

PHOENIX IRON WORKS

CFA Pile Installation

Contamination Risk Assessment

Rev 01: 3rd April 2025

INTRODUCTION

Green Piling has been appointed by Eric Wright Construction to undertake the design, supply, installation, and testing (where required) of Continuous Flight Auger (CFA) piles of 450mm diameter.

The local planning authority has stipulated conditions regarding contaminated land, which require the submission and approval of a remediation strategy before development commences. Additionally, any use of piling or penetrative foundation methods must be consented by the local planning authority to ensure that no unacceptable risks to groundwater arise.

This Piling Risk Assessment has been prepared to satisfy the planning condition, demonstrating that the installation of CFA piles will not result in unacceptable risks to the groundwater system or controlled waters.

SITE DESCRIPTION AND CONTEXT

The site has the following hydrological characteristics; Secondary Undifferentiated Aquifer (superficial deposits) overlying a Principal Aquifer to the west of site and Secondary B Aquifer in the remainder of the site (Bedrock Geology). The Rochdale Canal is located immediately south of Parcel C and a canal basin is located 95 m south west of the site.

CONTAMINATED LAND CONDITION OVERVIEW

As per the planning conditions and the guidance from the Environment Agency, the site is deemed to present a significant risk to controlled waters. The condition requires the submission of a remediation strategy, along with a comprehensive risk assessment for the piling works, to demonstrate that the groundwater will not be adversely affected by the construction processes.

Key elements of the contaminated land condition include:

- No development can commence without an approved remediation strategy for contamination risks.
- Piling or penetrative foundation techniques are only permissible with the express consent of the local planning authority, contingent on evidence that no unacceptable risk to groundwater will result.
- A Piling Risk Assessment must be provided to evaluate potential impacts during the installation of CFA piles.

GROUND INVESTIGATION

Site Investigation Information

Soils Information:	MANCHESTER LIFE PLOT A / PHOENIX IRON WORKS
	PHASE 2 GROUND INVESTIGATION REPORT
	Curtins Ref: 080866-CUR-XX-XX-T-GE-00003
	Revision: P01 Issue Date: 07 February 2025

Table 10 – Summary of Ground Conditions Encountered

Strata	Depth to Top of Strata m bgl (m AOD)	Recorded Thickness (m)		Description
		Min	Max	
Made Ground	0.00 (50.96 – 49.47)	0.0.40	3.10	Surface Cover: Concrete / Tarmacadam
				Sub-base: Slightly clayey sandy gravel
				General: Interbedded cohesive and granular deposits.
				Canal Infill: Black sandy clayey gravel/gravelly clay with strong hydrocarbon odour and an iridescent sheen.
				Demolition Rubble: Dark grey/dark brown sandy gravelly clay with cobbles and boulders.
Glacial Till Deposits	0.50 – 3.10 (48.77 – 46.68)	17.90	20.90	Brownish grey slightly gravelly slightly sandy to sandy clay. OR Locally Brown clayey sand and gravel.
Manchester Marls Formation	20.00 – 24.00 (29.97 – 26.62)	0.40	10.00*	Weathered: Weathered sandstone recovered as a clay OR Weathered mudstone recovered as a clay or Sands & Gravels
				Competent: Sandstone and Mudstone

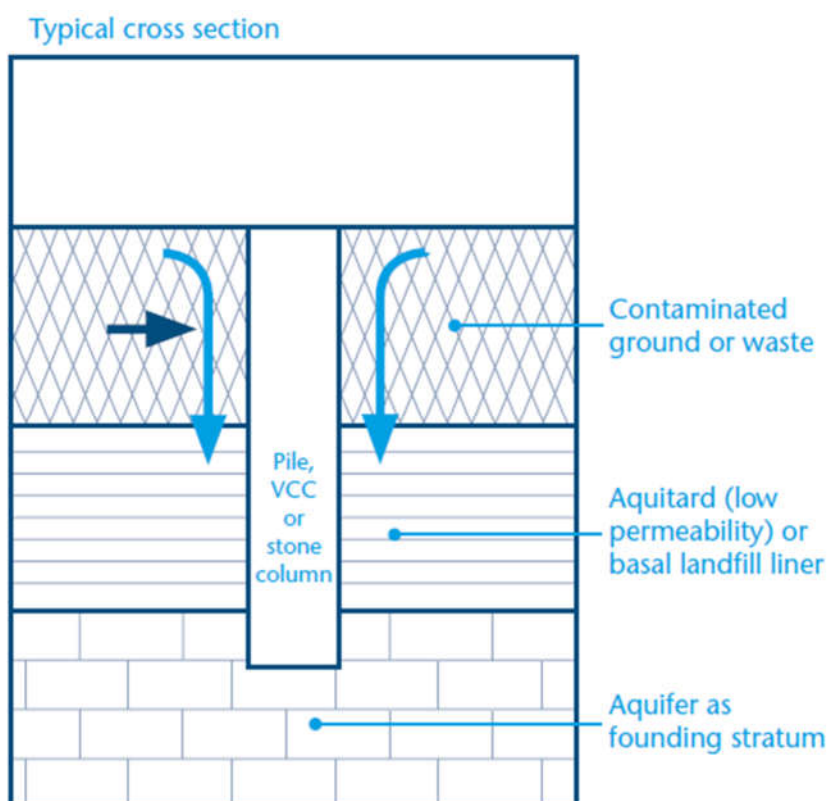
*Full extent of strata not proven.

It should be noted that E3P did not record ground levels of their exploratory borehole locations, as such, ground levels were estimated from LiDAR data.

HAZARD IDENTIFICATION

Pollution Scenario

The hazard identified at Worrall Street is referred to as 'Pollution Scenario 1' in the Environmental Agency's report "Piling into contaminated sites". This is described as the "creation of preferential pathways through an aquitard to allow potential contamination of an aquifer". It is illustrated thus: -



RISK ASSESSMENT

Pollution Scenario	Source (S)		Comment
	Pathway (P)		
	Receptor (R)		
Creation of preferential pathways 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 cast in intimate contact with the surrounding soil.
	P	Pile / soil interface	
	R	Secondary and Principal Aquifers	
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.
	P	Pile / soil interface	
	R	Secondary and Principal Aquifers	
Contamination of groundwater, and subsequently, surface waters by wet concrete, cement paste or grout.	S	Construction Materials	Risk: Low Secondary A superficial aquifer with an underlying Principal aquifer within the sandstone bedrock. The Groundsure report indicates that the site is not located within a groundwater source protection zone. Whilst the risk of contamination cannot be discounted the impact is assessed as low as both concrete and grout have low mobility potential.
	P	Migration via permeable strata	
	R	Groundwater	

ASSESSMENT OF THE INSTALLATION PROCESS

Continuous Flight Auger (CFA) piles are specifically chosen for projects where it is crucial to minimise the risk of contaminating the aquifer or introducing preferential pathways for groundwater migration. The unique characteristics of the CFA piling method ensure that contamination risks are significantly reduced compared to other penetrative foundation methods.

- **Retention of Soil on Auger Flights:** During the installation process, the soil is retained on the auger flights, providing support to the surrounding soil. This means that no material is transported downward into the aquifer, thereby avoiding contamination of lower strata. Additionally, as the auger rotates, it forces the soil upwards, creating a heap of soil at the surface, which further supports the goal of preventing contaminants from migrating downward.
- **Positive Pressure Differential:** The positive rotation of the augers and the outward pressure across the pile's side wall prevents groundwater from entering the pile during installation. This is crucial in maintaining the integrity of the surrounding soil and ensuring that groundwater is not inadvertently directed downward, preventing contamination of the deeper aquifers.
- **Concrete Placement and Friction Bond:** Once the desired depth is reached, the concrete is pumped through the hollow auger stem into the borehole. This process resembles the "tremie" method, where the head of concrete pressure forces the spoil and any groundwater upwards out of the hole. However, the CFA method has the added benefit of the concrete being actively pumped, ensuring that the concrete makes intimate contact with the borehole's sidewalls as the auger is withdrawn. This creates a friction bond between the concrete and the surrounding soil, which is crucial for the structural integrity of the pile and also prevents any preferential pathways for contamination to seep downward.

According to the National Groundwater & Contaminated Land Centre report NC/99/73, as long as the pile is in intimate contact with the surrounding soil, there is no formation of preferential pathways for contaminants. This is true in the case of CFA piles, where the concrete is cast directly against the soil, ensuring a solid and effective barrier to groundwater contamination.

- **Rig Instrumentation and Quality Assurance (QA):** The CFA rigs are equipped with sophisticated monitoring systems that track key parameters such as depth, torque, penetration, extraction, and concrete pressure. These real-time data ensure that the piling process adheres to quality standards, with precise control over the concrete placement. The removal rate of the auger ensures that the tip of the auger during extraction is buried in the fresh concrete and the monitoring system helps guarantee that soil and contaminants are pushed up ahead of the fresh concrete, and that the auger is fully extracted from the borehole only after the concrete reaches the surface. This ensures that the entire process takes place consistently and without risk of contamination.

CONCLUSION

Based on the characteristics and methodology of CFA piling, it is reasonable to conclude that:

- The installation of CFA piles will not directly transfer contaminated material to lower levels.
- The process will not create preferential pathways for groundwater migration either during or after the construction.
- There will be no contamination of the lower aquifer, as far as is reasonably practicable, due to the containment provided by the CFA method.

The combination of auger action, positive pressure differential, intimate contact between concrete and surrounding soil, and the robust quality assurance provided by the CFA rig instrumentation ensures that no unacceptable risk to groundwater or the surrounding environment arises.

All piling works will be completed as per the Green Piling Risk Assessment Method Statements (RAMS).

The use of CFA piling is therefore deemed to be an effective and safe method for this project, in full compliance with local planning and environmental requirements.