Report Ref: P2970

Appendix 9.8

Piling Risk Assessment

Cavan Regional Sports Campus, Cavan
County Cavan

Client: **McAdam Design**

Issued: March 2024

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1.0 INTRODUCTION

1.1 Report Brief

MCL Consulting Ltd (MCL) was appointed by McAdam Design, on behalf of Cavan County Council, to undertake a Piling Risk Assessment for lands north, south and west of Royal School Cavan and west of Breffni Park GAA grounds, County Cavan.

The current proposal includes;

- Indoor sports complex to include sports halls with spectator seating, fitness studios, changing facilities, reception, café and ancillary accommodation.
- 7 no. outdoor sports pitches.
- Covered sports arena with playing pitch, spectator seating and other ancillary accommodation.
- Ancillary sporting facilities include 8 lane athletics track and cricket practice nets.
- New vehicular access / junction and closure of Park Lane/Dublin vehicular junction, relocation of existing Breffni Park turnstiles to facilitate reconfiguration of Park Lane, bridge structure, internal roads, cycle/pedestrian paths, associated car/bus/cycle parking, electric charge points and streetlighting.
- Pedestrian access points of Kilnavara Lane and Dublin Road.
- Hard and soft landscaping including acoustic fencing, wildlife habitat area/corridors, artificial badger-sett, walking trails and other ancillary works such as spectator stands, retaining walls, fencing and ball stop fencing, team shelters, toilet block, floodlighting, signage, drainage infrastructure including attenuation tanks, SuDs and culverting of a minor watercourse, storage space, ESB Substation, ancillary accommodation and all associated site works to accommodate the development.
- The proposed bridge is a single span integral reinforced concrete bridge, supported on piled foundations.

1.2 Scope of Works

The following works were undertaken as part of this assessment;

- Review of site setting;
- Review of ground and groundwater conditions encountered at the site;
- Review of Conceptual Site Model (CSM);
- Discussion of geotechnical requirements;
- Undertaking of a Piling Risk Assessment.

The report further assesses the CSM developed in the previously completed PRA / GQRA, including a risk assessment in line with CIRIA 552 methodology. The report will then outline suitable working methods, relating to piling operations including controls for groundwater monitoring and management and outline further remedial measures (if required).

The report has been produced in line with the guidance presented in *"Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention. Environment Agency National Groundwater and Contaminated Land Centre Report NC/99/73 May 2001".*

The aim of this report is to determine risk to environmental receptors associated with the use of piles which may be utilised within the development.

1.3 Site Setting

The site, c.27.5ha, is located in central Cavan, County Cavan, on lands surrounding Royal School, College Street and west/northeast of Kingspan Breffni (IGR: 241769, 303932). A site location map is presented as Figure 1 and the site area is presented as Figure 2.

Figure 1: Site Location Map

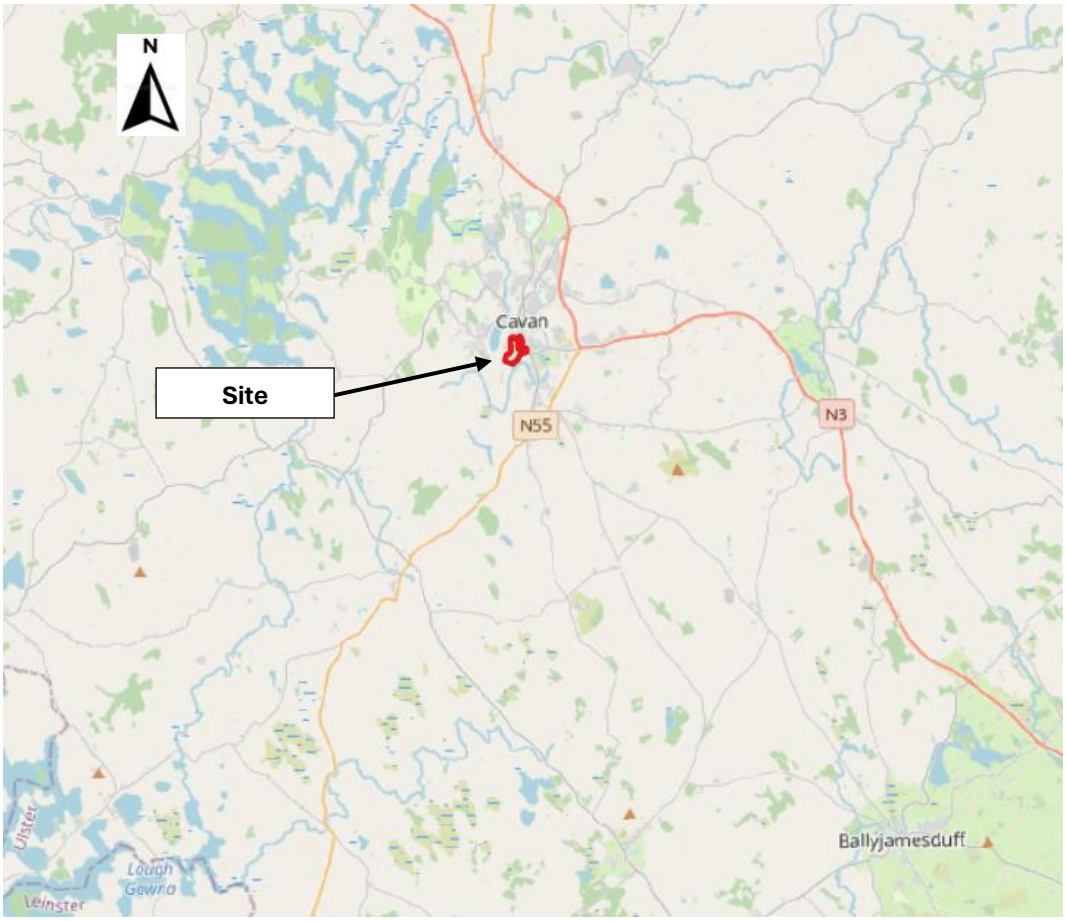


Figure 2: Aerial Image of the Site Boundary

The site currently occupied by agricultural land adjacent to Royal College, County Cavan and Breffni Park GAA. The surrounding area is characterised as largely residential, with mixed recreational and commercial land uses surrounding. A summary of the properties / land-use immediately adjacent to the site is presented in Table 1.

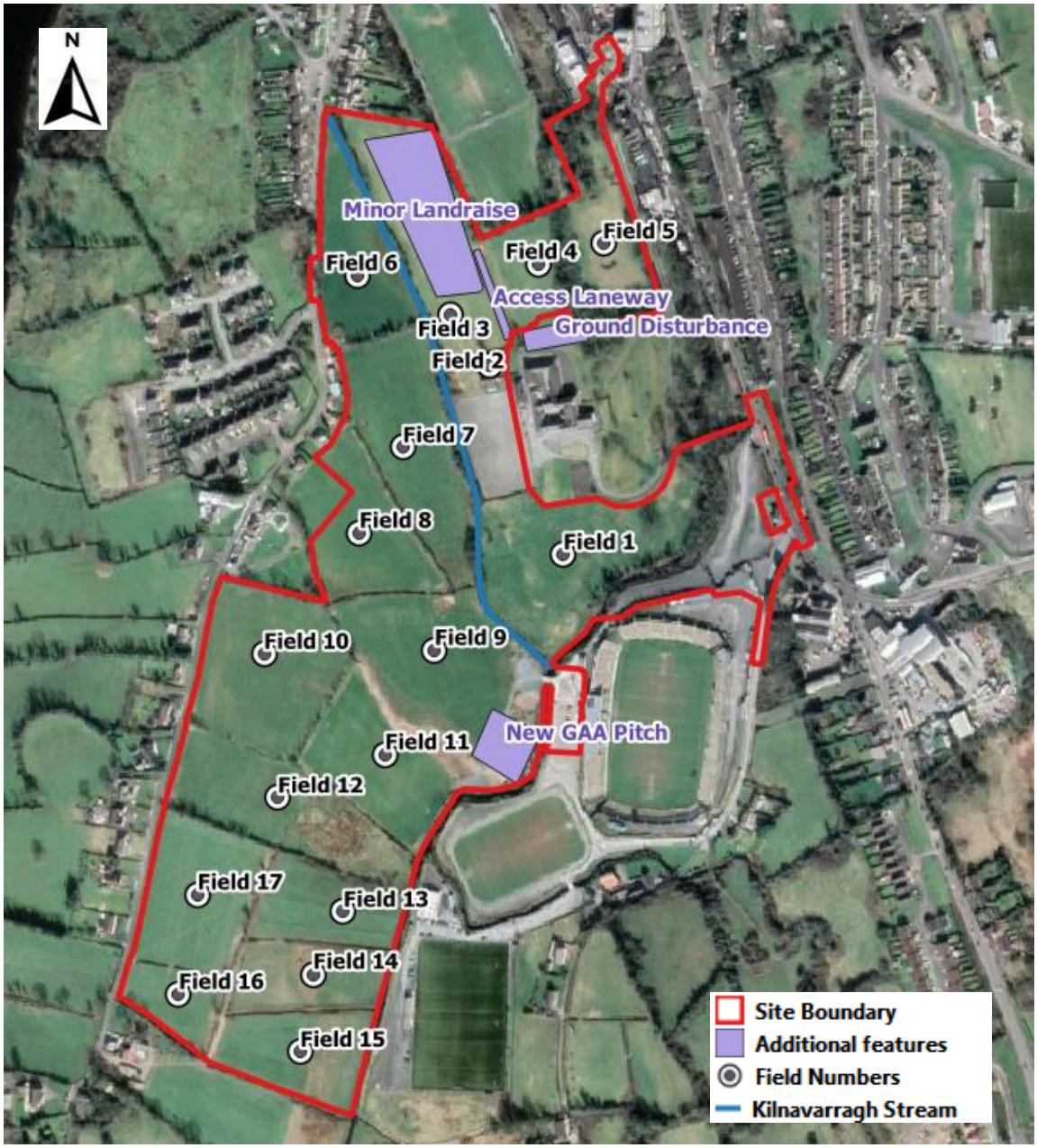
Table 1: Summary of Adjacent Land Use

Orientation from Site	Neighbouring Property/ Land Use beyond Site Boundaries
North	Sport fields are directly to the north of the site with residential/commercial properties beyond this leading into Cavan town.
South	Developed sport fields lie directly to the south with adjacent agricultural fields. Lands beyond this are dominated by agricultural lands with small residential properties within.
East	Residential/commercial properties with agricultural properties beyond.
West	Agricultural/residential properties are adjacent to the site with Sweelan Lough beyond this. Lands beyond this are for agricultural/residential use.

1.4 Site Walkover

A site walkover was undertaken by MCL on 20th April 2023. A tributary of the Cavan River (Kilnavarragh Stream) enters the site via a culvert under the Kinavarragh Lane, flowing southwards in an open wooded channel, before flowing southeast into the Cavan River. This tributary roughly dissects the site into east and west. Therefore, for ease of description, the site can be divided into lands east of Kilnavarragh Stream and lands west of Kilnavarragh Stream as shown on Figure 3.

Figure 3: Separation of Site into field sections



1.4.1 East of Kilnavarragh Stream

This area of site can be accessed via access road into Royal School Cavan. From this access road, there is an all-weather gravel sports pitch used by the school. To the west of this pitch is Kilnavarragh Stream which dissects the site. South of the pitch is Field 1, which is greenfield land. The topography slopes to the south/southeast in this area, where the field borders the Cavan River. There was an area of marshy land in the southwest of this field along Kilnavarragh Stream. Drainage pipes from Breffni Park grounds, were identified flowing into the Cavan River. Looking south from the recently constructed Aggregate Access Laneway

constructedallowing access to farmlands north of new school building, note ponded water on surface o laneway.

North of Field 1 is a gravel pitch currently used by Royal School Cavan as a Car Park in the south and a Physical Education ground. Slightly upgradient of the Gravel Pitch is a grass field (Field 2). East of Field 2, beyond the site boundary and encroaching into Field 4 is an active construction site, where the construction of a new 2-storey school building structure has recently been completed. Groundworks within this area include a land cut / reprofiling and land-raising in an area behind the new-constructed retaining structure.

To the north of the new school building, within Field 3 and Field 4, localised land-stripping has been undertaken to create a new hardcore access lane. This leads northwards, opening up into a large area of very recent minor land raise. A c.1m thick layer of what appears to be mainly clay materials arising from the school development cut has been spread out over agricultural lands to the north of the school development. The western area of Field 3 and the eastern area of Field 4 have remained mainly greenfield.

To the north of the new school building, within Field 3 and Field 4, localised land-stripping has been undertaken to create a new hardcore access lane. This leads northwards, opening up into a large area of very recent minor land raise. A c.1m thick layer of what appears to be mainly clay materials arising from the school development cut has been spread out over agricultural lands to the north of the school development. The western area of Field 3 and the eastern area of Field 4 have remained mainly greenfield.

Field 5 is located slightly upgradient of Field 4 and is greenfield land. There is then a steep decline in topography eastwards towards the Cavan River.

1.4.2 West of Kilnavarragh Stream

Field 6 and Field 7 are located west of Kilnavarragh Stream. The topography increases west from Field 2 and Field 3 to Field 6 and Field 7. The topography decreases from Field 6 towards Field 7. Field 6, Field 7 and Field 8 are all greenfield land with no previous activities occurring in these areas.

Field 9 can be accessed via a newly-constructed bridge across the Cavan River located within the grounds of Breffni Park GAA grounds car park. The land slopes upgradient in a north west direction from the bridge. In the east of this field, a car park associated with Cavan GAA is currently under construction. A GAA playing pitch has recently been constructed along the south/south west of Field 9. This would have required a programme of ground disturbance cut and fill / alteration of land profile to create a flat platform on what have originally been sloping lands.

The field boundary and associated small area of woodland observed to exist between Field 9 and Field 11, as observed by comparing aerial photography dated between 2021 and 2022, has recently been removed creating a strip of bare / disturbed cleared ground now partly occupied by the new playing field.

In the northwest corner of Field 9, along the boundary with Field 8, a low flowing watercourse enters the site flowing southeast.

Field 10 located upgradient of Field 11, the boundaries of which is separated by a ditch with limited water flow. Field 12 is also separated from Field 10 and Field 11 by a ditch, with limited, stagnant water. Field 10, Field 11 and Field 12 (scrub) are all greenfield land with no evidence of former land use activity.

Field 13-17 are located in the southernmost regions of the site. The walkover of these fields indicated that the vast majority of areas are all greenfield land, with no evidence of contaminating land use evident. There is a clear decrease in elevation between Fields 16 and 17 and the lower Fields 13-15, with the lower fields meeting the Cavan River on the eastern boundary. Fields 13-15 showed extensive flooding during the site visit, likely from field drains present along the field boundaries. The flooding covered a large portion of the eastern sections of the fields.

2.0 SITE ASSESSMENT

2.1 Key Details of Proposed Development

The following key elements of the development are considered in this piling risk assessment:-

- Single single span integral reinforced concrete bridge, north of Breffni Park, crossing the Cavan River
- Other proposed buildings/structures may require piling such as; the Indoor sports complex, the covered sports arena with playing pitch, spectator seating and other ancillary accommodation, the Spectator stands, retaining walls, fencing and ball stop fencing, team shelters, toilet block, ESB Substation, ancillary accommodation and all associated site works to accommodate the development.

2.2 Previous Reporting

The site has been subject to contaminated land (PRA/GQRA) assessment and Geotechnical Assessment, as follows:-

- *MCL Consulting Preliminary Risk Assessment (Stage 1)*
- *MCL Consulting Generic Quantitative Risk Assessment (Stage 2)*
- *Northwest Geotech Report No. 23-0092, Ground Investigation Report, Cavan County Council*

2.3 Land Contamination

Investigation of the site identified some areas of made ground due to historical site reprofiling but no significant soil or groundwater contamination was identified across the site.

To the north of the new school building, within Field 3 and Field 4, localised land-stripping has been undertaken to create a new hardcore access lane. This leads northwards, opening up into a large area of very recent minor land raise. A c.1m thick layer of what appears to be mainly clay materials arising from the school development cut has been spread out over agricultural lands to the north of the school development.

The Geotechnical Investigation carried out by Northwest Geotech identifies significant thickness of made ground / fill in the Dublin Road access zone, north of Breffni Park, extending down to the bridge site. The fill extends to significant depth of up to >9.6m (BH13) of fill in these areas. However, there is no laboratory data for this material, therefore the Human Health/Environmental Risk is unknown. It is recommended that a further Land Quality Site Investigation is carried out to assess the fill in this area of the site for human health exposure and environmental protection.

2.4 Ground Conditions

The ground conditions observed during intrusive investigations are summarised in **Table 2**. The reader should refer to the Geotechnical Reports prepared by *Northwest Geotech* and the GQRA prepared by MCL Consulting for borehole logs and detailed descriptions of ground and groundwater conditions.

Table 2: Ground Conditions at Sites where Piling is Likely

Location	Ground Conditions
Bridge Site, North of Breffni Park	Up to >9.6m Made Ground Gravelly Clay underlying Made Ground
Other proposed buildings/structures	Limited Made Ground/ No Made Ground Gravelly Clay underlying Made Ground

At the bridge site, the upper few metres of the ground being piled through will be comprised of made ground. The made ground is typically re-worked natural materials similar to the local geology. The quality of the underlying soils are unknown.

2.5 Groundwater

The underlying Superficial Deposits comprising Glacial Till are not recognised as a potential Superficial Aquifer, due to its low permeability and inability to transmit significant quantities of groundwater. Drilling has indicated that river gravels, which if significantly thick and laterally continuous along the river channel can transmit useable quantities of groundwater and provide important baseflow to the river, are essentially absent at the site. Therefore, the only groundwater system present will be associated with the glacial till.

Information from the Causeway Geotech Ltd Site Investigation of a portion of the Royal School lands to the west of the Cavan River indicates that the shallow drift would appear to be reasonably dry, though some groundwater was encountered in a sand layer at a depth of 3.1m.

An intrusive site Investigation report prepared by Causeway Geotech Ltd (Appendix 5 of the PRA) covering a portion of the Royal School lands to the west of the Cavan River identified Limestone bedrock at a depth of 3.5m below ground level. This was described as laminated with white calcite veins and also as fractured. No groundwater was encountered in the upper 3m of bedrock, with the borehole terminated in dry limestone.

Karstic groundwater systems, and groundwater systems relying on fracture flow are characterised by groundwater being restricted to the network of interconnected fractures and joints, and the groundwater within these systems is usually confined (under pressure). Therefore, where the cut-fill engineering associated with the development has the potential to encounter or intersect a bedrock groundwater zone, groundwater could potentially enter excavations with significant force and rise to a much higher level that the elevation of the groundwater zone.

A recently-completed site investigation (logs presented in Appendix 9-6) has enabled a good understanding of the local geology and hydrogeology. As part of the Land Quality Ground Investigation, a total of 25 No. groundwater monitoring wells were installed throughout the site.

The drilling results record a range of shallow groundwater strikes in the till during the drilling works, although some boreholes were recorded as dry on completion. A programme of manual dip readings was undertaken at all installed groundwater monitoring points on 4no. occasions throughout the monitoring period between 16/2/24 and 1/3/24. This indicated a slightly confined system in the till with water levels rising slightly from the depth of water strike. This is not unexpected in a low permeability system such as the till, where water is likely to be restricted to gravelly layers within the sequence, which are likely confirmed by overlying less permeable clay-rich layers.

The groundwater level monitoring data enabled to production of a Groundwater Flow Map for the shallow groundwater system within the till. The groundwater flow map and hydrographs indicate a general west to east groundwater flow direction over lands to the west of the Cavan River, and a general east to west groundwater flow direction over lands to the east of the Cavan River. This confirms, as expected, that all shallow groundwater flow is toward the Cavan River. The Cavan River will therefore receive baseflow from the shallow groundwaters at the site. The shallow groundwater system underlying the site is therefore hydraulically connected to the Cavan River.

The groundwater flow data, in showing reasonable flow patterns, also indicates a good degree of hydraulic continuity is present between individual boreholes and the wider groundwater and surface water system. Therefore, the groundwater system is likely to have some reasonable, albeit modest permeability, and active flow.

The groundwater data indicates shallow groundwater elevation ranging widely, falling from c 66mOD in the west to c.62mOD close to the river channel and 77mOD in the east (close to the Dublin Road), again falling to c 62mOD close to the river channel.

Seven (7) No. deeper boreholes (DBH01 – DBH07) were drilled by rotary core technique to 15m depths across the cut fill zone of the development to assess deeper groundwater conditions in the lower drift and underlying bedrock. The drillers logs are presented in Appendix 9-6. Only one of these boreholes encountered bedrock, which was identified as Limestone, at 7.4m below ground level (DBH06). The borehole was extended into the bedrock to a total depth of 15m (7.6m into the bedrock) and was found to be completely dry. Therefore, the upper bedrock in the main cut-fill zone appears to be devoid of groundwater. All the other deeper boreholes in the main cut-fill zone terminated in the glacial till at 15m depth and were also dry / devoid of groundwater.

Deeper groundwater was however encountered in some other deeper boreholes drilled at the bridge crossing site. At BH21 (Figure 9-11 (b)), groundwater was struck at the interface between the made ground and rockhead at a depth of 5.2m below ground level. At BH23 (Figure 9-11 (b)), groundwater was struck at the interface between the till and rockhead at a depth of 6.4m below ground level. This would suggest that the limestone bedrock is a water-bearing aquifer in some areas of the site.

2.6 Ground Gas

Ground gas data was collected at SBH01 to SBH25 on 16th February, 20th February, 26th February and 1st March 2024. During the monitoring period, atmospheric pressure ranged from 988mb to 1021mb across falling, rising and constant pressures. Review of the gas monitoring data identifies that Carbon Dioxide was not detected on site. A minimal concentration of Methane at 0.1%vol was detected across all monitoring rounds of the site with the same 0.1% detection for LEL. Steady flow was measured between 0.2-0.3l/h across all monitoring points on site with Oxygen levels remaining between 21.0% and 21.3%. The site has been classified as CS1 Very Low Risk as all Hazardous Gas Flow rates were <0.07l/hr. Therefore, no ground gas mitigation measures are required. There would be no risks to construction workers during the construction phase regarding ground gas inhalation. No explosive levels of ground gas were detected. Entering excavations and confined spaces during earthworks would not pose a risk from a ground gas perspective.

3.0 PILING RISK CONSIDERATIONS

3.1 Bridge Site, North of Breffni Park

The bridge will be a single span integral reinforced concrete bridge crossing the Cavan River, north of Breffni Park.

It is recommended that CFA Piling Technique is used to minimise ground vibration. This approach was agreed in order to minimise the construction phase vibration impact to and to protect badger setts, otters, pearl mussel and white clawed cray fish. Piles will be drilled to bedrock.

3.2 Other proposed buildings/structures

It is recommended that the Silent Sheet Piling Technique is used should other buildings/structures on site require piling, due to the ecological sensitivity of the site. Piles will be drilled to bedrock.

3.3 Environmental Hazard Identification

Based upon an assessment of the site setting, the following possible hazards are identified with regards to the use of driven piles in the site;

- Creation of preferential pathways, through a one or more low permeability layers (an aquitard), to allow potential contamination of an underlying aquifer (Environment Agency Pollution Scenario 1);
- Creation of preferential pathways, through a one or more low permeability layers (an aquitard), to allow upward migration of soil gas or contaminant vapours to the surface (Environment Agency Pollution Scenario 2);
- Contaminated arisings being brought to the surface by piling work, with subsequent risks to site workers and site users, and the need for appropriate handling; (Environment Agency Pollution Scenario 3);
- The effects of aggressive ground conditions on materials used in piles (Environment Agency Pollution Scenario 4);
- Driving contaminated materials downwards into the aquifer during construction/installation (Environment Agency Pollution Scenario 5); and
- Concrete or grout contamination of groundwater and any nearby surface waters (Environment Agency Pollution Scenario 6).

4.0 PILING DESIGN

At the time of reporting the piling design works for the bridge landing sites have been outlined as requiring CFA Piling for ecological protection reasons. All other proposed buildings/structures will be piled using silent sheet piling technique.

There are numerous types of piled foundations used in industry, however they generally fall under two main categories:

Driven pre-cast piles are one form of *Displacement Piling* where the pile is formed by displacing soil from the space to be occupied by the pile **without** the removal of soil to the ground surface. The dominant movement of soil is in a radial horizontal direction with limited vertical movement of soils downwards. This typically results in volume reduction/ densification of the soil around the pile and is considered to generally result in a reduction in permeability.

CFA (Continuous Flight Auger) piles fall within the *Non-Displacement Piling* category. This involves the extraction of soils and the subsequent replacement of the void created by the pile (typically through casting of concrete in-situ by pumping from the surface). Displacement of the soils around the pile is minimised and there is minimal radial or vertical soil movement or densification. This does involve the bringing of soil arisings to the surface. Typically, the void created does need temporary support through the use of temporary or permanent casings or use of bentonite. The use of these supports can sometimes cause some minimal displacement type effects on surround soils.

Silent piling or the 'press-in' technique is a non-dynamic method for the installation of steel sheet piles suited to ecologically sensitive construction sites. It utilises hydraulic rams to push the piles into the ground and is commonly marketed as 'silent piling', which is essentially vibration free.

5.0 SOURCE- PATHWAY- RECEPTOR SUMMARY

A summary of the relevant S-P-R linkages which occur or could develop due to piling is presented in **Table 3**.

Table 3: S-P-R Linkages Summary

Source	Pathway	Receptor
Potentially contaminated soils in upper infill	Downward displacement around pile	Groundwater within lower aquifer units
		Site workers/site users where brought to surface
Impacted shallow groundwater in upper infill/superficial deposits.	Downward vertical movement around pile and potential lateral movement to lough	Groundwater within lower superficial units
		Nearby surface waters
Impacted shallow groundwater in underlying superficial deposits	Downward vertical movement around pile and potential lateral movement to lough	Groundwater within lower bedrock aquifer units
		Nearest surface water (Cavan River)
Soil gas/vapours	Upward vertical migration around pile	Site workers and site users

6.0 PILING RISK ASSESSMENT

The introduction of piles through the made ground and superficial deposits (gravelly Clay) to depth has the potential to create preferential pathways for the downward migration of contamination from the shallow groundwater into the gravelly Clay which is hydraulically linked to the Cavan River and subsequently the Lough Oughter SAC.

Only CFA and Silent Sheet Piling are considered in this risk assessment, since hammer-driven piles and other piling methods have been ruled out on the basis of vibration risk to ecology.

CFA Piling is a non-displacement 'bored' piling technique which extracts a core of soil and replaces it with concrete cast in-situ. CFA piles are constructed by rotating a hollow stem continuous flight auger into the soil to a designed depth. Concrete or grout is pumped through the hollow stem, maintaining static head pressure, to fill the cylindrical cavity created as the auger is slowly removed. The reinforcement cage is placed through the freshly placed concrete.

CFA Piling is a low vibration method making it ideal for ecologically sensitive areas. The method enables piles to be formed in water-bearing strata, without the need for casing or bentonite. The pile is drilled and concreted in one continuous operation.

CFA Piles are considered to provide better protection for multi-layer aquifer systems than driven piles, since the in-situ casting creates a water-tight seal against the geology over the length of the pile.

Hydraulically driven 'Silent Piles' are considered a low / zero vibration method making it ideal for ecologically sensitive areas.

A summary of the risk assessment undertaken for the proposed piling works is presented in **Table 4**, with the risk classification based on the CIRIA 552 methodology

Table 4: CSM and Piling Risk Assessment

Activity	Consequence	Consequence of Risk	Probability of Risk	Risk Classification	Comments
Silent Sheet Piles (Temporary Works)	Potentially contaminated arisings from pile	Low-Moderate	Low	Low	With this piling method it not considered that there will any significant volume of arisings during installation or removal.
	Piles acting as pathways into lower aquifer units for shallower groundwater	Low due to insignificant volumes of shallow groundwater	Low	Low	Sheet piles do not provide good protection from mixing of groundwater from different units, however, where the consequences of allowing this are insignificant, sheet piles may still be appropriate. The volume of shallow groundwater is minimal and its presence is sporadic. The risks of groundwater mixing is low, the consequences of groundwater mixing are insignificant.
	Movement of contaminated made ground / infill further down into natural ground	Low, no significant contamination present	Low	Low	No significant contamination detected in vicinity of proposed application.
	Creation of Hydraulic link to underlying groundwater system when used for in-river works	Low-Moderate	Moderate	Low	Surface water and groundwater are already hydraulically linked across the floor of the riverbed. Installation will only be temporary for a short period of time of a few months and will then be withdrawn restoring the pre-construction hydraulic conditions. The environmental risk of these works is therefore considered as Low.
	Contact with contaminated soil / groundwater by construction workers	Low	Low	Low	No significant contamination detected in vicinity of proposed hub building
	Upward migration of gas/ vapours from made-ground / natural degradation or organic material or contamination	Moderate	Low	Low	Site is classified as CS1 Very Low Risk. No risks associated with ground gas on site.
	Migration of concrete/grout	Low	Low	Low	No grout/concrete applied into ground in this method reducing risk of any off-site migration.
	Aggressive attack on pile structure	Low	Low	Low	Specific pile design will take into account site setting and ground and water quality

Activity	Consequence	Consequence of Risk	Probability of Risk	Risk Classification	Comments and Mitigation Measures
CFA Piles	Potentially contaminated arisings from pile	Low-Moderate as nature of Made Ground unknown	Low	Low	Soil arisings will be produced using this method. Appropriate stockpiling of soils will be necessary in accordance with the oCEMP. Materials may have to be removed from the site or re-used on site.
	Piles acting as pathways into lower aquifer units for shallower contaminated groundwater	Low	Low	Low	Removal of soils can potentially lead to vertical migration of shallow groundwater to lower units, however the CFA piling technique do not provide an easy preferential pathway (5.2.1 EA Guidance) and will be temporary with subsequent concrete/grout emplacement integrating with surrounding soils as a seal. Surrounding ground is Made Ground/gravelly Clay which may already allow some vertical migration in places. There is insignificant volumes of shallow groundwater and occurrence is sporadic. The risks of groundwater mixing is low, the consequences of groundwater mixing are insignificant.
	Movement of potentially contaminated made ground / infill further down into natural ground	Low	Low	Low	Soil arisings will be produced and the soils would be appropriately stockpiled on site for the appropriate re-use on site or disposal off-site.
	Contact with potentially contaminated soil / groundwater by construction workers	Low	Low	Low	No significant groundwater contamination present.
	Upward migration of gas/vapours from made-ground/ contamination	Moderate	Low	Low	Site is classified as CS1 Very Low Risk. No risks associated with ground gas on site.
	Migration of concrete/grout	Low	Low	Low	Measures described in the oCEMP will be to minimise excessive grout use preventing escape of concrete dust and slurry.
	Aggressive attack on pile structure	Low	Low	Low	Specific pile design will take into account site setting and ground and water quality.
	Retention of piles under construction platform	Low	Low	Low	Although required on a temporary basis for the construction phase, CFA piles are difficult to remove subsequently. The piles will be retained and cut down to 1m below ground level to facilitate landscape / restoration of the area following completion of construction works at the bridge site.

Should the presence of Crayfish in the Cavan River be confirmed, piling works along the Cavan River are constrained to the months of April, July, August, September and October.

Figure 4: Seasonal Constraints for Construction and Associated Works

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
In river works (If crayfish presence confirmed)												
Tree and shrub clearance (Birds)												
Tree and shrub clearance (Bats)												
Tree and shrub clearance (Pine marten)												
Badger Sett Creation												
Badger Sett exclusion												

Red: Exclusion Period
Green: Approved Period

7.0 CONCLUSION AND SUMMARY

Overall, the risk assessment has concluded a low risk associated with the use of permanently installed CFA piles and Silent Sheet Piling.

CFA piling solution would appear to be good practice and an appropriately conservative approach in terms of ensuring protection of groundwaters, surface waters and local ecological receptors. The CFA Pile method, being a low vibration option, also provides adequate protection for ecological purposes.

The use of Silent sheet piles for other proposed buildings/structures meets all of the environmental objectives to minimise environmental impact.

If during the development works, new contamination or risks are encountered which have not previously been identified, works should cease, and the Planning Authority shall be notified immediately. This new contamination shall be fully investigated in accordance with LCRM. In the event of unacceptable risks being identified, a remediation strategy shall be agreed with the Planning Authority in writing, and subsequently implemented and verified to its satisfaction.

If an alternative piling solution is considered at the detailed design stage, all piling methods must be low vibration during installation and removal (where necessary), and must offer similar degree of environmental protection to the piling solutions assessed at the planning stage.

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