

UNIT 23 | CHILTERN TRADING ESTATE |
EARL HOWE ROAD | HIGH WYCOMBE | HP15 6QT
www.piledesigns.co.uk | 01494 216333



PILEDESIGNS

MANCHESTER – CHORLTON VILLAS

PILING RISK ASSESSMENT

26422-PRA



Document Control

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1.0 Introduction

Piledesigns Limited has been appointed to complete a Piling Risk Assessment for the piled foundations at residential property known as Chorlton Villa, in Hardy Lane, Chorlton Cum Hardy, Manchester. The purposes of this document is to determine the risks profile for a bearing pile foundation solution for the structure.

The site, centred at approximately National Grid Reference SJ 81506 92591, is irregular in shape and lies on the western end of the Chorlton Villas development. At the time of writing it is understood that a single residential property has been constructed and founded on bottom driven grndomat steel tubular piles. Prior to construction the site is understood to comprises of undeveloped land though historical undifferentiated buildings and cutting/embankments are noted within the site boundary . The site is understood to be approximately level with ground levels ranging between 24.9mAOD and 26.69mAOD.

The site is bounded by residential properties to the east, railway line to the north, a golf courses to the south and a woodland area to the west. A site location and aerial photograph of the site and surrounding area is presented in figure 1 below.

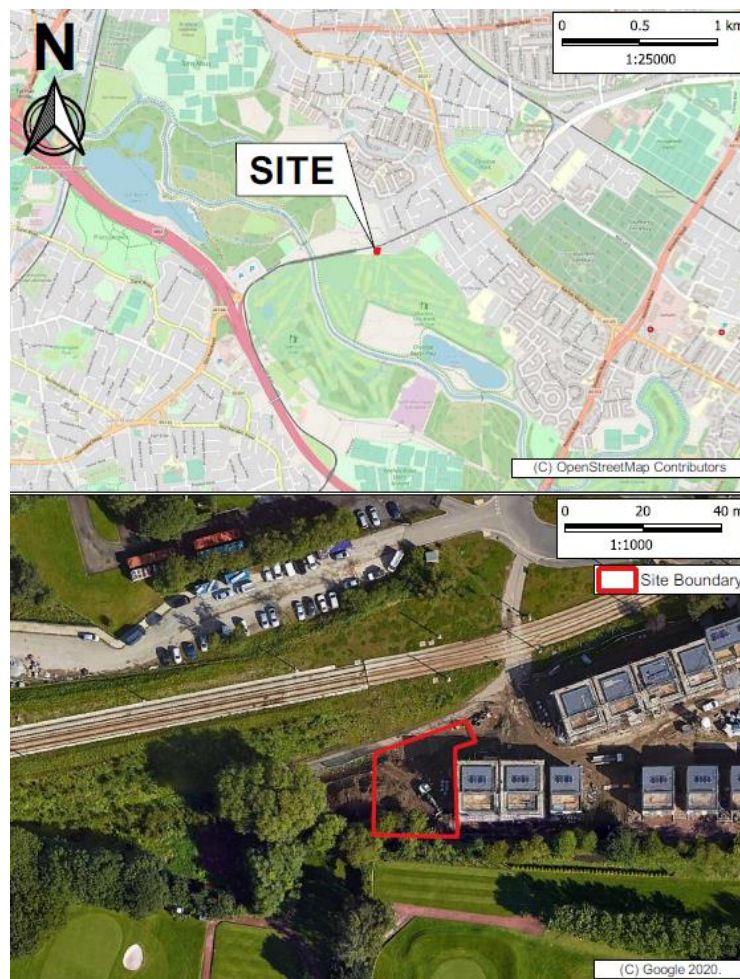


Figure 1: Aerial photograph of site (Approximate Site Boundary Marked in Red)

Piledesigns Limited (PDL) has been appointed by Hughes and Hilton Piling Limited to undertake the piling risk assessment based on the findings of the Phase 2 Geo-environmental Investigation undertaken by LK Consult (LKC).

1.1 Basis for Assessment

The assessment has been carried out in conjunction with the guidance and information provided in the following documents:

- Piling in layered ground: risk to groundwater and archaeology. Environment Agency (October 2006), Science Report SC020074/SR
- Piling and penetration ground improvement methods on land affected by contamination: guidance on pollution prevention. Environment Agency.

2.0 Information Provided

The main documents that have been consulted in preparing this report summarised below. Any subsequent revisions to these documents should be forwarded for review.

2.1 Engineering Documentation

The following engineering documentation relevant for the design is presented in Table 1 below.

Table 1 – Design Documents

Reference	Rev	Dated	Title	Author
21-HH-325-100	P01	3 rd Aug. 2021	Pile Foundation Details	ads Structural
21-HH-325-101	P01	3 rd Aug. 2021	Pile Foundation Details – Overlaid on Architects Plan	

2.2 Ground Investigation

For information on the site setting, and full details of the intrusive ground investigation and assessment completed for the site, this piling risk assessment should be read in conjunction with the ground investigation report detailed in Table 2 below.

Table 2 - Ground Investigation Report

Author	Report Name	Reference	Rev./Issue	Date
LK Consult	Phase 2 Geo-Environmental Investigation, Risk Assessment and Remediation Strategy	CL-602-LKC 21 1012-02	R0	March 2021

Please note the information presented within the ground investigation listed in table 2 above have been taken in good faith as providing a true and representative data pertaining to site conditions. No attempt has been made to validate the information or recommendation given. Piledesigns Limited does not warrant work/data undertaken/provided by others.

In addition it should be noted that the exploratory holes and testing completed assess only a small percentage of the area in relation to the overall size of the site, and as such can only provide a general indication of conditions. The number of sampling points and methods of sampling and testing does not preclude the possible existing of localised “hotspots” of contamination where concentration may be significantly be higher than those actually encountered or ground condition that vary from those identified. In addition there may be exceptional ground conditions elsewhere on the site which have not been disclosed by this investigation and which have therefore not been taken into account in this report. For example these include spatial variations in soil properties the

varying thickness and physical nature of the strata identified and changes in groundwater levels or flow rates and the like.

2.3 As-Built Records

Bearing pile installation records have been provided and indicate that forty piles comprising of 150mm diameter grundomat piles were installed across the development to a depth between 7.1m and 9.2m below piling platform level on the 16th August 2021. These bearing piles were installed to a set of between 1mm and 2mm.

3.0 Site Setting

3.1 Site History

A review of published historical aerial photographs presented in Google Earth shows that the site formed part of a woodland area until circa 2013 when a railway line was constructed immediately north of the site. LK Consult Phase 2 Geo-Environmental Investigation, Risk Assessment and Remediation Strategy (Ref: CL-602-LKC 21 1012-02 Rev. R0) dated March 2021 reports that undifferentiated buildings and culvert are presented on site between 1981 to 2014.

3.2 Environmental Setting

3.2.1 Published Geology and Hydrogeology

The British Geological Geoindex Website, shows the site as underlain by Alluvium deposits. Glacial Drift Deposits including Devensian Till and Glaciofluvial Sheet Deposits – Sand and Gravels are recorded immediately east of the site. The solid geology for the site is mapped as the Helsby Sandstone Formation.

Published borehole records undertaken in the immediately vicinity of the site indicate the area is underlain by Topsoil and possible Alluvium to a depth of 3.05m overlying by Probable Glacial Drift Deposits and very weak sandstone encountered at circa 7.5m.

The superficial deposits have been given a designation of Secondary Aquifer – A and the bedrock is designated a Principal Aquifer. Principle aquifers are highly permeable formations that can support large abstractions for public supply and other purposes.

The site is not located within a Groundwater Source Protections Zone (SPZ).

There are no groundwater abstractions within 500m of the site.

3.2.2 Hydrology

The nearest surface water has been identified as an un-named watercourse in the south west of the site. No water quality data has been provide and no surface water abstractions within 500m has been reported within the LK Consult Phase 2 Geo-Environmental Assessment.

The site is recorded at risk of flooding from rivers of the seas without defences. Further information should be sought from the Environment Agency if required since this may represent a significant constraint to development, although as the site is immediately adjacent to existing residential development to west, consideration has likely been made to potential flooding events.

3.2.3 Mineral/Mining

LK Consult Phase 2 Geo-Environmental Investigation details that the site is not in a Coal Mining Development High Risk Area (DHRA) nor is it an area that require a coal report. No mineral extractions is reported within 500m of the site and the site is not in the Cheshire Brine Compensation District.

3.2.4 Landfill Sites

It is understood that 'Hardy Farm Tip' operating between 1967 and 1974 is within the boundary of the site. Deposited waste includes inert, industrial, commercial, household, special waste and liquid sludge. In addition a well 25m north of the site is understood to have been infilled by 1894 and a pond 70m east was potentially infilled by 1907.

4.0 Summary of Ground Investigations

Information on ground conditions have been taken from the available published geological information and ground investigation reports carried out for the site by LK Consult as summarised in table 2. This investigation contains the records of five windowless sample boreholes to maximum depth of 5.45m.

In addition the LK Consult Geo-Environmental Investigation reports on the finding from an earlier ground investigation undertaken for the wider site area in 2014. This ground investigation is understood to comprise of four cable percussion boreholes, eleven trial pits and five windowless sample boreholes. However no borehole records or test results for this investigation has been provided and therefore the conclusion reached from this investigation are taken in good faith.

4.1 Summary of Ground and Groundwater Conditions

Ground conditions encountered comprised of made ground to depths between 2.0m and 3.8m and typically described as brown and dark brownish grey slightly gravelly to gravelly sandy clay with brick fragments, rare rubber and wood fragments and localised rare organic material. This was underlain by superficial deposits generally comprising of soft to firm and firm becoming stiff brown and brownish grey very sandy slightly gravelly clay (Probable Glacial Drift Deposits) or locally firm brownish grey sandy slightly organic clay and light brownish grey fine to medium sand in WS103 (Possible Alluvium). No bedrock was encountered during the advancement of the boreholes.

Groundwater was encountered during the advancement of the boreholes at a depth of 4.0m in three exploratory holes and likely to represent an inconsistent perched groundwater within the granular lenses of the Glacial Drift Deposits. No long term groundwater monitoring has been provided.

Chemical analysis undertaken by LK Consult identified slightly elevated PAHs within the made ground that could pose a risk to human health following redevelopment in areas of the site not covered with buildings or hardstanding. As such LK Consult have recommended that in soft landscaped areas a capping layer of chemically suitable material is installed. In addition the slightly elevated PAH is reported by LK Consult that the source is anticipated to be associated with the ash, clinker and coal noted with made ground therefore contamination associated with these deposits are not anticipated to be mobile due to the residual crystalline nature of the matrix. Furthermore no evidence of significant mobile contamination has been identified at the site.

In addition to the above elevated methane and carbon dioxide has been identified within the previous ground investigation undertaken in 2014 and organic inclusion noted in the natural clay. LK Consult have therefore recommended that the site is classified as Characteristic Situation 2 (CS2).

Furthermore LK Consult recommend sulphate resistant concrete in line with DS2 AC1s is used at the site which equates to a design chemical class of DC1 in line with the BRE Special Digest 1: 2005.

5.0 Conceptual Site Model

This section provides a conceptual site model (CSM) with regards to the proposed use of piled foundations for the development of the site and associated risks that could be realised due to identified contamination.

5.1 Contaminant Sources

The soil contamination outlines in table 3 were identified as potential contamination sources at the site following the ground investigation undertaken by LK Consult.

Table 3 – Summary of Contaminant Sources

Source Areas	Review of Risks
Made Ground across the site	Elevated concentration PAHs within the made ground were identified during the ground investigation undertaken by LK Consult. Gas monitoring undertaken at the site as part of the previous investigations in 2014 identify elevated of methane and carbon dioxide.

5.2 Receptors

The potential receptors are considered to comprise the following

- 1) Human Health (Construction workers and future site users);
- 2) The underlying Principle Aquifer within the Helsby Sandstone Formation;
- 3) Un-named watercourse in the south west of the site;

5.3 Migration Pathways

It is understood driven gundomat piles have been installed to between 7.1m and 9.2m below piling platform level. These piles can introduce preferential migration pathways due to the smooth surface of the piles or allow potentially contaminated soils be dragged along the shaft of the pile or pushed ahead of the pile toe whilst driving.

6.0 Piling Risk Assessment

6.1 Grindomat Piles

It is understood forty, 150mm diameter grindomat piles have been installed across the footprint of the proposed development to depths between 7.1m and 9.2m below piling platform. The grindomat method is a type of bottom driven steel tubular pile, which uses compressed air to drive the piles. No piling rig is required. The compressed air can be supplied from outside the piling area, using small machinery and generates minimum vibrations.

The grindomat pneumatically drives the starter casing, of which the base has been crimped to form a closed ended pile filled with limestone or dry mix plug, until the top of the casing is just above ground level. Driving is then paused and a follower, an additional open ended casing, is welded onto the starter casing and the driving process continued until either the pre-determined driving depth is reached or the set rate of penetration is achieved.

Based on the as-built pile lengths and the sets achieved it is envisaged that piles have been driven to practicable refusal onto the bedrock strata of the Helsby Sandstone Formation

6.2 Piling Risk Assessment

Six possible pollution scenarios are identified and described by the Environment Agency guidance, representing situations where there is a concern that piling or penetrative ground improvement operation have potential to cause a risk to receptors. These are as follows:

1. Creation of preferential pathways through a low permeability layer (an aquitard), to allow potential contamination of an underlying aquifer;
2. Creation of preferential pathway, through a low permeability surface layer, to allow upward migration of landfill gas, soil gas, or contamination vapours to the surface;
3. Direct contact of site worker and others with contaminated soils arising which have been brought to the surface;
4. Direct contact of the piles or engineered structures with contaminated soil or leachate causing degradation of pile material (where the secondary effects are to increase the potential for contamination migration);
5. The driving of solid contamination down into an aquifer during pile driving; and
6. Contamination of groundwater and subsequently, surface water by wet concrete, cement paste or grout.

Scenario 1: - Creation of vertical preferential pathways down the pile shaft is a potential risk on any site with contaminated soils or groundwater. However it should be noted that by using driven piles the soil will be densified as it is displaced laterally. The high soil stress set up during driving will inhibit groundwater flow in the fill and superficial deposits. In permeable soil, the densifying effect of driving piles will set up high soil stress that improves the soil/pile shaft contact rather than reduce it by creating a gap. In cohesive soils the Environment Agency Science Report SC020074/SR (October 2006), Piling in layered ground: risk to groundwater and archaeology confirms that solid cylindrical piles become effectively sealed when driven through clay layers with a thickness of 2 or more pile diameters. In the field, this sealing ability would preserve the integrity of such a layer acting as an aquitard.

Consequently this is considered a low risk with driven grunomat piles.

Scenario 2: - Piles have the potential to create a pathways for any soil gas or containment vapour to migrate to the surface. Gas monitoring undertaken as part of the previous ground investigation in 2014 and reported by LK Consult within the Phase 2 Geo-Environmental Investigation, Risk Assessment and Remediation Strategy (Ref: CL-602-LKC 21 1012-02 Rev. R0) dated March 2021 confirm the presence of elevated methane and carbon dioxide at the site with the principle source understood to be most likely associated the biodegradation of finely disseminated organic matter and wood fragments contained within the made ground and organic rich Alluvium deposits.

That being said the creation of pathways up the pile shaft to allow migration of gas vapours is not considered a significant risk with driven grunomat piles for same reason identified in Scenario 1 above. Also on completion of the pile installation it is understood that the internal hollow sections of the piles have been in filled with concrete/grout thus preventing the migration up through the internal sections of the pile. In addition it should noted that LK Consult have recommended gas protection measures for a Characteristic Site 2 (CS2). With all this taken into account the risk for soil gas or vapour migrating to the surface is considered low with driven grunomat piles.

Scenario 3: - LK Consult Phase 2 Geo-Environmental Investigation, Risk Assessment and Remediation Strategy (Ref: CL-602-LKC 21 1012-02 Rev. R0) dated March 2021 has identified limited contamination present at the site, mainly in the made ground and comprising of elevated PAH's. However it should be noted during the pile driving process there is normally no removal of soil and consequently there is no significant risk. In addition any follow on works to construct ground beams and the like where excavation into the made ground is required, the contractor should ensure that all construction works wear appropriate PPE/RPE and the application of mitigation measures including dust suppression and wheel washes as appropriate may need to be adopted. Therefore given

that site workers will have limited exposure to excavated soils this should prevent Scenario 3 from being a significant concern and the risk is considered very low.

Scenario 4: - With regards to the potential for contaminated soils or leachate causing degradation of the pile material, appropriate chemical resistant concrete should be employed for the piles in accordance with the guidance provided in BRE Special Digest 1 Concrete in Aggressive Ground. In addition it should be noted steel tubes are fabricated off site and therefore result in improved quality control compared with cast in-situ piles.

Consequently this considered a very low risk with driven grndomat piles.

Scenario 5: - Driven piles have the potential for soils in contact with the sides of the pile and material below the toe of the solid or closed ended pile to be dragged down. However it should be noted that there is a tendency for soil to be displaced lateral when driving. In addition given the stratigraphy at site comprising of made ground typically described as soft to firm clay overlying firm and stiff Glacial Drift Deposits, the potential from driving contaminated soils ahead of the piles is considered very low. Furthermore it should be noted grndomat piles are crimped at the bottom forming a pointed end which will help mitigate this risk further.

Consequently this is considered a low risk with driven grndomat piles.

Scenario 6: - Grndomat piles comprises of hollow steel tubes which are manufactured off site and once installed can be infilled with wet concrete, cement paste or grout using the steel tubes as casing. Therefore whilst piles appear to be driven to the top of the Helsby Sandstone Formation based on the as-built records the risk of pollution by spillages of concrete during pile installation and infilling is considered low given that grout/cement is encased within the hollow steel tubes and only remains mobile until hardened. In addition good site practices should be employed to prevent escape of concrete, cement and grout particularly with regard to spillages of such material into the unnamed water course identified in the south west part of the site.

Consequently this is considered to represent a low risk assuming good site management practices.

7.0 Conclusions

On review of the site data and on consideration of the piling method used to install the bearing piles across the proposed development it is considered that there is a low risk to local controlled water or human health receptors.

However consideration should be given to protecting construction workers, particular in follow on trades where there remain a risk due to exposure to contamination at surface, associated with the made ground. Contamination has been identified within the made ground that could be brought to the surface during excavation to allow construction the ground beams. Mitigation measures to alleviate these risks could include (but not limited to) dust suppression and the wearing of appropriate PPE/ RPE.

This risk assessment and opinions provided are based on current available guidance relating to acceptable contamination concentration, no liability can be accepted for the retrospective effects of any future changes or amendments to these values. Specific assumptions associated with Piledesigns Limited risk assessments process have been outlines within the body of the report.

END OF CALCULATIONS



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