



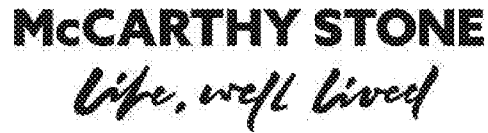
RIDGE

PILING RISK ASSESSMENT
WATER LANE, ANGMERING

PLANNING APPLICATION
A/110/21/PL

MCCARTHY STONE

10 AUGUST 2021



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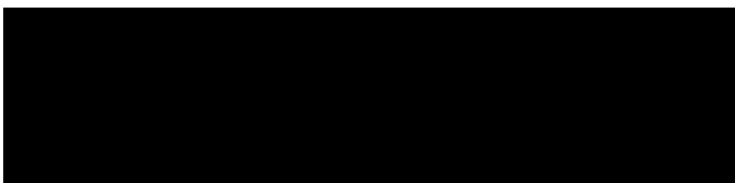
10 AUGUST 2021

PLANNING APPLICATION A/110/21/PL

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VERSION CONTROL

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1. INTRODUCTION

1.1. Instructions

Instructions were received from McCarthy Stone (MCS) to prepare a Piling Risk Assessment (PRA) in relation to the re-development of land at the former BMW Garage, Water Lane, Angmering, BN16 4EH (hereafter referred to as the “site”).

1.2. Proposed Development

Erection of retirement apartment with 20 No. 1 Bed flats & 13 No.2 Bed flats with communal facilities & car parking, erection of a retail store with car parking & associated highway works. This application was validated on 3 June 2021. The Environment Agency are a statutory consultee for the application and have recommended the following draft condition in relation to piling:

Condition 6 – Piling

Piling and using penetrative methods shall not be carried out other than with the written consent of the local planning authority. The development shall be carried out in accordance with the approved details.

Reason

Section 11.1.6 of the Ground Condition Assessment (Feb 2021) states that a piling Risk Assessment will be required and we support this. Therefore this condition is required to ensure that the proposed redevelopment does not harm groundwater resources in line with paragraph 170 of the National Planning Policy Framework.

1.3. Site Conditions

The site is centred on Easting 575376 and Northing 198409, situated at approximately 10mAOD (Above Ordnance Datum), located within the village of Angmering, West Sussex.

The majority of the site is currently disused and was last used as a BMW garage, which provided new and used car sales, servicing, and accident repair services. A derelict two storey residential house and associated garden areas are located within the west of the site. Most of the site is currently secured from public use apart from a courtyard within the west of the site which is currently being used as an area of permitted parking.

1.4. Previous Reports

Several reports have been prepared based on ground investigation and are listed below:

- Southern Testing – Site Investigation Report (2007)
- Ridge – Desk Top Study – for MCS – (2020)
- Ridge – Ground Condition Assessment – for MCS – (Feb 2021)

1.5. Objectives

This report provides the context and framework for piling on land affected by contamination and provides justification of the choice of piling methodology for the proposed development and mitigation measures to be adopted (if required).

This report has been prepared to provide information on the following:

- Background on the site setting and contamination
- Summary of the Conceptual Site Model
- Details of the proposed development and the selected foundation methodology
- A Piling Risk Assessment in accordance with Environment Agency Document Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention ref NC/99/73
- Justification of foundation methodology selection and measures required to mitigate any associated risks.

This report has been prepared in relation to the reports outlined above.

1.6. Report Limitations

This report has been prepared in accordance with the instructions received from McCarthy Stone and includes details of the assessment of risk from the use of piled foundations as part of the construction of the proposed building.

The information contained in this report is intended for the use of McCarthy Stone pursuant to the development described above. The assessment of risk and details contained herein may not be appropriate to other development proposals.

2. PHYSICAL SETTING

2.1. Published Geology

The Geology of Britain Viewer indicates that the site is likely underlain by Superficial Head Deposits over a Bedrock Geology of the undifferentiated white chalk - White Chalk Subgroup (formerly Upper Chalk).

2.2. Hydrogeology

There are no Source Protection Zones within 500m of the site.

Head is defined as Secondary Undifferentiated. Groundwater within the underlying chalk is designated as a Principal Aquifer.

2.3. Hydrology and Drainage

The site appears to be well drained with no areas of ponding evident at the time of the Ridge site inspections.

Groundsure records make note of a surface water feature bounding the north-west of the site, this feature was not observed during the site walkover, however subsequent research identified that the stream had been diverted via a culvert beneath Water Lane from a location 260m north-east and 140m south-west of the site. There are no further records within 400m of the site boundary.

Access was not afforded to this culvert during the investigation, due to it being secured by metal fencing; it is assumed that access is permitted via the Environment Agency.

3. SITE HISTORY / PREVIOUS INVESTIGATIONS / REMEDIATION

3.1. Site History

Based on review of available Ordnance Survey maps the site was a commercial garage from at least circa 1970. Some alterations to this garage have occurred since, with the extension of the main building and the addition of an annex structure.

Ridge reviewed previous correspondence with the Trading Standards Department at West Sussex County Council (WSCC) dated November 2019 in relation to a buried tank recorded in 1954 and thought to be located within the northern part of the site. The previous correspondence detailed the approximate location of a proposed tank and the existing tanks. A certificate pertaining to the making safe of the tank via foam filling in 2002 was also included within the provided emails.

The Trading Standards Department at WSCC were contacted again by Ridge on 21st October 2020. The Council informed Ridge that they have not been made aware of any further tanks onsite in addition to any remedial works, decommissioning or leaks and spills. The Council also confirmed that they are not aware of any further installations of tanks or pumps along Water Lane.

3.2. Previous Investigations

Previous intrusive investigations at the site that Ridge of aware of are summarised below.

3.2.1. Southern Testing

The investigation centred on a 10m x 10m area around a known underground tank within the northern part of the site. The object of the ST investigation was to assess the nature and extent of any potential contamination pertaining to the underground feature, assuming a continued commercial use.

The intrusive investigation comprised 6no. windowless sample boreholes to a maximum depth of 4.00mbgl and the installation of 2no. monitoring wells. The investigation encountered the following sequence of materials: Concrete block paving from ground level to 0.10mbgl, underlain by a subbase comprised loose brown sandy gravel from 0.10mbgl to a maximum depth of 0.30mbgl. A concrete slab was encountered between 0.30mbgl to 0.50mbgl. Made Ground, comprising loose dark grey, sandy silty clayey gravel, with occasional brick and flint fragments, was encountered underlaying the concrete slab to a depth of between 0.60mbgl and 1.70mbgl. Natural soils inferred as Head Deposits were encountered directly beneath the Made Ground and typically comprised, firm to stiff brown, silty gravelly Clay. Occasional black speckling and very soft off-white chalky silt was identified at the base of TH2 and TH6. The Head deposits were encountered to the full exploratory depth of 4.00mbgl.

Strong hydrocarbon odours were noted within the chalky silt material encountered within TH2 and TH6. Groundwater was encountered between 0.80m and 1.80mbgl during the investigation. Subsequent monitoring visits confirmed the presence of groundwater between 0.81m and 1.77mbgl.

28no. soil samples were submitted for contamination suite including total petroleum hydrocarbons (TPHs) volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). Two soil samples (TH3 at 1.00mbgl and TH6 at 4.00mbgl) presented slightly elevated TPH levels, one sample (TH4 at 1.00mbgl) presented elevated PAHs and Carbazole. The report concluded that despite the slightly elevated levels of soil contaminants that there was no significant risk to the human health receptors assuming a continued commercial land use. It should be noted that the Southern Testing report was written in relation to a continued commercial end-use, as opposed to a residential end-use currently proposed.

Eight groundwater samples were taken from a subsequent monitoring visit and 2no. surface water samples were obtained from the inflow and outflow portals of the culverted watercourse that runs adjacent to the site. All samples were tested in accordance with ST's contamination suites, which included TPHs, VOCs and SVOCs. Slightly elevated levels of TPH were encountered within the downstream culvert sample and in two of the groundwater samples from both TH1 and TH2. Two groundwater samples from TH1 displayed slightly elevated VOCs, including 4-Methylphenol, Diethyl Phthalate, Di-n-butyl phthalate and aniline. The upstream culvert sample tested free from any significant contaminants.

The report recommended further investigation to define the extent of the contamination over the wider site to assess any links and the impact on the adjacent water course and the chalk aquifer.

3.2.2. Ridge

The Ridge investigation was undertaken in November 2020. Thirteen windowless sample boreholes (WS1-WS13) were advanced through the base of their respective inspection pits to a maximum depth of 5.45mbgl, completed using a tracked dynamic sampling rig. The objective of these boreholes was to allow for the assessment of underlying ground conditions and permit in-situ Standard Penetration Testing (SPT) to provide geotechnical parameters for future use. Furthermore, it allowed for the production of detailed engineering logs and the recovery of samples for geotechnical and environmental testing.

WS1, WS5, WS6 and WS7 were installed with standpipes to enable future ground gas monitoring. The response zones were determined to target a combination of groundwater, Made Ground and hydrocarbon-impacted soils; further information within the engineering logs. These monitoring wells were secured within traffic-rated flush steel covers. The remaining windowless sample boreholes were backfilled with arisings in reverse order and reinstated in respect of existing conditions upon completion.

All intrusive locations were logged, and visual/olfactory evidence of contamination noted in accordance with best practice. Soil sampling of the near surface materials was undertaken to assess the contamination risks to human health and controlled waters. Samples were also removed at varying depths for geotechnical testing. Environmental samples were handled using a fresh pair of nitrile gloves. Selected samples were placed in sealable bags, sealed glass jars or plastic tubs (dependent on the exact laboratory requirement and analysis to be undertaken) and stored in a temperature-controlled environment before transit.

Spot ground gas monitoring was conducted during three occasions over December 2020 to January 2021. Gas monitoring was conducted in accordance with BS8576:2013 *Guidance on investigations for ground gas – permanent gases and volatile organic compounds*.

Groundwater was identified at depths ranging 3.00m to 4.30mbgl within the exploratory holes during the investigation. During subsequent groundwater gauging groundwater levels were recorded ranging 2.00m to 3.90mbgl.

3.2.2.1. Visual and Olfactory Observations

The table below summarises observations made during the investigation.

HOLE ID	OBSERVATIONS
WS1	Strong hydrocarbon odour from 3.50 to 4.00m
WS2	Strong hydrocarbon odour from 3.10 to 3.50m
WS6	Strong hydrocarbon odour from 2.00 to 3.00m
WS8	Strong hydrocarbon odour from 3.10 to 3.50m

Table 3.1: Visual and Olfactory Evidence

3.2.2.2. Soil Results

An exceedance of the applicable screening criteria was returned for lead from two tested soil samples. There were no other exceedances of the screening criteria for any of the remaining heavy metal determinands from all tested soil samples. Concentrations for chromium VI, mercury and selenium were returned below their respective laboratory Limit of Detection (LOD) from all tested samples.

An exceedance of the applicable screening criteria were returned for four PAHs (benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene and dibenz(a,h)anthracene) exclusive to one soil sample, WS6 at 0.50m. There were no other exceedances of the screening criteria for any of the remaining PAH determinands from all tested soil samples. PAH concentrations from a deeper soil sample (WS6 at 2.50m) returned all PAH concentrations returned below their respective laboratory LOD.

An exceedance of the applicable screening criteria was returned for two TPH determinands (aliphatic >C8-C10 and <C10-C12) exclusive to one soil sample, WS6 at 2.50m. There were no other exceedances from the remaining tested soil samples. It should be noted that the majority of TPH determinands from six of the tested samples (WS1 at 3.70m, WS2 at 3.50m, WS4 at 0.50m, WS7 at 0.40m, WS8 at 0.20m and WS11 at 0.30m) were returned at, or close, to laboratory LOD.

There were no exceedances of the screening criteria from any of the tested samples for all BTEX determinands and MTBE. It should be noted that marginally elevated BTEX was returned from sample WS6 at 2.50m; the same sample recorded TPH exceedances. Results for all BTEX and MTBE were recorded as below laboratory LOD for the remaining tested soil samples.

3.2.2.3. Leachate Results

Three soil samples were submitted to the laboratory for leachate analysis to specifically assess the potential leachability of certain contaminants. Leachate analysis can help assess whether soils have to potential to impact the underlying Principal Aquifer. In light of the contaminants of concern outlined above, all samples were scheduled for a leachate suite including TPH, BTEX and MTBE

Two exceedances of the groundwater screening criteria have been identified exclusively from one soil sample (WS6 at 2.50m). Concentrations from WS6 at 2.50m for aromatic >C10-C12 (36ug/l) and aromatic >C16-C21 (0.013ug/l) exceed the WFD EQS assessment criteria levels of 2.4ug/l and 0.1ug/l, respectively.

Results for all TPH determinands, BTEX and MTBE were recorded below laboratory LOD for both of the remaining soil samples.

3.2.2.4. Gas Results

Ground gas monitoring was conducted by Ridge on five occasions, 4 and 10 December 2020, 11 January, 1 March and 20 April 2021. Atmospheric pressure was noted to be decreasing during monitoring rounds 2, 3 and 4 and increasing during monitoring round 1.

Following the gas monitoring rounds the GSV for the site development area is classified as Characteristic Situation 2. Furthermore, VOC levels were reported as above 400ppm within WS07 during the monitoring regime and elevated elsewhere. This is consistent with the soil laboratory results and observations made during the investigation.

3.2.2.5. Assessment of Contamination Sources

Following investigations conducted to date and screening of chemical analysis results, the following contaminant sources have been identified:

- Contamination relating to the site's former industrial land use including the recorded tanks, licenced pollution releases and elevated TPH and PAH levels identified during this investigation and previous works. The potential for soil vapour is high given the recorded hydrocarbons and initial results from ground gas monitoring (i.e. Elevated VOCs).
- Elevated lead and PAH within shallow (<1.00m) Made Ground soils.
- Radon and ground gas; the site has been identified as CS2 and within a radon affected area.

Following leachate analysis, exceedances of the groundwater screening criteria were identified pertaining to hydrocarbon-specific contamination. It is likely that these exceedances are related to the fuel infrastructure on site. These results coincide with the findings from the Southern Testing investigation (Ref: J9299, dated 26 September 2007), i.e. elevated TPH from groundwater samples. In conjunction with the Southern Testing investigation, it is evident that the underlying groundwater is likely being impacted by the hydrocarbon-specific contamination on site. The contaminants have been confirmed to be leachable, and as such, any valid pathway (i.e. fractures within the underlying chalk) will assist migration of these contaminants. Moreover, the presence of the adjacent culvert exacerbates this contamination migration potential.

The sensitivity of the underlying groundwater (Principal Aquifer) increases the overall risk to Controlled Waters.

Piling has been considered as an option for proposed foundation design. Piling through contaminated ground can generate a preferential pathway and encourage the migration of contaminants to the underlying groundwater

All ground workers and contractors to follow suitable health and safety risk assessments to reduce exposure to identified contaminants whilst working on site.

Pile design to prevent pathways – Foundation Works Risk Assessment (FWRA) required detailing the suitability of the piling method for limiting downward migration of contamination. To be approved by the LA and EA.

Given the inherent unpredictability of the nature of Made Ground and the contamination within, there could be other areas of contamination that were not picked up during the ground investigation. If contamination is suspected, a protocol for hotspot removal should be enforced.

3.2.3. Conceptual Site Model

3.2.3.1. Sources

Following investigations conducted to date and screening of chemical analysis results, the following contaminant sources have been identified:

1. Contamination relating to the site's former industrial land use including the recorded tanks, licenced pollution releases and elevated TPH and PAH levels identified during this investigation and previous works. The potential for soil vapour is high given the recorded hydrocarbons and initial results from ground gas monitoring (i.e. Elevated VOCs).
2. Elevated lead and PAH within shallow (<1.00m) Made Ground soils.
3. Radon and ground gas; the site has been identified as CS2 and within a radon affected area.

3.2.3.2. Pollutant Linkage Assessment

By considering the sources, pathways and receptors (pollutant linkages), an assessment of the human health/ environmental risks is made with reference to the significance and degree of the risk. This assessment is based on consideration of whether the source contamination can reach a receptor and hence whether it is of major or minor significance.

Source 1) was assessed to pose a **Low** risk to future site users and occupiers, construction ground workers, new site buildings and structures and the Surface water culvert and a **Low to Moderate** risk to the underlying Principal Aquifer.

Source 2) was assessed as a **Low to Moderate** risk to future site users and occupiers, a **Low** risk to construction ground workers, and a **Low to Moderate** risk to on site buildings and structures. **Low** risk to the Principal Aquifer and **Very Low** risk to Surface Water culvert.

Source 3) was assessed as a **Moderate** risk to future site users and occupiers and on site buildings and structures.

3.2.4. Recommendations

It was recommended that all fuel tanks were decommissioned and subsequently removed along with all connecting pipework. This includes the identified UST and interceptor below and adjacent to the vehicle display forecourt. It will be necessary to undertake soil sampling adjacent to the tanks in order to target potentially impacted soils with the aim to demonstrate betterment. This exercise should be ideally undertaken after demolition of the existing structures with the aim to flag any potential risks.

It was recommended that the local water board were contracted to determine the type of pipework that should be used on site. However, it can be expected that suitable barrier pipes will be incorporated within the new development, due to the former use of the site. Services should be laid within lined trenches and backfilled with clean fill (such a pea shingle), which will demarcate the services, protecting both the services and future maintenance/groundworkers.

In consideration of the fact that gardening activities will be carried out by a professional contract organisation as opposed to residents, and thereby reducing risks to residential end users significantly, it was recommended that a capping layer, of a minimum thickness of 400mm, of clean imported subsoil and topsoil is placed in all areas of soft landscaping.

Any areas of proposed soft landscaping should ensure that imported topsoil and subsoil is suitable for use. Imported topsoil and subsoil should ensure they do not have levels of common contaminants (such as heavy metals, PAHs and petroleum hydrocarbons) that exceed the applicable screening criteria. Where Made Ground is shallower than 400mm, excavations can be halted on natural soils, subject to visual assessment and verification by an Environmental Consultant. Similarly, it will be possible to re-use natural soils, subject to assessment and verification.

The presence of the underlying Principal Aquifer and proximity of the culvert increases the sensitivity of the underlying controlled waters. Removal of the hydrocarbon-impacted soils will reduce the overall risk to groundwater. However, if these soils remain in-situ or more is found then a detailed quantitative groundwater risk assessment should be undertaken. The assessment should be agreed with the Environment Agency prior to being undertaken. The assessment will likely involve groundwater and surface water monitoring/analysis pre, during and post construction.

Given the proximity of the site to the identified culvert and surrounding river network particular care should be undertaken throughout development to ensure this receptor is not adversely impacted. Any surface water connections should be capped off at the site boundary prior to demolition to avoid contaminants entering the sewers and culvert.

4. PROPOSED DEVELOPMENT

4.1. Proposed Development

The proposals comprise the demolition of the existing structures and development of 33no. one- and two-bedroom retirement living apartments spread over a two-storey building within the south and east of the site. The development allows for 21no. residential parking spaces within the west and eastern portions of the site. The proposals also include the development of a 'local' Tesco supermarket totalling 4080sq.ft attached to the residential development within the north of the site. 12no. additional parking spaces are proposed for Tesco customer parking within the north of the site.

The proposed development utilises a positive surface water drainage system that ultimately discharges into the surface water culvert beneath Water Lane north of the site. Therefore the only infiltration of rainwater into the ground on the developed site is via new areas of soft landscaping.

The proposed development layout is included as Figure 1.

5. ALTERNATIVE FOUNDATION SOLUTIONS

Alternative foundation solutions have been explored for the site and comments are provide in Table 5.1 below :

FOUNDATION SOLUTION	REASONS WHY NOT SUITABLE
Traditional strip, pad, trench-fill	Ground conditions too soft and would lead to excessive settlement.
Raft foundation	Ground conditions too soft and will lead to excessive settlement of raft slab and bearing failure.
Ground improvement (stone columns) followed by traditional foundations	Soft clays too soft for this technique
Dynamic compaction	Not suitable given ground conditions and residential setting of the site.
Ground improvement using Rigid Inclusions followed by raft foundation	Method not approved by NHBC
Ground improvement using Controlled Modular Columns followed by raft foundation	Method not approved by NHBC

Table 5.1. Alternative foundation options

6. PILING RISK ASSESSMENT

6.1. Proposed Piling Methodology

The development is proposed to be founded on 224 No. Continuous Flight Auger (CFA) bearing piles and will be comprised of 300mm diameter piles with lengths 18-25m in length that will terminate in the underlying indigenous White Chalk Sub-Group.

This is subject to detailed design by the piling contractor.

6.2. General

The Piling Risk Assessment has been undertaken in accordance with guidance by the Environment Agency, namely, Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention NC/99/73 (EA, 2001). In particular this risk assessment refers to the six pollution scenarios detailed within NC/99/73 which are summarised in Table 6.1. The six possible pollution scenarios have been identified and described, representing situations where the Environment Agency is concerned that piling or penetrative ground improvement operations have a potential to cause pollution. The six scenarios considered are as follows:

SCENARIO	DETAILS
1	Creating of preferential pathways through a low permeability layer (an aquitard) to allow potential contamination of an aquifer.
2	Creation of preferential pathways through a low permeability surface layer to allow migration of landfill gas, soil gas or vapours to surface.
3	Direct contact of site workers and others with contaminated soil arisings that have been brought to the surface.
4	Direct contact of the piles of engineered structures with contaminated soil or leachate causing degradation of pile materials.
5	Driving of solid contaminants down to an aquifer during pile construction.
6	Contamination of groundwater and subsequently surface waters by wet concrete, cement paste or grout.

Table 6.1: Generic Pollution Scenarios

6.3. Risk Assessment

The piling risk assessment for the site is contained within Table 6.2, below. Risk estimation has been undertaken in line with guidance provided by the NHBC and Environment Agency (NHBC/EA, 2008).

POLLUTION SCENARIO	SOURCE (S) PATHWAY (P) RECEPTOR (R)	COMMENT
Creation of preferential pathways through a low permeability layer (an aquitard) to allow potential contamination of an aquifer.	S Contaminated Made Ground	Risk: Low The proposed piling method is CFA which is a non-displacement method of piling. Theoretically, any disturbance to the ground is minimal and there should be no formation of preferential pathways, as the concrete is cast in intimate contact with the surrounding soil. The pile carries load via skin friction so is in contact with the surrounding ground for its full length.
	P Pile / soil interface	
	R Principal Aquifer	
Creation of preferential pathways, through a low permeability surface layer, to allow migration of landfill gas, soil gas or vapours to surface.	S Soil Gas / Vapours	Risk: Low The proposed development will incorporate gas protection measures in line with the requirements of a Characteristic Situation 2 site. This will include a suspended floor slab and a proprietary hydrocarbon proof gas membrane with all joints and penetrations sealed. Additionally the creation of any new pathways will be minimal due to the CFA piling technique. No cases of known/inferred pollution from this scenario reported.
	P Pile / soil interface	
	R Buildings, Construction Workers and End Users	
Direct contact of site workers and others with contaminated soil arisings that have been brought to the surface.	S Contaminated Made Ground	Risk: Low CFA piling results in the generation of arising at the surface which could include potentially contaminative material (including asbestos). Health and safety precautions e.g. method statements, person protective equipment (PPE) and respiratory protective equipment (RPE) will be adopted by the contractor during piling works.
	P Direct Contact and Inhalation and Ingestion of Dust	

	R	Site Workers	Any contaminated arisings will be stockpiled then disposed off-site at a suitably licensed facility under an appropriate duty of care.
			No cases of known/inferred pollution from this scenario reported by EA.
Direct contact of the piles or engineered structures with contaminated soil or leachate causing degradation of pile materials.	S	Contaminants in soils and groundwater	Risk: Low Aggressive ground conditions will be established following the results of the site investigation. However, based on knowledge of surrounding sites and existing information, it is anticipated that the aggressive ground conditions and below ground concrete will be designed to design sulphate (DS) and aggressive concrete environment classifications (ACEC) of DS-3 and AC-3. No cases of known/inferred pollution from this scenario reported by EA.
	P	Direct contact and aggressive attack	
	R	Buried concrete	
The driving of solid contaminants down into an aquifer during pile driving.	S	Contaminated Made Ground	Risk: Low Proposed piling method is CFA which is a non-displacement method of piling. No cases of known/inferred pollution from this scenario reported by EA.
	P	Soil / pile interface	
	R	Secondary and Principal Aquifers	
Contamination of groundwater, subsequently, surface waters by wet concrete, cement paste or grout.	S	Construction materials	Risk: Low The site is located within a Groundwater Source Protection Zone and piles are proposed to extend beneath groundwater levels within the upper and lower Aquifers. Whilst the risk of contamination cannot be discounted the impact is assessed as low as both concrete and grout have low mobility potential. No cases of known/inferred pollution from this scenario reported by EA.
	P	Migration via permeable materials	
	R	Groundwater	

Table 6.2: Piling Risk Assessment for Water Lane site.

7. CONCLUSIONS

The foundation solution for the proposed building is to comprise 224 No. CFA piles. Pile diameters will be 300mm diameter and in the range 18-25m in length, terminating in the White Chalk Sub-Group. Final depths are load dependant and subject to specialist design.

CFA piling is a non-displacement method. Non-displacement piling methods involve the extraction of soil prior to the placing of the pile. Theoretically therefore there is no disturbance of the surrounding soil and provided that the pile is formed or placed in intimate contact with the surrounding soil there should be no formation of preferential pathways. The pile relies on skin friction to carry the load and therefore by design has to be in tight contact with the surrounding ground to work.

Detailed investigation of the site has been undertaken and limited contamination identified. The proposed tank pull and removal from site of impacted materials (if present) will improve the site conditions and should be viewed as betterment.

Various potential foundation solutions have been evaluated for the site and the piled solution is the only feasible solution for the proposed building given the ground conditions present.

As part of this assessment a number of potential adverse environmental impacts have been considered and assessed on a qualitative basis. The overall risks associated with the proposed foundation works are considered to be low and the use of CFA piles is considered appropriate for the ground conditions at the site.

References

Environment Agency. 2001. Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention ref NC/99/73.

HBC and Environment Agency 2008. Guidance for the Safe Development of Housing on Land Affected by Contamination. R&D Publication 66: 2008.

APPENDIX 1 – REPORT CONDITIONS

This report is produced solely for the benefit of **McCarthy Stone** and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

The report is based on ground investigations carried out by Ridge & third parties. Some of the opinions are based on unconfirmed data and information and are presented in good faith without exhaustive clarification. Where ground contamination is suspected but no physical Site test results are available to confirm this, the report must be regarded as initial advice only, and further assessment should be undertaken prior to detailed activities related to the Site. Where test results undertaken by others have been made available these can only be regarded as a limited sample. The possibility of the presence of contaminants, not revealed by this research cannot be discounted.

This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to Ridge and Partners LLP. In time improved practices or amended legislation may necessitate a re-assessment.

The report is necessarily limited to those aspects of land contamination specifically reported on and no liability is accepted for any other aspect especially concerning gradual or sudden pollution incidents that may occur. The opinions expressed cannot be absolute due to the limitations of time and resources within the context of the agreed brief and the possibility of unrecorded previous use and abuse of the Site and adjacent Sites. The report concentrates on the Site as defined in the report and provides an opinion on surrounding Sites. If migrating pollution or contamination (past or present) exists this can only practically be better assessed following extensive on and off Site intrusive investigations and monitoring.



FIGURE 1 – DEVELOPMENT PLANS



status	Panning	scale	A1 1200
diag no	50-2729-03-LA-001		
references	50-2729-03 AC 102 Proposed 5 to P anby KSA Arch		

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