of the site.

3.1.3 Site Walkover

A walkover survey including interviews with the client/landowner was undertaken in accordance with DoE (1994a), Environment Agency (2004a) and BSI (2001) by a geo-environmental engineer from TGEN on the 17/02/2011. Observations made during the walkover are summarised below and should be read in conjunction with the photographic record presented in Appendix E.



Site Address	Cherry Lodge Golf Club, Jail Lane, Westerham, Kent, TN16 3AX.	
Site Area	Golf course and clubhouse comprising 44ha.	
Grid Reference	TQ 435 587.	
Usage	Golf course (including clubhouse and pro-shop).	
Feature	Details	Description
Land-Use Surrounding the Site	North	Rural/Agricultural/Woodland
	South	Rural/Agricultural/Woodland
	East	Rural/Agricultural/Woodland
	West	Rural/Agricultural/Woodland
Access	n/a	Via driveway along W perimeter of site off Jail Lane to the N of the site.
Topography	Site	The general topography of the site is undulating with an overall fall from N to S.
Surfacing	Site	The golf course was soft surfaced whereas the clubhouse and surrounds (patio, pathways etc.) were under hard-standing (concrete, paving etc.). The car park was predominantly under hard-standing (tarmac) with some areas comprising compacted aggregates.
Vegetation	Site	Vegetation at the site included large areas of rough grass/fine turf associated with the fairways, tees and greens making up the course, with pockets of mature trees/woodland, which included a number of different species such as oak, conifer etc. around the course and the perimeter of the site. No signs of significant stress/dieback were observed at the time of the walkover (winter).
Foundations	Site	Not investigated, although we would assume that strip foundations have been used for the current clubhouse.
Services	Site	Not observed, although assumed to enter the site along the driveway on the W perimeter from Jail Lane at the N of the site.
Buildings	Site	The clubhouse comprised a split level part single part two-storey brick building with a flat roof. A green-keepers yard was located to the SE of the clubhouse and comprised a single storey breeze block building with roller shutter doors and several metal storage containers.
Activities	Site	The site was operational at the time of the walkover, with recreational (golf), commercial (golf shop, bar) and groundworks (green keeping) taking place.
Tanks	Site	A 3500litre MDPE bunded above ground storage tank (AST) was located within the green keepers' shed containing red diesel for fuelling the green keeping machinery (tractor etc.). There was no evidence (visual or olfactory) of significant contamination (leakage/spills) associated with the tank. A large, mains fed water tank was located within the green keepers yard. A redundant 2500litre MDPE bunded AST was also located within the green keepers' compound, which we understand is empty and has been cleaned. There was no evidence of significant contamination (e.g. leakages, spills etc.) associated with this tank.
Interceptors	Site	None observed.
Surface Water	Site	An ornamental pond was located immediately to the NW of the clubhouse, which we understand is lined (butyl liner or similar).
Additional Observations	Site/ Surrounds	We understand that water from the course (tees and greens) drains to land. Rainwater from the roof of the clubhouse is harvested for irrigation of the course. Effluent from the clubhouse and adjacent property to the S is drained to a sump adjacent to the 1 st tee, from where it is pumped to the mains drain on Jail Lane. The irrigation system for the golf course is supplied by a large mains fed water tank. Chemicals (fungicides and herbicides) for use on the course were kept in a locked container within the green keepers' shed.



3.1.4 Proposed Development Plan

It is proposed to:-

- ✎ Re-grade various parts of the existing course to provide a more challenging and aesthetically pleasing environment for playing golf.
- ✎ No buildings are proposed as part of the development.

3.2 Geology and Ground Conditions

3.2.1 Published Geology

The published geological survey map (1:50,000 scale, British Geological Survey, Sheet 287, Sevenoaks, Solid and Drift Edition) for the Westerham area is summarised in sequence from the surface in the table below:-

Stratum	Aquifer	Area Covered	Estimated Thickness	Age	Typical Description
Topsoil/Subsoil*	No	Whole Site	0 to 1m	Recent	Sandy, silty clay with gravel.
Diamicton	No	Whole Site	Circa 15m	Pleistocene	Clay with flints.
Upper Chalk	Principal	Whole Site	Circa 35m	Cretaceous	White chalk with abundant flint nodules.
Middle Chalk	Principal	Whole Site	Circa 50 to 75m	Cretaceous	White chalk.
Lower Chalk	Principal	Whole Site	Circa 50 to 75m	Cretaceous	Soft, grey to white chalk, argillaceous in lower part.

* Whilst the geological map does not record topsoil/subsoil, based on our observations during the walkover we have assumed that topsoil/subsoil are present in areas of soft surfacing at the site.

3.2.3 Other Ground Conditions

- ✎ Natural ground hazards at the site are allocated a moderate rating due to the potential for soluble rocks to be present.
- ✎ The site is within an area where <1% of homes are above the radon action level and therefore no radon protective measures are considered necessary.
- ✎ The site is not listed as being within 75m of an area potentially affected by coal mining.



3.3 Controlled Waters

3.3.1 Hydrogeology and Groundwater

The superficial strata (Diamicton) at the site is classified by the Environment Agency (the agency) as unproductive*. The underlying bedrock (Upper Chalk) is classified as a primary aquifer** as shown on the plan below:-



■ Principal ■ Secondary A ■ Secondary B ■ Secondary (undifferentiated)

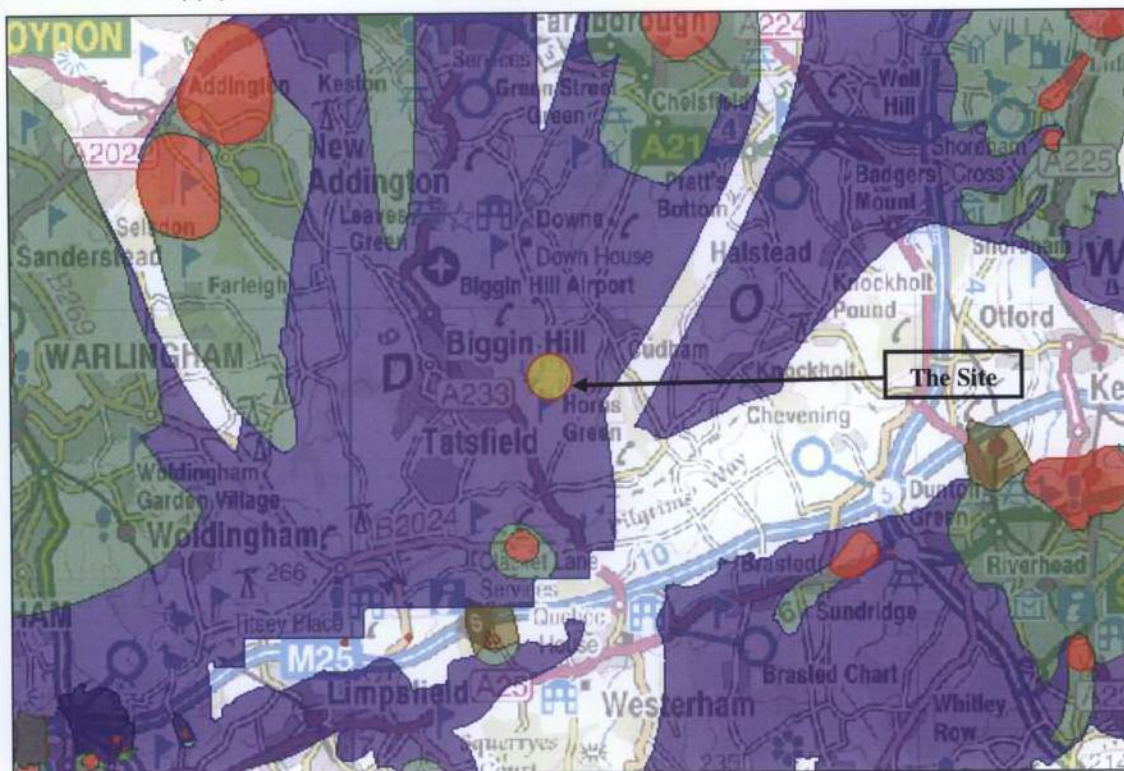
The clay-dominated diamicton is likely to be largely impermeable and will act as an aquiclude/aquitard and therefore provide protection to the underlying chalk from vertical leaching.

* Unproductive strata are described as those with low permeability and of negligible significance for water supply or river base flow.

** Primary aquifers are defined as layers of rock or drift deposits that have high inter-granular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifers.



The site is located in Zone 3 (total catchment) of an agency designated source protection zone (SPZ) for potable water supply, as shown on the plan below:-



Key - ■ - Inner Zone ■ - Outer Zone ■ - Total Catchment ■ - Special Interest

The nearest Zone 1 (Inner Catchment) or Zone 2 (Outer Catchment) is greater than 1km to the S of the site.

There is/are:-

- ❖ No groundwater abstraction licenses listed within 1km of the site.
- ❖ No surface water abstraction licenses listed within 1km of the site.
- ❖ No groundwater abstractions licenses for potable supply listed within 2km of the site.

3.3.2 Hydrology and Surface Water Features

There is/are:-

- ❖ No detailed river network entries within 500m of the site and no agency general quality assessment (GQA) monitoring points within 1.5km of the site.
- ❖ Surface water features are shown on site and within 250m of the site. On site there is an ornamental (lined pond) adjacent to the clubhouse and those within 250m are assumed to relate to other ponds.
- ❖ No rivers are listed within 1km of the site by the agency within the river basin management plan (RBMP) for the Thames region.

3.3.3 Flood Risk

The site is not located in or within 250m of Zone 2 or Zone 3 of an agency indicative fluvial floodplain that is liable to flooding. In addition, the susceptibility from groundwater flooding is listed as being not applicable, which indicates that groundwater flooding is not considered to be an issue at the site.

Although the site is not in a designated floodplain, a flood risk assessment (FRA) may be required as the footprint of the proposed development exceeds 1ha.



3.4 Environmental Setting

3.4.1 Authorisations, Incidents and Registers

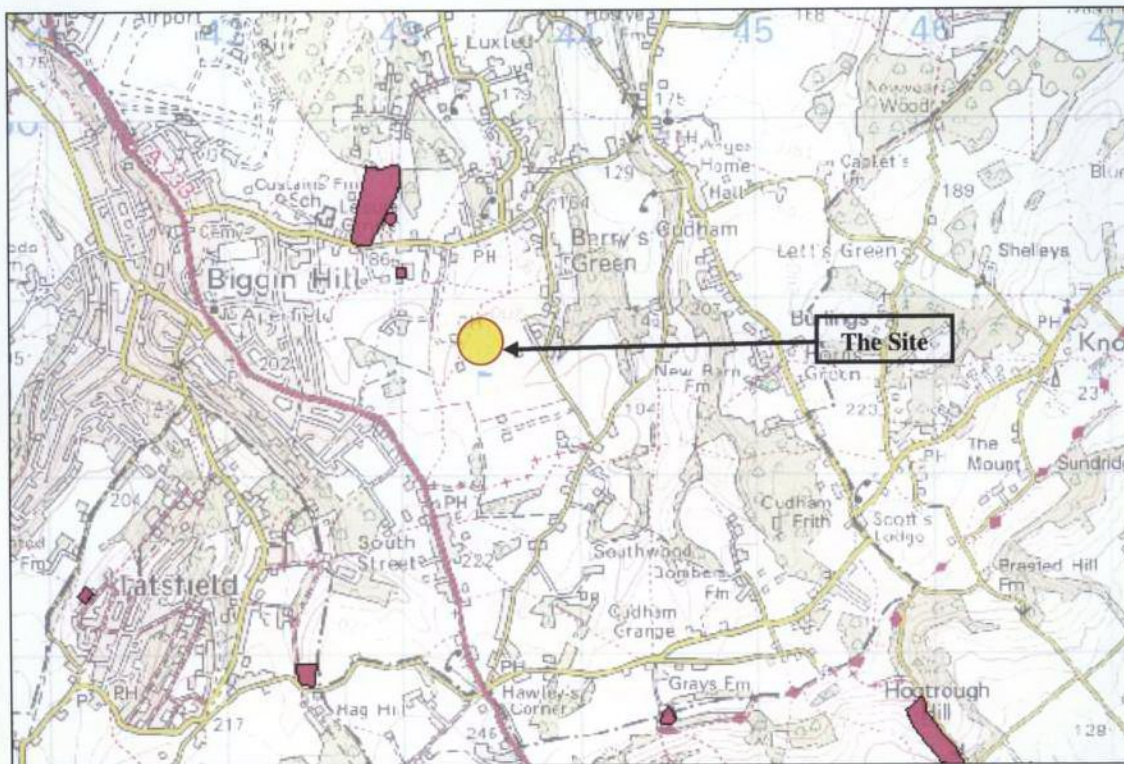
There is/are:-

- ✎ No entries in the Contaminated Land Register under Section 78R of the Environmental Protection Act 1990 Part IIA for the site or within 250m of the site.
- ✎ Two (2) licensed discharge consents within 500m of the site boundary (216m to the S and 452m to the NE) both of which relate to sewage (final/treated) discharges to land.
- ✎ No local authority pollution prevention and control (LAPPC) or integrated pollution prevention and control (IPPC) authorisations listed within 500m of the site boundary.
- ✎ No recorded pollution incidents recorded within 500m of the site boundary.
- ✎ No Part A(2) and Part B activities listed within 500m of the site boundary.

3.4.2 Landfill and Other Waste Sites

There is/are:-

- ✎ Three (3) historic landfill sites listed within 500m of the site boundary, all of which are located to the NW of the site on Jail Lane. The nearest site is Golden Acres, which was licensed for inert waste. No details are provided for Primrose Farm located circa 328m to the NW. Chavic Farm circa 396m to the NW was operated between 21/12/1958 and 31/12/1978 and licensed for inert and industrial waste. These sites are shown on the map below:-



- ✎ No current landfill sites or current/historic waste treatment/transfer/disposal sites listed within 500m of the site boundary.



3.4.3 Current Land Uses

There is/are:-

- Four (4) contemporary trade directory entries for potentially contaminative industrial activities listed within 250m of the site boundary including the following:-

<ul style="list-style-type: none">Gas valve compound (NW boundary of site)Works/factories (178m to W)	<ul style="list-style-type: none">Vehicle breakers (24m to NE)
--	--

- No fuel station entries listed within 500m of the site boundary.

3.4.4 Environmentally Sensitive Land Uses

A review of information provided on www.natureonthemap.gov.uk, www.magic.gov.uk and www.ads.ahds.ac.uk shows the following:-

- Parts of the Kent Downs, circa 400m to the S of the site, are designated as areas of outstanding natural beauty (AONB) by Natural England/Countryside Council.
- Downe Bank and High Elms, circa 840m to the NE of the site are designated as a site of special scientific interest (SSSI).
- Several areas are designated as lowland mixed deciduous forest and/or ancient and semi-natural woodland within 500m to the N, S, E and W of the site.
- The site is not in a designated nitrate vulnerable zone (NVZ).
- A preliminary review of information provided by the Archaeological Data Service revealed no entries for the site itself. A World War II hangar located at Biggin Hill (circa 2.5km to the NW of the site) is listed by the Council for British Archaeology. Several medieval and post-medieval transition (Tudor) houses are listed as Greater London Sites and Monuments located on Luxted Road (circa 2km to the N), Cudham Road (circa 2km to the N) and Milking Lane (circa 2.5km to the NW).
- We are not aware of any statutory or other rural designations relevant to the site, its surrounds or the proposed development.



4.0 TIER 1 QRA

The following section summarises our Tier 1 QRA, culminating in the compilation of a preliminary CSM. The purpose of this section of the report is to identify and assess the potential risk and plausibility of the presence of sources of contamination, sensitive receptors and pathways between the two.

4.1 Potential Sources

No potential sources of contamination have been identified at or adjacent to the site and as such no areas of potential concern (AoPC) have been identified.

In addition, due to the absence of potentially contaminative activities at or adjacent to the site no PCoC have been identified.

4.2 Potential Receptors

Based on the information summarised in Section 3.0 and the proposed development plans, we would consider the following potential receptors to be present at or adjacent to the site as a result of the proposed development:-

- ✧ End-users (golfers and green-keepers).
- ✧ Flora and fauna (grass, trees and shrubs to be planted in areas of soft landscaping).
- ✧ Buildings and construction materials (concrete and water supply pipes).
- ✧ Surface water (streams and ponds on the golf course immediately adjacent to the proposed development).

4.3 Potential Pathways and SPL

As no potential sources of contamination have been identified, there can be no risk of harm to sensitive receptors as no SPL exist. However, the following is a summary of the process undertaken in order to reach this conclusion.

4.3.1 Human Health SPL (End-Users)

We have based our assessment of the human health SPL on the following known facts and/or assumptions:-

- ✧ The proposed development comprises the continued use of the site as a recreational facility for golf and leisure.
- ✧ End-users are considered to comprise predominantly adults, although it cannot be discounted that children will visit the site on an infrequent basis.
- ✧ Staff operating the site will be adults.
- ✧ Use of the site and facilities will be on a regular basis (e.g. weekly).
- ✧ No crops will be grown for consumption across the site.
- ✧ Existing and new landscape planting will be incorporated within the development.
- ✧ No new buildings are included as part of the development.

Based on the above, where applicable for our Tier 1 QRA we have selected a standard commercial end-use scenario based on Environment Agency (2009c).



The standard human health SPL are as presented in the table below:-

SPL	Human Health	End-User
1	Direct soil ingestion.	x
2	Direct soil derived indoor dust ingestion.	x
3	Consumption of site-grown vegetables.	x
4	Indirect ingestion via site-grown vegetables.	x
5	Skin contact with soil-derived indoor dust.	x
6	Skin contact with soil.	x
7	Inhalation of soil-derived indoor dust.	x
8	Inhalation of soil-derived outdoor dust.	x
9	Inhalation of soil vapours indoors.	x
10	Inhalation of soil vapours outdoors.	x

✓ SPL Present x SPL Absent

Due to the absence of a potential source of contamination we do not consider any of the SPL to end-users to be active as a result of the proposed development.

It should be noted that the human health SPL do not include a contribution from direct exposure to surface waters or shallow groundwater used for abstraction. It is therefore assumed that there will be no on-site abstractions for drinking, cooking or washing. It is also considered unlikely for end-users to come into contact with groundwater. Disturbances to subsurface soil are likely to occur during construction works. The CLEA model is designed on the basis of chronic effects associated with frequent exposure over a number of years and as such is not appropriate for assessing the potential effects of an increased incidence of exposure over a short period of time that will be experienced by a construction worker. Potential effects of this scenario should be managed through the use of appropriate Health and Safety controls in accordance with UK H&S regulations (including the use of appropriate PPE).

4.3.2 Flora and Fauna SPL

Our understanding of the proposed development indicates that the majority of the landscaped areas will be laid to grass (fairways, tees and greens) with additional tree/shrub planting anticipated to supplement the existing vegetation. The potential presence of phytotoxic elements (those that pose a risk to plant health) within the near surface materials at the site (e.g. copper, nickel and zinc) and soil reaction (pH) may have the potential to impede the growth of sensitive amenity species used in the landscape planting scheme, where in-situ soils are either planted directly into or re-used within the scheme allowing root uptake of soluble fractions.

SPL	Flora/Fauna	Vegetation
11	Root uptake of soluble contaminants in surface soils.	x

✓ SPL Present x SPL Absent

Due to the absence of a potential source of contamination we do not consider the SPL to flora and fauna to be active as a result of the proposed development.

4.3.3 Groundwater SPL

The clay-based superficial strata (Diamicton) at the site is anticipated to be circa 15m thick and will therefore act as an aquiclude/aquitard, thus protecting the underlying chalk aquifer. Any vertical or lateral migration to nearby water bearing strata is not considered to be plausible due to the anticipated presence of a significant thickness of largely impermeable Diamicton. Although the site is within a designated SPZ (Zone 3), the nearest Zone 1 (Inner) or Zone 2 (Outer) are greater than 1km to the S of the site and there are no groundwater abstraction licenses within 1km of the boundary.

SPL	Controlled Waters Exposure	Groundwater
12	Leaching of contaminants from within the soil via vertical infiltration to principal aquifer.	x
13	Leaching of contaminants from within the soil via vertical infiltration to secondary aquifer.	x

✓ Pathway Present x Pathway Absent



Although a sensitive receptor has been identified, due to the absence of a potential source of contamination and the presence of an aquiclude/aquitard we do not consider the SPL to groundwater to be active as a result of the proposed development.

4.3.4 Surface Water SPL

The surface water feature on the site comprised a lined ornamental pond. Due to the presence of clay based strata underlying the site it is not considered plausible that any water within the site soils will be in hydraulic continuity with the water in any nearby surface water features, although surface water run-off directly from the site soils into the adjacent streams and ponds is considered to be plausible this should be managed accordingly during the proposed development.

SPL	Controlled Waters Exposure	Surface Water
14	Horizontal migration of impacted perched water to surface water receptors.	x

✓ Pathway Present x Pathway Absent

Due to the absence of a potential source of contamination we do not consider the SPL to surface water to be active as a result of the proposed development.

4.3.5 Buildings and Construction Materials SPL

Based on the latest UK guidance from BRE, CIRIA and NHBC etc., some types of contaminants associated with made ground, former industrial activities and some natural strata (e.g. heavy metals, organic compounds, cyanides and sulphates) could potentially have a detrimental effect on construction materials, such as below ground concrete structures, pipework/services and membranes through direct contact. In addition to this, volatile compounds and ground gases may potentially migrate through permeable below ground strata and accumulate in void spaces (e.g. rooms and cavity spaces), where they can be considered to pose a risk to the buildings through potential flammability/explosivity.

SPL	Buildings/Construction Materials Exposure	Buildings/Construction Materials
15	Direct contact of aggressive chemical contaminants with subsurface building materials.	x
16	Migration of ground gases within permeable strata accumulating in void spaces.	x

✓ SPL Present x SPL Absent

Due to the absence of a potential source of contamination we do not consider SPL 15 to be active.

Whilst there is evidence of potential in filled ground on and within 250m of the site, there are no buildings associated with the proposed development and as such due to the absence of a sensitive receptor we do not consider SPL 16 to be active.



4.4 Preliminary CSM & Risk Assessment

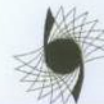
The table below presents a preliminary CSM for the site based upon the historic and contemporary information reviewed and summarises in a tabular form the relevant sources, pathways and receptors on the site that may be associated with the proposed development.

Source(s)		Shallow Soils	Deep Soils	Groundwater	Shallow Soils	Shallow Soils	Shallow Soils	Shallow Soils	Shallow Soils
Pathway(s)	1) Direct Soil Ingestion	x	x	x	x	x	x	x	x
	2) Direct soil-derived indoor dust ingestion	x	x	x	x	x	x	x	x
	3) Consumption of site-grown vegetables	x	x	x	x	x	x	x	x
	4) Indirect ingestion via site-grown vegetables	x	x	x	x	x	x	x	x
	5) Skin contact with soil-derived indoor dust	x	x	x	x	x	x	x	x
	6) Skin contact with soil	x	x	x	x	x	x	x	x
	7) Inhalation of soil-derived indoor dust	x	x	x	x	x	x	x	x
	8) Inhalation of soil-derived outdoor dust	x	x	x	x	x	x	x	x
	9) Inhalation of soil vapours indoors	x	x	x	x	x	x	x	x
	10) Inhalation of soil vapours outdoors	x	x	x	x	x	x	x	x
	11) Root uptake of soluble contaminants within surface soils	x	x	x	x	x	x	x	x
	12) Vertical leaching of contaminants to principal aquifer	x	x	x	x	x	x	x	x
	13) Vertical leaching of contaminants to secondary aquifer	x	x	x	x	x	x	x	x
	14) Horizontal migration of groundwater to controlled surface water	x	x	x	x	x	x	x	x
	15) Direct contact with surface soils	x	x	x	x	x	x	x	x
	16) Migration/accumulation of volatile compounds/ground gases	x	x	x	x	x	x	x	x
Receptor(s)		End-Users			Flora & Fauna	Groundwater	Surface Water	Buildings	Construction Materials
It should be noted that exposure pathways from deep soils (>1mbgl) and inorganic compounds within the groundwater (i.e. metals) and semi-volatile organic compounds with a Henry's Law Constant less than 1E ⁻⁰⁵ atm-m ³ /mole (i.e. certain PAH) have not been considered with regards to human health.									

✓ Pathway Present ✗ Pathway Absent

In our opinion the risk of the site being classified as contaminated land by the local authority under the provisions of the statutory guidance made under Part IIA of the Environmental Protection Act (1990) is **VERY LOW**.

In our opinion, the risk of potentially significant harm being caused to potentially sensitive receptors by the impact of the potential environmental hazards identified at or surrounding the site in its current state with regards to the proposed end-use is deemed to be **VERY LOW**.



5.0 CONCLUSIONS AND RECOMMENDATIONS

The risk attributed to the potential for contamination to exist at the site is considered to be very low. Although potentially sensitive receptors have been identified at and in close proximity to the site, as a result of the absence of potential sources of contamination (i.e. on-site and/or off-site) we do not consider any of the SPL assessed to be active and as such we do not consider that a Phase 2 site investigation is required at this site as a result of the proposed development.

5.1 Additional Works

Whilst we do not consider that any additional works are required to assess potential contamination issues at the site, the following may warrant additional consideration:-

- ✦ The proposed development footprint exceeds 1ha and as such a FRA may be required.
- ✦ Any soils imported onto site as part of the development should be appropriately specified, verified and validated in accordance with the requirements of an agency environmental permit.
- ✦ Standard operating procedures in accordance with a detailed specification should be practised throughout the proposed development in order to prevent harm to human health or environment.

5.2 Discovery Strategy

If during any excavation associated with future phases of the development, sources of potential contamination or materials previously unidentified during the Phase 1 site survey (e.g. those of an unusual appearance and/or odour etc.) be encountered we would recommend that works are halted in that area, the local authority informed and the advice of a geo-environmental specialist sought to determine an appropriate course of action, which would need to be agreed with the local authority.

5.3 Regulatory Approval

We would recommend that formal approval be sought from the local authority, and/or the agency with regards to the recommendations contained within this report prior to commencing future phases of investigation and/or development of the site.



6.0 LIMITATIONS AND USE OF THIS REPORT

IMPORTANT: This section should be read before reliance is placed on any of the opinions, advice, recommendations or conclusions set out in this report.

- a) This report has been prepared for the purpose of providing advice to the client pursuant to its appointment of Terragen Environmental Consultants Limited (TGEN) to act as a consultant.
- b) Save for the client no duty is undertaken or warranty or representation made to any party in respect of the opinions, advice, recommendations or conclusions herein set out.
- c) All work carried out in preparing this report has used, and is based upon, our professional knowledge and understanding of the current relevant English and European Community standards, approved codes of practice, technology and legislation.
- d) Changes in the above may cause the opinion, advice, recommendations or conclusions set out in this report to become inappropriate or incorrect. However, in giving its opinions, advice, recommendations and conclusions, TGEN has considered pending changes to environmental legislation and regulations of which it is currently aware. Following delivery of this report, we will have no obligation to advise the client of any such changes, or of their repercussions.
- e) TGEN acknowledges that it is being retained, in part, because of its knowledge and experience with respect to environmental matters. TGEN will consider and analyse all information provided to it in the context of our knowledge and experience and all other relevant information known to us. To the extent that the information provided to us is not inconsistent or incompatible therewith, TGEN shall be entitled to rely upon and assume, without independent verification, the accuracy and completeness of such information.
- f) The content of this report represents the professional opinion of experienced environmental consultants. TGEN does not provide specialist legal advice and the advice of lawyers may be required.
- g) In the summary and recommendations sections of this report, TGEN has set out our key findings and provided a summary and overview of our advice, opinions and recommendations. However, other parts of this report will often indicate the limitations of the information obtained by TGEN and therefore any advice, opinions or recommendations set out in the executive summary, summary and recommendations sections ought not to be relied upon unless they are considered in the context of the whole report.
- h) The assessments made in this report are based on the ground conditions as revealed by walkover survey and/or intrusive investigations, together with the results of any field or laboratory testing or chemical analysis undertaken and other relevant data which may have been obtained including previous site investigations. In any event, ground contamination often exists as small discrete areas of contamination (hot spots) and there can be no certainty that any or all such areas have been located and/or sampled.
- i) There may be special conditions appertaining to the site which have not been taken into account in the report. The assessment may be subject to amendment in light of additional information becoming available.
- j) Where any data supplied by the client or from other sources, including that from previous site investigations, have been used it has been assumed that the information is correct. No responsibility can be accepted by TGEN for inaccuracies within the data supplied by other parties.
- k) Whilst the report may express an opinion on possible ground conditions between or beyond trial pit or borehole locations, or on the possible presence of features based on either visual, verbal or published evidence this is for guidance only and no liability can be accepted for the accuracy thereof.
- l) Comments on groundwater conditions are based on observations made at the time of the investigation unless otherwise stated. Groundwater conditions may vary due to seasonal or other effects.
- m) This report is prepared and written in the context of the agreed scope of work and should not be used in a different context. Furthermore, new information, improved practices and changes in legislation may necessitate a reinterpretation of the report in whole or part after its original submission.
- n) The copyright in the written materials shall remain the property of the TGEN but with a royalty-free perpetual license to the client deemed to be granted on payment in full to TGEN by the client of the outstanding amounts.
- o) These terms apply in addition to the TGEN standard terms of engagement (or in addition to another written contract which may be in place instead thereof) unless specifically agreed in writing. (In the event of a conflict between these terms and the said standard terms of engagement the said standard terms of engagement shall prevail). In the absence of such a written contract the standard terms of engagement will apply.

Woodland Environmental Limited

TJ2475AR1 - Cherry Lodge Golf Club, Jail Lane, Westerham, Kent, TN16 3AX
February 2011



Appendix A Contaminated Land Investigation Protocol.



CONTAMINATED LAND RISK ASSESSMENT

1.0 INTRODUCTION

Part IIA of the Environmental Protection Act (1990) introduced a statutory definition for contaminated land, as follows:-

"...any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that :-

- a) significant harm is being caused or there is a significant possibility of such harm being caused, or*
- b) pollution of controlled waters is being caused, or there is a significant possibility of such pollution being caused"*

The United Kingdom (UK) government's objectives with respect to contaminated land are:-

- To identify and remove unacceptable risks to human health and the environment
- To seek to bring damaged land back into beneficial use.
- To seek to ensure that the cost burdens faced by individuals, companies, and society as a whole are proportionate, manageable and economically sustainable.

These three objectives underlie the fitness for purpose approach to remediation of contaminated land within the UK. The fitness for purpose approach consists of three elements:-

(a) Ensuring that land is suitable for its current use - in other words, identifying any land where contamination is causing unacceptable risks to human health and the environment, assessed on the basis of the current use and circumstances of the land, and returning such land to a condition where such risks no longer arise (remediating the land); the contaminated land regime (Part IIA) provides general machinery to achieve this;

(b) Ensuring that land is made suitable for any new use, as planning permission is given for that new use - in other words, assessing the potential risks from contamination, on the basis of the proposed future use and circumstances, before official permission is given for the development and, where necessary to avoid unacceptable risks to human health and the environment, remediating the land before the new use commences; this is the role of the town and country planning and building control regimes; and

(c) Limiting requirements for remediation to the work necessary to prevent unacceptable risks to human health or the environment in relation to the current use or future use of the land for which planning permission is being sought - in other words, recognising that the risks from contaminated land can be satisfactorily assessed only in the context of specific uses of the land (whether current or proposed), and that any attempt to guess what might be needed at some time in the future for other uses is likely to result either in premature work (thereby risking distorting social, economic and environmental priorities) or in unnecessary work (thereby wasting resources).

Most remediation of land contamination in the UK takes place when a site is redeveloped for a new use. Conditions requiring remediation are normally attached to the planning consent. Where no redevelopment is proposed, a remediation notice can be served under the contaminated land regime introduced under Part IIA of the Environmental Protection Act 1990. Government policy is to encourage voluntary remediation of contamination through site redevelopment wherever possible rather than regulation under the contaminated land regime



The basis of an environmental risk assessment involves:-

- Identifying a **source** of contamination.
- Identifying a **pathway**/media through which the contamination may migrate.
- Identifying a **receptor** or target at risk from the contamination.

The site can only be designated as contaminated land if there is a significant pollutant linkage (SPL) i.e. a source of contamination, a plausible pathway and a sensitive receptor.

The source-pathway-receptor model used to assess sites is widely accepted in the industry however it does not take into account less scientific factors such as perceived risk.

The list of statutory and non-statutory guidance documents, regulations, reports, models, tools and standards used by TGEN to plan, undertake, risk assess and report site investigations for contaminated land are presented in Section 6 of this appendix.

1.1 General Approach

The general approach to risk assessment adopted for the investigation of contaminated land within UK policy framework is based on a generic quantitative risk assessment (GQRA) of data generated during a site investigation against compliance criteria based on generic assessment criteria (GAC) derived using an appropriate tool.

1.2 Assessment Criteria

Two criteria are used for the selection of potential contaminants to test for during a ground investigation, as follows:-

- Contaminants must be likely to be present on many sites affected by current or former industrial use in the UK in sufficient concentrations to cause harm. The purpose of this criterion is to exclude substances that are rarely found or are unlikely to be present in harmful concentrations.
- Contaminants must pose a potential risk to human beings and to sensitive environmental receptors, i.e. the water environment, the ecosystem or the integrity of construction or building materials.

Only substances meeting both of the above criteria are selected for chemical analysis. Therefore, the selected substances are:-

- Likely to occur on many industrial sites in sufficient concentrations to cause harm or pollution.
- Known or suspected to pose significant risk to humans (death, serious injury, cancer or other disease, genetic mutation, birth defects or the impairment of reproductive functions).
- Known or suspected to pose a significant risk in the water environment, or likely to cause other adverse impacts in the water environment, as a result of their presence on land.
- Known or suspected to pose a significant risk to ecosystems as a result of their presence on land.
- Known or suspected to have a significant effect on buildings or building materials.
- Known or suspected to be persistent and mobile in soils or have tendency to bio-accumulate through exposure of sensitive organisms.

The following documents are the primary sources for identifying those contaminants likely to be present:-

- Environment Agency (2002) identified priority contaminants, selected on the basis that they are likely to be present on many current or former sites affected by industrial or waste management activity in the UK in sufficient concentrations to cause harm.
- DoE (1995a) describe specific industrial processes and the chemicals that are commonly found on industrial land.

Woodland Environmental Limited

TJ2475AR1 - Cherry Lodge Golf Club, Jail Lane, Westerham, Kent, TN16 3AX
February 2011





2.0 HUMAN HEALTH RISK ASSESSMENT

2.1 Risk Assessment Approach

The approach to risk assessment with respect to the assessment of potential risk to human health from contaminated land in the UK is set out in Environment Agency (2004).

This sets out a tiered approach:-

- Tier 1 Qualitative Risk Assessment (QRA) i.e. establishing potential pollutant linkages.
- Generic Quantitative Risk Assessment (GQRA) i.e. the comparison of contaminant concentrations against SGV or other GAC.
- Detailed Quantitative Risk Assessment (DQRA) i.e. the comparison of contaminant concentrations against site specific assessment criteria (SSAC).

2.1.1 Tier 1 QRA

Information relating to the potential sources of contamination is normally obtained through a study of available documents and evidence, including current and historical land use, database survey, correspondence with regulatory authorities, site walkover survey and an assessment of the results derived from previous intrusive investigations at the site, commonly termed a desk study in order to identify any areas of potential concern (AoPC) that could be classed as potential sources.

The environmental setting information relates to the potential pathway and receptor stages. The information collected as part of the Tier 1 QRA is then used to construct a preliminary conceptual site model (CSM) to identify potentially significant pollutant linkages (SPL).

TGEN use the term Phase 1 site survey to describe the works undertaken to allow the construction of the preliminary CSM.

The potentially active SPL identified in the CSM are then assessed in terms of the potential risk of harm to the identified receptors through a combination of the probability of occurrence and the potential severity of the consequence. The assigned risk takes into account the potential for regulatory or third party liability, the potential for affecting value and saleability and the potential for extraordinary environment related development costs. The Tier 1 QRA risk matrix summarised below is based on guidance contained in CIRIA (2001). Definitions of the risk classifications presented in the guidance are as follows:-

Risk Matrix		Severity of Consequence			
		Severe	Medium	Mild	Minor
Probability of pollutant linkage	High Likelihood	Very High Risk	High Risk	Moderate Risk	Low/Moderate Risk
	Likely	High Risk	Moderate Risk	Low/Moderate Risk	Low Risk
	Low Likelihood	Moderate Risk	Low/Moderate Risk	Low Risk	Very Low Risk
	Unlikely	Low/Moderate Risk	Low Risk	Very Low Risk	Very Low Risk

Very High Risk – There is a high probability that severe harm could arise to a designated receptor from an identified source; or there is evidence that severe harm to a designated receptor is currently happening.

High Risk – Harm is likely to arise to a designated receptor from an identified source.

Moderate Risk – It is possible that harm could arise to a designated receptor from an identified source. It is relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild.



Low Risk – It is possible that harm could arise to a designated receptor from an identified source; but it is likely that this harm, if realised, would at worst normally be mild.

Very Low Risk – There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.

2.1.2 Tier 2 GQRA

If necessary an intrusive site investigation together with suitable chemical analysis of soil, leachate and/or water samples, ground gases etc. is designed and implemented in order to gather sufficient information to provide quantification of the risks identified within the Tier 1 QRA.

The information gathered as part of the intrusive investigation is then compared against GAC to assess links within the source-pathway-receptor model and as part of the Tier 2 GQRA a refined CSM can then be produced to assess the identified risks. Remedial measures and/or further works are then designed to either mitigate or further assess the identified risks.

TGEN use the term Phase 2 site survey to describe the works undertaken to allow the construction of the refined CSM.

2.1.3 Tier 3 DQRA

Where necessary, the information gathered as part of the site investigation (and supplemented with additional information) can be compared against SSAC in order to fully rationalise any identified risks. The outcome of the DQRA may be that the risk is not significant or, if the risk is identified as being significant, the generation of site-specific remedial targets will be required. Where SSAC are significantly exceeded remedial measures may be required immediately.

There are a wide range of remedial methods available, with the method chosen being dependent upon the contaminant(s) identified, the site conditions, the proposed development, timescales and budget available. The simplest remediation method that is generally accepted for contamination that has been identified to pose a potential risk to humans, but not to other receptors, is to provide a barrier between occupiers / users of a site and the identified contamination. This barrier normally comprises a clean covering horizon of soil. This remediation method is only suitable for contaminants that are of low volatility and or mobility.

In accordance with UK policy and where feasible the removal of soil from site is minimized and disposal off-site as waste to landfill is considered as a last resort.

2.2 Generic Quantitative Risk Assessment

In order to undertake a GQRA, contaminant concentrations need to be compared to appropriate GAC. Current industry practice is to use, as first preference, SGV published by the Environment Agency (the agency) and derived using the CLEA model.

The CLEA model provides an approach for the assessment of chronic risks to human health from concentrations of a substance within soil, where appropriate.

The current version of the model (v1.06) was published in 2009 and, following its publication, a number of SGV have also been produced. However, the SGV published to date are only for a limited number of contaminants. Where published SGV do not exist, other published GAC values derived from a risk-based assessment of human toxicological and/or ecotoxicological data have been utilised in accordance with the following hierarchy:-

- GAC prepared in accordance with the CLEA v1.06 model by authoritative bodies (e.g. CL:AIRE, CIEH, EIC).
- TGEN in-house GAC prepared in accordance with the CLEA v1.06 model and associated documents.



2.3 TGEN Approach

The approach adopted by TGEN has been to generate GAC for chronic risks to human health using CLEA v1.06. In generating GAC, input parameters consistent with the most recent agency publications have been adopted (see Section 6).

2.3.1 Substance Specific Information – Health Criteria Values

Toxicological data for respective contaminants have been chosen for use based on the guidance in Environment Agency (2009a). Where UK guidance is available (i.e. existing published TOX reports) the appropriate health criteria values (HCV) have been adopted. Where no TOX report is available the following approaches has been used (given in order of preference):-

- Published toxicity reviews to derive HCV within CIEH (2009).
- Other appropriate UK sources.
- Authoritative European sources.
- International Organisations (e.g. World Health Organisation).
- Appropriate, authoritative US sources (e.g. USEPA).

2.3.2 Substance Specific Information – Physico Chemical Characteristics

Fate and transport characteristics for the contaminants for which GAC have been derived were chosen using the following hierarchy of data sources:-

- Environment Agency (2008a).
- Environment Agency (2003).
- Other UK Government documents.
- European data sources (e.g. NIPHE 2001).
- International data sources (e.g. WHO and USEPA).

2.3.3 Model Settings

In the generation of GAC, default settings have been used for the following exposure scenarios:-

- Residential with Plant Uptake.
- Residential without Plant Uptake.
- Allotments.
- Commercial/Industrial.

The default soil type is set as sandy loam with a pH of 7. A soil organic matter of 1%, 3% and 6% have been considered.

2.3.4 Soil Saturation

With the exception of petroleum hydrocarbon fractions, GAC have been limited to the calculated soil saturation limit for organic species, which is in accordance with the approach taken by the agency in the production of SGV. Petroleum hydrocarbon fractions are assessed, where appropriate, based on Hazard Index and so have not been limited to soil saturation.

2.3.5 Cyanides

The primary risk to human receptors from free cyanide in soils is an acute risk (i.e. a single dose could have a lethal affect as opposed to adverse affects from cumulative intake (chronic affect)).

There is no current UK guidance available for calculating acute risks from free cyanide, therefore the (officially withdrawn) SNIFFER (2003) methodology has been used to derive an acute GAC of 60 mg/kg for all exposure scenarios. The value is given for free or easily liberatable cyanide but can be used to



assess total cyanide in the absence of cyanide speciation. In cases where the total cyanide exceeds the GAC then analysis of free or easily liberatable cyanide is completed.

2.3.6 Limitations of the CLEA Model

In the application of GAC (and SGV) to a site TGEN recognises the limitations of the CLEA model. Specifically these relate to the absence of certain pollutant considerations such as risks to services, of fire and explosion, aesthetics, institutional perception, groundwater, surface waters, ecotoxicological risk and risks to buildings (amongst others).

In addition, the GAC specifically do not meet the requirements of the legal definition of significant possibility of significant harm but provide a benchmark below which concentrations of contaminants are not considered to warrant further consideration in the context of the land use scenario.

The CLEA model also does not explicitly consider the potential for chronic impact to human health from indoor inhalation of concentrations of volatile vapours from dissolved phase contamination. The potential exists for this to be an important exposure route for a limited number of highly volatile contaminants. As such, GAC have been calculated for volatile contaminants for volatilisation from groundwater using RISC 4. It should be noted that the RISC 4 approach does not include advection into buildings and we consider alternative approaches where this is likely to be a significant issue.

Exposure factors required for the model have been derived using the information contained within Environment Agency (2009a,b). Where ranges of values are provided for input parameters, an appropriate conservative single value has been chosen for input into the RISC 4 model. The following table details the receptor exposure factors used in the RISC 4 model to generate the GAC.

Receptor Parameters	Unit	Residential	Source	Commercial	Source
Lifetime	yr	6	Environment Agency (2009a) Section 3.2.3	49	Environment Agency (2009a). Section 3.4.1
Body weight	kg	14.2	Environment Agency (2009b). Table 3.2 average over age 0-6 considering child age 0-1 has 0.5yr exposure	70	Environment Agency (2009b). Section 4.1
Exposure frequency for indoor air	no/yr	365	Environment Agency (2009a). Table 3.1	230	Environment Agency (2009a) Table 3.9
Exposure duration for indoor air	yr	6	Environment Agency (2009a). Section 3.2.3	49	Environment Agency (2009a) Section 3.4.1
Lung retention factor	fraction	1	Conservative assumption	1	Conservative assumption
Inhalation rate indoors	m ³ /hr	0.5	Environment Agency (2009a). Calculated average from Table 4.14	0.56	Environment Agency (2009a). Calculated average from Table 4.14
Time indoors	hr/day	21.7	Environment Agency (2009a). Table 3.2	8.3	Environment Agency (2009a). Box 3.6
Bioavailability for all contaminants	%	100	Default conservative assumption	100	Default conservative assumption



Default building parameters that have been utilised in the generation of the groundwater GAC values as presented in the following table:-

Building Parameters	Unit	2-storey small terrace house	Source	Pre-1970, 3-storey office	Source
Cross sectional area of building	m ²	28	Environment Agency (2009a). Table 3.3	424	Environment Agency (2009a). Table 3.10
Volume of building	m ³	134.4	Environment Agency (2009a). Table 3.3	4070.4	Environment Agency (2009a). Table 3.10
No. of air exchanges per day	no.	12	Environment Agency (2009a). Table 3.3	24	Environment Agency (2009a). Table 3.10
Thickness of basement or foundation walls	m	0.15	Environment Agency (2009a). Table 3.3	0.15	Environment Agency (2009a). Table 3.10
Fraction of the foundation that are cracks	Fraction	0.001429	Environment Agency (2009a). Floor crack area as a fraction of total floor area	0.000389	Environment Agency (2009a). Floor crack area as a fraction of total floor area
Porosity of foundation cracks	Factor	1	Assumes crack fraction is entirely available for vapour ingress	1	Assumes crack fraction is entirely available for vapour ingress
Water content in foundation cracks	cm ³ /cm ³	0	Conservative assumption	0	Conservative assumption

In the absence of UK guidelines, the exposure scenario adopted has considered a groundwater source 0.5m below the base of the building as a conservative approach representing an example of a very shallow aquifer and corresponding with the depth of a soil source as adopted in the generic scenario in the CLEA model. The appropriateness of this assumption is assessed on a site by site basis considering the conceptual model for the site. The groundwater model parameters are presented in the following table:-

Groundwater Parameters	Units	Value	Source
Distance to building foundation from groundwater	m	0.50	Environment Agency (2009a). Page 51
Total porosity in source zone	cm ³ /cm ³	0.53	Environment Agency (2009a). Table 4.4 (i.e. sandy loam)
Water content in source zone	cm ³ /cm ³	0.33	Environment Agency (2009a). Table 4.4 (i.e. sandy loam)
Thickness of capillary fringe	cm	10	Estimate
Air content in the capillary fringe	cm ³ /cm	0.01	Estimate

For many contaminants, no risk is calculated at concentrations below the pure phase solubility of the contaminant. Caution is applied when non-aqueous phase liquids (NAPL) are likely to be present, either where these have been detected during monitoring or where the concentration of a component in a mixture exceeds 10% of its calculated effective solubility. In such cases a separate assessment of the generation of volatile vapours from NAPL via modelling or a soil vapour survey may be undertaken.

It is important to note that the values are only applicable to human health and cannot be used to determine the potential risks to controlled waters.



2.4 Use of Statistical Tests in Data Interpretation

A statistical basis for the assessment of the analytical results obtained during the site investigation is detailed within CL:AIRE (2008). The premise is to review an entire data set in an appropriate way in comparison to SGV/GAC. The assumption made is that the results from the site investigation are to some degree representative of the contaminant concentration throughout that area or volume of soil represented by the sample or samples. The most appropriate method for assessing a given dataset is dependent upon a range of site specific factors together with the quantity and quality of the data generated and the chosen approach differentiated for datasets where random or targeted sampling has been undertaken and where a site is being considered in a planning or Part 2A context.

In accordance with the recommendations provided within CL:AIRE (2008) where appropriate we select the one sample t-test (same as the mean value test described in CLR7) at a 95% confidence level as the most appropriate statistical tool for generating site representative soil concentration values in instances where it is assumed that the data is normally distributed and where the test is required to draw conclusions about the condition of the land under scrutiny as part of a planning scenario (whereby comparison is made between a value larger than the sample mean, in this case the upper confidence limit (UCL) and the critical concentration) as opposed to the Part 2A scenario (whereby comparison is made between the lower confidence limit (LCL) and the critical concentration).

In instances where the UCL exceeds the given critical value (i.e. SGV/GAC) then the Grubbs test is used to identify upper outliers (same test as the maximum value test described in CLR7) to assess whether the highest value belongs to the general population of the dataset or is representative of an outlier.

2.4.1 Averaging Zones

CLEA methodology requires the definition of averaging zones based on previous / current / future spatial land use, soil type, proposed site end uses or other distinguishing features. Where there is similar historic and/or contemporary land use across a site and the redevelopment plans indicate that the site is to be under a single end-use then horizontally the whole site is taken as one averaging area.

2.4.2 Sample Depths

It is intended that the CLEA statistical analysis is applied to soils from <1.0mbgl. This is due to the greatest likelihood that site end users would be exposed to these soils. Samples tested from below this depth during this assessment have been subjected to a similar analysis to assess the chemical characteristics of natural soils and deeper areas of fill. Where samples are included within the dataset(s) that are >1mbgl, it is assumed, with regards to human health, that excavation associated with the development may result in soils from these greater depths being within 1m of final levels in areas of sensitive end-use at the site. This could be considered as an additional layer of conservatism within the approach adopted.

In addition, it should be noted that the methodology makes depth-based assumptions regarding risks to human health from soils, which can be summarised as follows:-

- For direct ingestion of soil and dust, dermal contact with soil outdoors and soil-derived dust indoors, and inhalation of soil-derived dust outdoors and indoors contamination is assumed to be present in the top 0.1m of the soil profile.
- For consumption of vegetables and ingestion of soil attached to them it is assumed that the contamination is present in the top 0.5m of the soil profile.
- For inhalation of soil vapours outdoors, the contamination is assumed to be at a depth of 1.0m.
- For inhalation of soil vapours indoors, the contamination is assumed to be directly below the building.



Where necessary (and feasible), TGEN take account of the different depths of the potential risks to human health in designing and/or assessing site investigations.

3.0 CONTROLLED WATERS RISK ASSESSMENT

3.1 Control of Residual Contamination

Part 2A of the Environmental Protection Act (1990) introduced the regime for the identification and remediation of contaminated land. Land may be classified as contaminated land under the regime by virtue of actual or likely pollution of controlled waters caused by substances in, on or under the land. The agency is a statutory consultee in relation to controlled waters issues. In situations where there is no existing pollutant linkage, Section 161 of the Water Resources Act (1991) (as amended 2003) and the Anti-Pollution Works Regulations (1999) can be used to address contamination which could represent a potential risk.

3.2 Control of Contamination from Ongoing Activities

The existing Groundwater Directive (80/68/EEC) aims to protect groundwater from pollution by controlling discharges and disposals of certain dangerous substances to groundwater. In the UK, the directive is implemented through the Groundwater Regulations (DETR 1998b). Groundwater pollution is prevented under these regulations by preventing or limiting the inputs of listed substances into groundwater. Substances controlled under the regulations fall into two lists:-

List 1	List 2
<ul style="list-style-type: none"> • Organohalogen compounds and substances which may form such compounds in the aquatic environment; • Organophosphorus compounds; • Organotin compounds; • Substances which possess carcinogenic, mutagenic or teratogenic properties in or via the aquatic environment (including substances which have those properties which would otherwise be in List 2); • Mercury and its compounds • Cadmium and its compounds; • Mineral oil and hydrocarbons; and • Cyanides 	<ul style="list-style-type: none"> • The following metals and metalloids and their compounds; Zinc, Copper, Nickel, Chromium, Lead, Selenium, Arsenic, Antimony, Molybdenum, Titanium, Tin, Barium, Beryllium, Boron, Uranium, Cobalt, Thallium, Tellurium, Silver; • Biocides and their derivatives not appearing in List 1; • Substances which have a deleterious effect on the taste or odour of groundwater and compounds liable to cause the formation of such substances in such water and to render it unfit for human consumption; • Toxic or persistent compounds of silicon and substances which may cause the formation of such compounds in water, excluding those which are biologically harmless or are rapidly converted in water into harmless substances; • Inorganic compounds of phosphorus and elemental phosphorus; • Fluorides; and • Ammonia and nitrites.

Notes

List 1 substances are the most toxic and must be prevented from entering groundwater. Substances in this list may be disposed of to the ground, under a permit, but must not reach groundwater.

List 2 substances are less dangerous, and can be discharged to groundwater under a permit, but must not cause pollution.

Listed dangerous substances have assessment criteria in the form of environmental quality standards (EQS). The dangerous substance is not believed to be detrimental to aquatic life at a concentration below its EQS limit (see EU 2008a).

The existing Groundwater Directive is to be repealed by the Water Framework Directive (WFD) in 2013. DEFRA (2010a) has been used to enact both the WFD and its daughter directive on the protection of groundwater in E&W. This new Groundwater Directive (2006/118/EC) is commonly referred to as the Groundwater Daughter Directive (EU 2006).



The existing principle of preventing or limiting the inputs of List 1 or List 2 substances respectively into groundwater under the original Groundwater Regulations (DETR 1998b) remains, but have been expanded and will continue to expand to encompass any substance liable to cause pollution. In addition, the WFD provides a risk-based framework for regulation.

3.3 Water Framework Directive

The WFD (EU 2000) came into force in England & Wales (E&W) on 02/01/04 through the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 (SI 2003:3242 dated 10/12/03). The WFD establishes the legal framework to protect and restore clean water across the EU and ensure its long-term, sustainable use. It sets specific deadlines for member states to protect aquatic ecosystems and sets the goal of achieving a good (chemical and ecological) status for all surface water (rivers, estuaries and coastal water) and groundwater (aquifers) in the EU by 2015.

Good status is considered to be a function of concentrations of pollutants which:-

- Do not exceed the quality standards under relevant EU legislation.
- Would not result in a failure of associated surface water bodies to achieve environmental objectives.
- Would not result in a significant diminution of the ecological or chemical quality of associated surface water bodies.
- Would not result in any significant damage to groundwater dependent terrestrial ecosystems.

The WFD is designed to:-

- Enhance the status and prevent further deterioration of aquatic ecosystems and associated wetlands, which depend on the aquatic ecosystems.
- Promote the sustainable use of water.
- Reduce pollution of water, especially by priority and priority hazardous substances.
- Ensure the progressive reduction of groundwater pollution.

The measures to achieve the objectives are set out in River Basin Management Plans (RBMP), of which there are 11 in E&W. The RBMP must be operational by 22/12/12. In E&W, the RBMP were submitted to DEFRA by the agency on 22/09/09 for approval and publication by the deadline. They were enacted by DEFRA (2009).

The WFD requires, as a matter of priority, the causes of pollution to be identified and emissions to be dealt with at source in the most economically and environmentally effective manner. In accordance with Article 4, all member states should implement necessary measures with the aim of progressively reducing pollution from priority substances and ceasing or phasing out emissions, discharges and losses of priority hazardous substances.

The Environmental Quality Standards Directive (2008/105/EC dated 16/12/08) (EQSD) has replaced the List of Priority Substances (2455/2001/EC) since its implementation on 13/01/09. Similarly, the EQSD (EU 2008a) has repealed the limit values contained in a number of specific daughter directives to the old Dangerous Substances Directive (see below) such as those for mercury (82/176/EEC and 84/156/EEC), cadmium (83/513/EEC), HCCH (84/491/EEC) and the List 1 Daughter Directive (86/280/EEC), as amended by 88/347/EEC and 90/415/EEC, although the directives themselves remain in force until fully repealed on 22/12/12. The EQSD is a daughter directive to the WFD and has been enacted in E&W by DEFRA (2010b).



The WFD repealed the Drinking Water Abstraction Directive (75/440/EEC dated 16/06/75) (DWAD) on 22/12/07 and will repeal on 22/12/13 the following directives:-

- The Groundwater Directive (2006/118/EC dated 12/12/06) (GWD) repealed 80/68/EEC dated 17/12/79, which was implemented in E&W by The Groundwater Regulations 1998 (SI 1998:2746 dated 02/12/98). The GWD is a daughter directive of the WFD and came into force in the EU on 16/01/09 but will itself be repealed by the WFD. The main aim of the GWD is to protect groundwater against pollution and deterioration. The new GWD has been implemented in E&W by DEFRA (2010a).
- The Shellfish Waters Directive (2006/113/EEC dated 12/12/06) (SWD) is a codified version, which repealed 79/923/EEC dated 30/11/79 and came into force on 16/01/07. The values set by the SWD must be conformed to by 16/01/13, when the WFD repeals the SWD.
- The Fresh Waters Fish Directive (2006/44/EC dated 06/09/06) (FWFD) is a codified version, which repealed 78/659/EEC dated 18/07/78. It was brought into force in E&W by the Surface Waters (Fishlife) (Classification) Regulations 1997 (SI 1997:1331 dated 12/06/97), as amended by SI 2003:1053 on 12/05/03.
- The Dangerous Substances Directive (2006/11/EC dated 15/02/06) (DSD) is a codified version, which repealed 76/464/EEC dated 04/05/76. The DSD has been integrated into the WFD and will be used to implement the EU wide good status of all water bodies by 2015. The current regulations used to implement the DSD into E&W legislation, such as the Surface Waters (Dangerous Substances) (Classification) Regulations 1997 (SI 1997:2560 dated 24/10/97) as amended by SI 1998:389 on 25/03/98, are still in force until repealed by the WFD.

Although the WFD has/will repeal the Directives listed above, and of course all relevant regulations used to introduce the directives into E&W law, the EQS values selected for the WFD must be at least as stringent as those that they replace.

The RBMP must contain measures to implement a number of directives (as listed below), which will remain in force and are not superseded by the WFD:-

- The IPPC Directive (2008/1/EC dated 15/01/08) (IPPCD) is a codified version, which repealed 96/61/EC dated 24/09/96.
- The Bathing Water Directive (2006/7/EEC dated 15/02/06) (BWD), which will repeal 76/160/EEC dated 08/12/75 on 31/12/14.
- The Drinking Water Directive (98/83/EC dated 03/11/98) (DWD) is a codified version, which repealed 80/778/EEC dated 15/07/80. It was brought into force in E&W on 25/12/03 by the Water Supply (Water Quality) Regulations 2000 (SI 2000:3184 made on 04/12/00) and amended by SI 2007:2734 dated 13/09/07, which came into force on 22/12/07.
- The Urban Waste Water Treatment Directive (98/15/EC dated 27/02/98) (UWWTD) amended 91/271/EEC dated 21/05/91 on 27/03/98.
- The Nitrates Directive – an EU wide standard (91/676/EEC dated 12/12/91) (ND).
- The Sewage Sludge Directive (86/278/EEC dated 12/06/86) (SSD).

Similarly, other directives to be taken into account include:-

- The Marine Strategy Framework Directive (2008/56/EC dated 17/06/08) (MSFD) is the equivalent of the WFD for marine waters. The MSFD must be transposed by member states by July 2010 with the aim of achieving good status across the EU by 2020.
- The Biocidal Products Directive (98/8/EC dated 16/02/98) (BPD).
- The Plant Protection Products Directive (91/414/EEC dated 26/07/93) (PPPD).



3.4 Assessment Approach

At the GQRA level, assessment typically comprises the following:

- Consideration of soil concentrations of organic substances in the context of soil saturation to determine the potential for migration under gravity.
- Comparison of soil leachate concentrations against appropriate GAC.
- Comparison of groundwater concentrations against appropriate GAC.

This approach is equivalent to Tier 1/Level 1 Assessment as undertaken using ConSim v2.5 (2003) and/or Environment Agency (2006).

The ideal remediation standard from the regulatory perspective is natural background quality, namely, there should be no significant deterioration in the water quality at the receptor (that is, it should not be detectable against natural background variations). This data may be obtained from up hydraulic gradient locations or regional datasets. The agency has published information on the baseline condition of several aquifers. It is recognised, however, that such data is rarely available and remediation to such a standard is often not technically achievable or cost effective. For this reason target concentrations utilised as GAC may be based on water quality standards that are appropriate for the intended use or to ensure that objectives for a groundwater or associated water body are met. The sources of the standards selected are listed in Section 7. In E&W, priority is given to UK standards, then EU standards, with those that are statutory taking precedence over those that are non-statutory. Where data is not available for a specific substance, additional standards such as those published by WHO or USEPA are used if appropriate.



4.0 ASSESSMENT OF RISKS FROM GROUND GASES

Where risks from ground gases are identified as a potential SPL then an appropriate programme of gas monitoring and risk assessment is undertaken.

During the site investigation the design of any gas monitoring is based upon the CSM derived as part of the Tier 1 QRA. An appropriate number of boreholes excavated during the site investigation and sited to target the SPL would be installed with standpipes (e.g. 19 to 50mm diameter HDPE monitoring standpipe, protected by an end cap and gravel pack, completed with a bung, valve and metal cover). The response zone (slotted section of pipe) would be confined to the strata identified as the potential pathway for the migration of ground gases. Typically the first one metre from ground level comprises plain standpipe with a bentonite seal to prevent the ingress of atmospheric gases.

In accordance with CIRIA (2007a,b) based on the gas hazard and site sensitivity and appropriate density/spacing for the boreholes would be chosen. Subsequently in accordance with CIRIA (2007a,b) based on the generation potential and site sensitivity for the development an appropriate programme of monitoring over an appropriate period of time would be designed and implemented, ideally during which time at least 2 sets of monitoring would be undertaken during low and/or falling atmospheric pressure.

The results of the gas monitoring assessment are then used to generate a gas screening value (GSV) for the worst case concentration of the gas at the worst case steady state flow (reported in litres per hour), which would then be compared with relevant guidance (see section 6).

- NHBC (2007).
- BSI (2007b).
- CIRIA (2007a,b).

It should be noted that the NHBC traffic light system is specifically for low rise housing developments with a clear, ventilated sub-floor void, whereas CIRIA is for residential (not low rise) developments and/or office/commercial/industrial developments.

Where appropriate the local environmental health department and/or building control are consulted on the scope of any proposed measures to be adopted at the earliest opportunity.



5.0 OTHER RISK ASSESSMENT

5.1 Ecological Risk Assessment

Where a statutory ecological receptor is identified on, or in proximity to the site, an assessment in accordance with the current agency Ecological Risk Assessment (ERA) Framework will be undertaken. The framework is currently in development (<http://www.environment-agency.gov.uk/research/planning/40375.aspx>).

Where soils are to be used for landscape planting, an assessment is made in accordance with BSI (2007a).

5.2 Building Materials Risk Assessment

Where required an assessment of potential risks to typical construction materials is included within the GQRA, with concentrations of contaminants compared against the threshold values given in BRE (2005) for concrete and WRAS (2002) for potable water supply pipes.



6.0 REFERENCES & BIBLIOGRAPHY

- Alloway (1995). Heavy Metals in Soils (2nd Edition).
- BRE (1994). Performance of Building Materials in Contaminated Land (BRE Report 255).
- BRE (2001). Protective Measures for Housing on Gas Contaminated Land (BRE Digest 414).
- BRE (2004). Cover Systems for Land Regeneration (March 2004).
- BRE (2005). Concrete in Aggressive Ground (BRE Special Digest 1, 3rd Edition, 2005).
- BRE (2007). Soakaway Design (BRE Digest 365, March 2007).
- BSI (1999). Code of Practice for Site Investigations (BS 5930:1999).
- BSI (2001). Investigation of Potentially Contaminated Sites Code of Practice (BS 10175:2001).
- BSI (2007a). Specification for Topsoil and Recommendations for Use (BS 3882:2007).
- BSI (2007b). Code of Practice for the Characterisation and Remediation From Ground Gas in Affected Developments (BS 8485:2007, October 2007).
- BSI (2010). Investigation of Potentially Contaminated Sites Code of Practice (BS 10175:2010, Consultation Draft).
- CIEH (2009). Generic Assessment Criteria for Human Health Risk Assessment (Land Quality Press, 2nd Edition, 2009).
- CIRIA (2001). Contaminated Land Risk Assessment: A Guide to Good Practice (C552, January 2001).
- CIRIA (2007a). Assessing Risks Posed by Hazardous Ground Gases to Buildings (Report C659).
- CIRIA (2007b). Assessing Risks Posed by Hazardous Ground Gases to Buildings (Report C665).
- CL:AIRE (2008). Guidance on Comparing Soil Contamination Data with a Critical Concentration (May 2008).
- CL:AIRE (2009). Generic Assessment Criteria for Human Health Risk Assessment (December 2009).
- CL:AIRE (2010). A Framework for Assessing the Sustainability of Soil and Groundwater Remediation (March 2010).
- DEFRA (2007). The Environmental Permitting (England and Wales) Regulations 2007 (SI 2007 3538) (as amended).
- DEFRA (2009). River Basin Districts Surface Water and Groundwater Classification (Water Framework Directive) (England and Wales) Direction (December 2009).
- DEFRA (2010a). The Environmental Permitting (England and Wales) Regulations 2010 (SI 2010 675) (as amended).
- DEFRA (2010b). River Basin Districts Typology, Standards and Groundwater Threshold Values (Water Framework Directive) (England and Wales) Directions (August 2010).
- DETR (1998a). The Surface Waters (Dangerous Substances) (Classification) Regulations (SI 1998 389).
- DETR (1998b). The Groundwater Regulations 1998 (SI 1998:2746).
- DETR (2000). The Water Supply (Water Quality) Regulations 2000 (SI 2000:3184) (as amended).
- Dickinson et al. (2000). Planting Trees on Contaminated Soils: Issues & Guidelines. (Land Contamination & Reclamation, 8 (2), 2000).
- Dobson and Moffatt (1993) The Potential for Woodland Establishment on Landfill Sites. HMSO London,
- DoE (1991). Landfill Gas. (WMP27, 2nd Edition).
- DoE (1994a). Guidance on Preliminary Site Inspection of Contaminated Land (R&D Publication CLR2).
- DoE (1994b). The Surface Waters (River Ecosystem) (Classification) Regulations (SI 1994 1057).
- DoE (1995a). Industry Profiles (1995).
- DoE (1995b). Landfill design, Construction and Operational Practice (WMP26B).
- DoE (1996). The Surface Waters (Abstraction for Drinking Water) (Classification) Regulations (SI 1996 3001).
- DoE (1997). The Surface Waters (Fishlife) (Classification) Regulations (SI 1997 1331) (as amended 2003).
- ECHA (2009). Introductory Guidance on the CLP Regulations & on the Application of the CLP Criteria.
- Eikmann & Kloeke (1991). Taken from Land Contamination and Reclamation, 6 (4) (1998).
- Environment Agency (2000). Technical Aspects of Site Investigation: Volume 1 (Overview) & Volume 2 (Text Supplements) (R&D Technical Report P5-065/TR).
- Environment Agency (2001). Secondary Model Procedures for the Development of Appropriate Soil Sampling Strategies for Land Contamination (R&D Technical Report P5-066/TR).
- Environment Agency (2002). Priority Contaminants for the Assessment of Land (R&D Publication CLR8).
- Environment Agency (2003). Review of Fate & Transport of Selected Contaminants in the Environment (Report P5-079-TR1).



- Environment Agency (2004). Model Procedures for the Management of Land Contamination (R&D Publication CLR11).
- Environment Agency (2005). The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soil (Report P5-080/TR3).
- Environment Agency (2006). Methodology for the Derivation of Remedial Targets for Soil & Groundwater to Protect Water Resources (R&D Technical Report P20, Version 3.1).
- Environment Agency (2007a). How to Find Out if Waste Oil and Wastes That Contain Oil are Hazardous. A Guide to the Hazardous Waste Regulations (HWR08, Version 3.1, June 2007).
- Environment Agency (2007b). Information About Your Groundwater Quality Analysis Results (ea/br/e/std/v1 September 2007).
- Environment Agency (2008a). Compilation of Data for Priority Organic Pollutants (Report SC050021/SR7, November 2008).
- Environment Agency (2008b). Interpretation of the Definition and Classification of Hazardous Waste (Technical Guidance WM2, 2nd Edition, v2.2 May 2008).
- Environment Agency (2009a). Human Health Toxicological Assessment of Contaminants in Soil (Report SC050021/SR2, January 2009).
- Environment Agency (2009b). CLEA Software (Version 1.06) and Handbook (Report SC050021/SR4, September 2009).
- Environment Agency (2009c). Updated Technical Background to the CLEA Model (Report SC050021/SR3, May 2009).
- Environment Agency (2009d). A Review of Body Weight and Height Data Used in the CLEA Model (Report SC050021/Final Technical Review 1, January 2009).
- Environment Agency (2009e). Using Soil Guidance Values (SC050021/SGV Introduction, March 2009).
- Environment Agency (2009f). Getting the Basics Right: How to Comply With Your Environmental Permit (V23, June 2009).
- Environment Agency (2009g). Standards and Measures for the Deposit of Inert Waste on Land (June 2009).
- Environment Agency (2010a). H1 Environmental Risk Assessment for Permits (Consultation Draft, Version 2.0, April 2010).
- Environment Agency (2010b). Guiding Principles for Land Contamination (GPLC1, March 2010).
- Environment Agency (2010c). FAQs, Technical Information, Detailed Advice and References (GPLC2, March 2010).
- Environment Agency (2010d). Reporting Checklists (GPLC3, March 2010).
- EU (1998). The Quality of Water Intended for Human Consumption. Council Directive (98/83/EC).
- EU (2000). The Water Framework Directive (2000/60/EC).
- EU (2006). The Groundwater Directive (2006/118/EC).
- EU (2008a). The Environmental Quality Standards Directive (2008/105/EC).
- EU (2008b). The Waste Framework Directive (2008/98/EC).
- EU (2009). Classification, Labelling & Packaging of Substances & Mixtures (1272/2008/EC).
- HSE (1991). Protection of Workers & the General Public During the Development of Contaminated Land.
- HSE (2005). Approved Supply List (8th Edition, September 2005).
- HSE (2007). EH40/2005: Occupational Exposure Limits 2005 (as amended October 2007).
- HSE (2009). The Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 (SI 2009 716).
- HSE (2010). Asbestos: The Survey Guide (HSG 264, February 2010).
- ICRCL (1990). Notes on the Restoration and Aftercare of Metalliferous Mining Sites for Pasture and Grazing (Guidance Note 70/90).
- MADEP (2002). Characterising Risks Posed by Petroleum Contaminated Sites.
- MAFF (1998). The Soil Code.
- NEPC (1999). Guidelines on Investigation Levels for Soil and Groundwater. (Schedule B1).
- NHBC (2007). Guidance on Evaluation of Development Proposals on Sites where Methane and Carbon Dioxide are Present (RSK, March 2007).
- NHBC (2008). Guidance for the Safe Development of Housing on Land Affected by Contamination (R&D Publication 66, Volume 1).
- NIPHE (2001). Technical Evaluation of the Intervention Values for Soil, Sediment and Groundwater (RIVM Report 711701 023).
- SEGH (1993). Lead in Soil: Recommended Guidelines.
- SNIFFER (2003). Method for Deriving Site Specific Human Health Assessment Criteria for Contaminants in Soil (LQM, April 2003).



USEPA (1996). Soil Screening Guidance: Technical Background Document (EPA/540/R95/128).

USEPA (2005) Partition Coefficients for Metals in Surface Water, Soil and Waste, EPA/600/R-05/074.

World Health Organisation (WHO) (1984) Guidelines for Drinking Water Quality.

World Health Organisation (WHO) (2005) Petroleum Products in Drinking-water, Background document for development of WHO Guidelines for Drinking-water Quality, WHO (WHO/SDE/WSH/05.08/123).

WRAS (2002). The Selection of Materials for Water Supply Pipes to be Laid in Contaminated Land (IGN 9-04-03, Issue 1, October 2002).

Woodland Environmental Limited

TJ2475AR1 - Cherry Lodge Golf Club, Jail Lane, Westerham, Kent, TN16 3AX

February 2011



Appendix B Site Location Plan.

Woodland Environmental Limited

TJ2475AR1 - Cherry Lodge Golf Club, Jail Lane, Westerham, Kent, TN16 3AX

February 2011



Appendix C London Borough of Bromley Records.

020 8461 7982
pollution@bromley.gov.uk

Our Ref: rs/db

Your Ref: TJ2475A/PB040211

8th February 2011

Paul Brewer
The Ridings
4 Village Close,
Sherington,
Bucks
MK16 9PZ

Dear Sirs

Land Search at Cherry Lodge Golf Club, Jail Lane, Biggin Hill, Westerham, Kent, TN16 3AX

Thank you for your email dated 4th February 2011 and payment for contamination information we hold for the above site. Our records have been searched and we are now able to provide you with the following information in relation to your specific questions:

Site history including relevant current and historical activities.

Historically the area was mostly woodland and undeveloped land before turned into a golf course.

Planning history

Nothing relevant observed.

Contaminated land classification.

Not designated as Contaminated Land as per Part IIA of the Environmental Protection Act 1990. There are no plans for investigations.

Authorisations and licenses (e.g. licensed and unlicensed discharges and licensed abstractions for potable and other uses of water, including private abstractions).

The area is in a Source Protection Zone 3. The Environment Agency should be consulted as required.

Pollution incidents.

There are none according to our records on site.

Geology and hydrogeology.

Upper Chalk Bedrock and Clay with Flints (diamicton) Superficial Deposit

Waste sites.

None according to our records on site

Surface water records.

There is a watercourse possibly a lake near to the Club House.

Potable water and groundwater extraction licenses/permits.

There are none according to our records although The Environment Agency should be consulted to check their records.

Areas of special local character.

Not according to our records on site, this requires a check with the Planning Department

Conservation areas.

This requires consultation with the Planning Department

Protected habitats.

This requires consultation with the Planning Department

Listed buildings.

This requires consultation with the Planning Department

Locally listed buildings or architectural and historical importance.

This requires consultation with the Planning Department

Archaeological sites.

This requires consultation with the Planning Department

Bomb damage

Not to our knowledge although this requires consultation with the Planning Department

Any other relevant environmental information held.

We have no records of any significant contamination issues that have been reported and recorded by the Council for this immediate area. The site has not been currently identified for further review under Part IIA of Environmental Protection Act 1990. We have no current plans for investigations.

We have no reports of any significant problems associated with area. However, as there is the potential for contamination to be present, if a major new development is proposed a Phase 1 contaminated land risk assessment would normally be requested with the planning application

The information contained in this letter is correct at the date of this letter to the best of our knowledge, using the data we have available. There maybe additional information available from old Ordnance Survey maps, trade directories, local archives and histories and other public bodies. I would emphasise that any information provided by the London Borough of Bromley does not act as a guarantee against the Authority taking action in respect of land contamination at the property in the future.

Yours Sincerely

Daniel Bugden
Environmental Health

Woodland Environmental Limited

TJ2475AR1 - Cherry Lodge Golf Club, Jail Lane, Westerham, Kent, TN16 3AX
February 2011



Appendix D GroundSure Data Report.