Comhairle Contae Chorcaí
Cork County Council

ARUP

N25 Little Island Pedestrian and Cyclist Bridge

Environmental Impact Assessment Report

Volume 4
Appendices

September 2023

N25 Little Island Pedestrian and Cyclist Bridge
Environmental Impact Assessment Report

Preface

Preface - Volume 4

The structure of this Environmental Impact Assessment Report (EIAR) for the N25 Little Island Pedestrian and Cyclist Bridge (hereafter referred to as the Proposed Development) is summarised as follows:

Volume 1: Non-Technical Summary

Volume 1 provides a non-technical summary of the information contained in Volume 2 of the EIAR.

Volume 2: Main Environmental Impact Assessment Report

Volume 2 provides a general introduction, outlines the environmental impact assessment process, describes the scope of the Proposed Development, presents the consideration of reasonable alternatives and describes the environmental impacts specific to the Proposed Development.

Volume 3: Figures

Volume 3 provides drawings and large format images (labelled as ‘Figures’) that illustrate the information detailed in Volume 2 of the EIAR.

Volume 4: Appendices

Volume 4 provides documentation and data that is supplemental to the information provided in Volume 2 of the EIAR.

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1 Introduction

Cork County Council (CCC), the National Transport Authority (NTA) and Arup have identified the benefits associated with the provision of a new pedestrian and cycle bridge. The proposed bridge will cross the N25 and connect the Little Island Train Station, the Glounthaune Road and future greenway to the Eastgate Business Park in Little Island, Cork. Eastgate is a relatively dense employment zone within Little Island and the provision of a new bridge providing access to this area from the Train Station and greenway will strongly encourage an increase in trips via sustainable modes.

The project location lies approximately 10km east of Cork City on the N25 Cork to Waterford primary route as shown in Figure 1 below.

The proposal is to undertake a feasibility and constraints assessment for the proposed project in relation to structural, geotechnical, environmental and cost. The constraints assessment informed the selection of potential design options for the proposed bridge.

The objective of the proposed bridge is to provide efficient pedestrian and cycle connectivity between the Little Island Train Station and the Eastgate Business Park and to promote sustainable transport modes while minimising impacts on the surrounding area and environment.

While options of extension of the existing R623 Little Island Bridge/N25 Overbridge (additional traffic lanes installed in 2019) have been considered, the focus of this report is on the area west of the R623, which will directly connect the Little Island Train Station to proposed pedestrian, cycle and bus network improvements in the Eastgate area which are proposed as part of the Little Island Sustainable Transport Interventions Project (LISTI).

Figure 1: General Location of Project (Red Marker) © Bing Maps

2 Background Information

The report builds on work carried out by Arup as part of LISTI project where the benefits of a new pedestrian and cycle bridge were identified as part of the design interventions recommended on the existing public road network and East Gate Business Park. These recommendations were to deliver enhanced access for public transport and pedestrians/cyclists to and within Little Island and between Little Island and the Little Island Railway Station.

The LISTI Design Options Assessment Report provides the basis for the identification of the need for the proposed pedestrian and cycle bridge and the possible locations.

Previous work was also undertaken in relation to a new bridge proposal in a nearby location completed by RPS Consultant Engineers (RPS) referred to as “Little Island Pedestrian / Cycle Bridge - High Level Feasibility Study” - December 2016. The RPS report was assessed for any information that could aid in the identification of constraints for this feasibility study. It was noted that the recommended option proposed by RPS would not meet the design brief of this project as outlined in section 5 of this report, due to the bridge only including pedestrian steps and elevators. No ramps were included in that option and therefore the bridge would not accommodate cyclists unless cyclists dismounted and utilised the proposed elevators or stairs.

3 Methodology

The aim of this report is to identify the key constraints associated with the development of a pedestrian bridge in this location and determine if a potential bridge is likely to be feasible based on specific criteria including:

- Environmental;
- Construction;
- Planning;
- Construction Cost;
- Programme.

The feasibility study is based on a desktop review of publicly available information.

Design options for the bridge have included consideration, on a preliminary basis, of aspects such as aesthetic form, constructability, cost, and landing options.

4 Previous Considerations

There are several potential options to facilitate pedestrian and cyclist movements to Little Island and Eastgate Business Park from the train station and surrounding network.

As part of the LISTI project, an initial examination of 4 potential bridge landing locations were identified and examined. These 4 locations are identified in Figure 2 below.

Figure 2: Potential New Bridge Landing Points Considered

Initial examination based on walking catchment and location resulted in two of these options to be removed at an early stage, namely locations 1 and 4. In order for either of these locations to be viable, it was determined that it would require a relocation of the Little Island Train Station. Cork County Council held initial discussions with Iarnród Éireann (IÉ), during which the feasibility of relocating the station was discussed. IÉ indicated that it could be feasible to relocate the station, hence options 1 and 4 were considered. However, when comparing the pros and cons of relocating the train station against retaining its current location, it was considered that a relocation of the station would not provide sufficient benefits to justify the capital expenditure at this time. Therefore, Options 1 and 4 have not been considered further in this feasibility report.

In addition to the landing options identified in Figure 2, consideration was also given to providing a new bridge immediately adjacent to, or an extension of, the existing An Crompan Bridge. This option would provide a pedestrian and cycle route connecting the Glounthaune Road, Little Island Train Station and Little Island along the existing road network. However, as this option would either require the widening of two existing bridges or the construction of two new bridges, this option did not provide any reduction in capital costs relative to the other landing options considered. Furthermore, as a pedestrian route currently exists between the train station and Little Island, it is not anticipated that a new bridge in this location would attract a similar level of modal shift to the train station as a new connection into the Eastgate area. In addition, the provision of a new bridge connection to the west of the train station provides a significantly better opportunity to connect the bridge and wider Little Island area to the proposed Bury’s Bridge to Carrigtwohill greenway, ensuring cyclists have a fully segregated cycle network from the surrounding areas directly into Eastgate.

From a constructability perspective, it should be noted that widening the existing bridges over the N25 and the railway is a more complex process than providing a new standalone structure due to the requirements necessary to tie-in the new and old structures. These bridges would likely require significant traffic management measures for a considerably longer duration on the N25 and potentially on the railway. While this would not by itself rule out the feasibility of a new bridge in this location, when compared to alternative options, it makes for a less desirable outcome.

As a result of the sifting process which eliminated a number of potential landing points for further consideration, Locations 2 and 3 as presented in Figure 2 above remained and these shall be further assessed in this feasibility study.

5 Preliminary Options Assessment

5.1 Design Brief

The proposed bridge structure could potentially have an approximate span in excess of 90m, which is the distance between the park on the northern side of the N25 road and the Eastgate Business Park. The bridge will need an additional 130m - 140m of ramps either side to facilitate tie into existing infrastructure.

In accordance with TII Design Criteria for Footbridges document DN-STR-03005 the soffit of the proposed bridge will need to be a minimum 5.7m above the level of the existing N25 carriageway.

A combined pedestrian/cyclist bridge usually has a strict minimum width of 2.0m, with 2.7m if pedestrians and cyclists are segregated. Pedestrian bridge widths between 2.5 and 4 m are the most common widths in structures of combined traffic.

At this stage of the study and as agreed with the NTA, widths of 4 and 5 metres have been considered. These widths appear achievable at this stage but will be subject to verification pending a more detailed analysis.

The bridge is proposed to facilitate all pedestrians and cyclist traffic using approach ramps with a maximum gradient of 1:20 as requested by the NTA. As a result, the proposed structure should not have access elevators or stairs.

Splitting of the park with the proposed bridge structure is also to be avoided. Therefore, the approach ramps will be supported on columns spaced apart to allow the amenity of the park to be retained.

5.2 Design Parameters Structural

The proposed structure shall be designed in accordance with Eurocodes and the TII Design Manual for Roads and Bridges (DMRB), which both specify a design life of 120 years. It will be designed for pedestrian loading in accordance with IS EN 1991-2, load model LM4.

All pedestrian bridges should be categorized into bridge classes by their usage to determine the appropriate dynamic actions to be considered due to pedestrians. The bridge class has been identified as Class C in accordance with Cl.NA.2.46.2 of IS EN 1991-2:2003 (National Annex).

This class is suitable for urban routes subject to significant variation in daily usage (e.g. structures serving access to offices or schools). The number and nature of pedestrian users on a bridge results in the bridge becoming ‘excited’, the scale of the excitations is a function of the type of bridge, span, structural depth (inertia), materials and nature of the pedestrian usage i.e. groups of people jogging/running etc.

Generally, the intent is to have minimal or no perceptible dynamic response. However, in longer span bridges where the intent is to provide a slender solution with aesthetic merit, a balance between acceptable dynamic behaviour and the slenderness of the structure is required.

As the proposed structure will form a pedestrian and cyclist link, the parapet height shall be a minimum of 1.2m high for pedestrians and an additional rail for cyclists will be at a height of 1.4m minimum in accordance with TII DMRB requirements.

5.3 Bridge Alignments

As mentioned previously, the LISTI options assessment has identified landing points 2 and 3 as being optimal for maximising the number of pedestrians and cyclists that would use the bridge. These landing points have identified potential alignments for the bridge, resulting in three options; Bridge Alignment Option 1, Bridge Alignment Option 2 and Bridge Alignment Option 3. Bridge Alignment Options 2 and 3 are essentially very similar but an opportunity arose to improve connectivity for cyclists from the greenway by avoiding sharp turns on the approach ramps, hence both options have been examined.

These alignment options consider the bridge spanning the existing N25 dual carriageway and existing Cork to Midleton railway with connectivity to the Little Island Train Station via ramped access west of the station and the Eastgate Business Park as per the LISTI options assessment landing points.

The alignment options are discussed in further detail below as well as identifying advantages and disadvantages for each. These alignments have been compared and Bridge Alignment Option 3 has been chosen as the preferred alignment. This alignment will be used to complete the constraints study.

5.3.1 Bridge Alignment Option 1

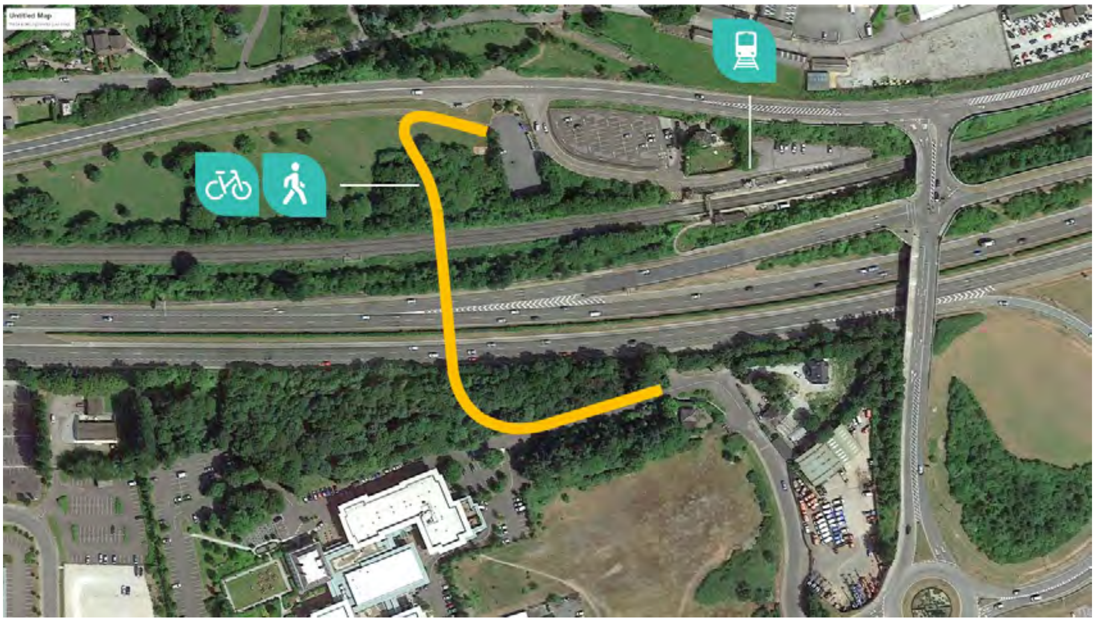

Figure 3: Bridge Alignment Option 1

Advantages

- Approach ramps much closer to train station;
- At grade connection to Bury’s Bridge Greenway;
- Closest bridge to Little Island Train Station;
- Provides multi-modal interchange (rail, bus, cycling, pedestrian connectivity).

Disadvantages

- Impact on third party landowner (Radisson Blu Hotel);
- Sharp bend in alignment is not preferred for cyclists;
- Longer span over N25;
- Does not have the same pedestrian/cyclist catchment;
- Poor tie in locations at the Eastgate Business Park side;
- Additional tree felling/site clearance to facilitate both approach ramps.

5.3.2 Bridge Alignment Option 2

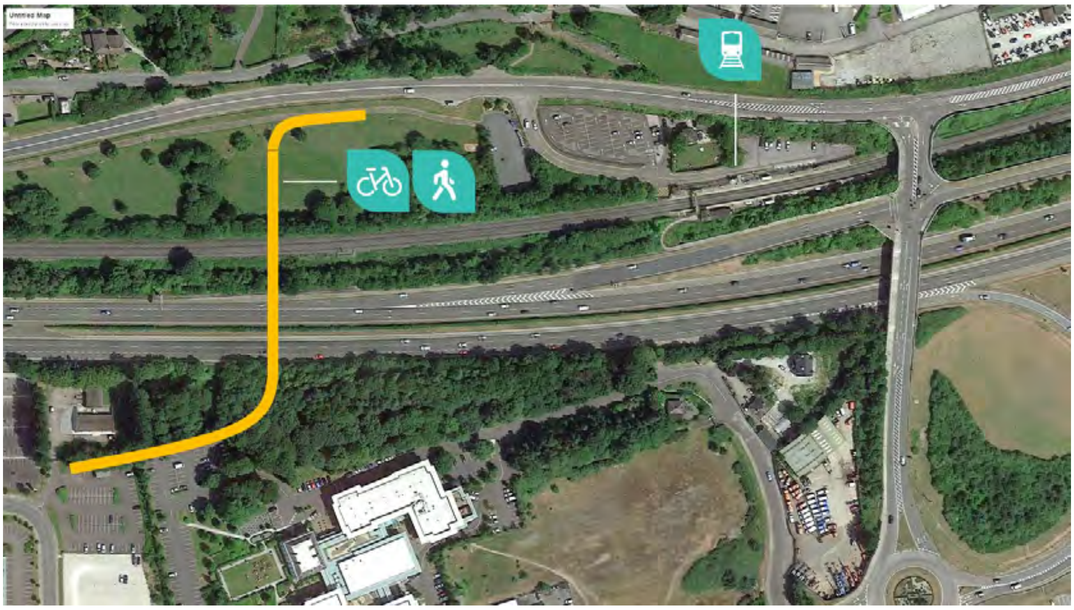

Figure 4: Bridge Alignment Option 2

Advantages

- Landing point within Eastgate (Highest Catchment);
- High quality connection between Tivoli and Bury's Bridge greenways;
- Provides multi-modal interchange (rail, bus, cycling, pedestrian connectivity);
- Shorter span over N25;
- Lower structure relative to Option 1 due to avoidance of rising carriageway levels at eastbound merge lane.

Disadvantages

- Enhanced connectivity with Euro Business Park will be necessary;
- Utility diversions necessary;

5.3.3 Bridge Alignment Option 3

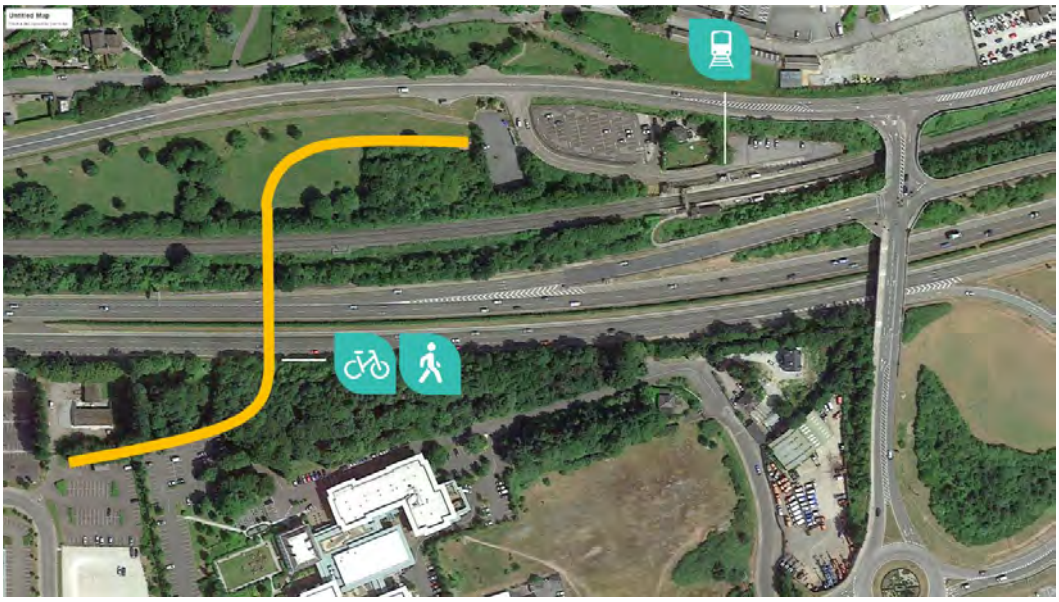

Figure 5: Bridge Alignment Option 3

Advantages

- Curved ramps reduce harsh angles for cyclists;
- Landing point within Eastgate (Highest Catchment);
- High quality connection between Tivoli and Bury's Bridge greenways;
- Provides multi-modal interchange (rail, bus, cycling, pedestrian connectivity);
- Shorter span over N25;
- Lower structure relative to Option 1 due to avoidance of rising carriageway levels at eastbound merge lane.

Disadvantages

- Enhanced connectivity with Euro Business Park will be necessary;
- Utility diversions necessary;
- Increased approach ramp length;

6 Constraints Analysis

6.1 Study Area

The feasibility study area for the proposed bridge crossing is illustrated in Figure 6 below. This area encompasses landing points 2 and 3 as discussed in Section 4 and the three alignment options presented in Section 5.3.

Figure 6: Feasibility Study Area © Bing Maps

The study area is bounded by the Glounthaune Road (former N25) to the north of the existing train station and extends between the train station to the east and a petrol filling station to the west on the northern side of the N25 road and existing Cork to Midleton railway.

To the south of the N25 road, the boundary extends to where it meets the perimeter of Zu Cars and traces the property boundary of an existing pumping station on the western side. The boundary extends to the east onto the Radisson Blu Hotel lands and continues until it meets the edge of a wooded area bordering the N25 road. The study area is bisected by the National Primary N25 road which is a high-quality dual carriageway with a speed limit of 120 km/h.

The study area for each constraint type may extend beyond or remain within the feasibility study area depending on the range and extent of potential impacts (both direct and indirect) from the proposed development.

6.2 Environmental Constraints

6.2.1 Biodiversity and Fisheries

Designated Sites

The closest Natura 2000 sites to the study area are the Cork Harbour Special Protection Area (SPA) site code 004030 and the Great Island Channel Special Area of Conservation (SAC) site code 001058. The Great Island Channel is also designated as a proposed Natural Heritage Area (pNHA) 001058. The boundary of Great Island Channel pNHA lies circa 250m to the east of the study area. The closest point of the Cork Harbour SPA is approximately 600m to the east and circa 2km to the southwest and west. The closest point of the Great Island Channel SAC lies approximately 1km to the east. The Dunkettle Shore pNHA site code 001082 is located circa 1km to the west. The Rock Farm Quarry pNHA site code 001074 is located circa 1.25km to the south. Refer to Designated Sites, below.

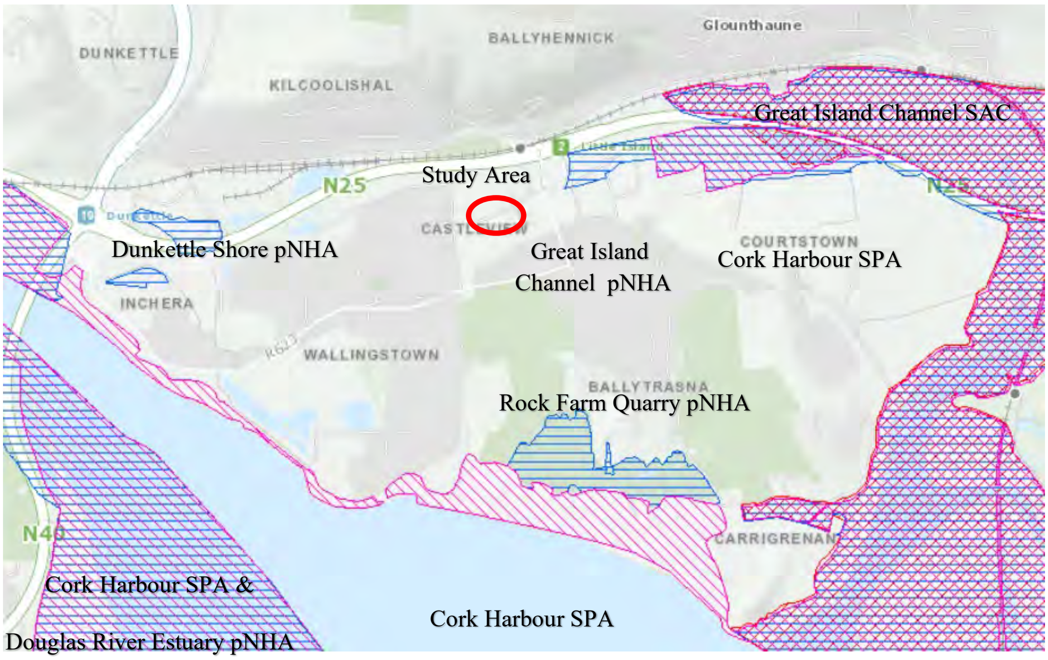

Figure 7 Designated Sites (source: NPWS [1]website, accessed December 2020)

For each of the SACs and SPAs, the National Parks and Wildlife Service (NPWS) publishes a site synopsis and conservation objectives and other data on its website[2] The site synopsis lists the species and habitats for which the site is designated. Table 1 summarises the significant features of the designated sites in the vicinity of the study area. It would be necessary to demonstrate that construction and operation of the proposed bridge would not have a significant negative effect on the species for which these sites are designated.

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[1] https://dahg.maps.arcgis.com/apps/webappviewer/index.html?id=8f7060450de3485fa1c1085536d477ba

[2] https://www.npws.ie/protected-sites accessed December 2020

Table 1 Summary of Significant features of Designated Sites

Designated Site	**Site Code**	**Summary of site significance**
Great Island Channel SAC	001058	Tidal Mudflats and Sandflats; Atlantic Salt Meadows; the site is a wetland of international importance for the birds
Cork Harbour SPA	004030	Cork Harbour is an internationally important wetland site, regularly supporting in excess of 20,000 wintering waterfowl
Great Island Channel pNHA	001058	Same as for Great Island Channel SAC
Dunkettle Shore pNHA	001082	No information on NPWS website
Rock Farm Quarry pNHA	001074	The area is of considerable interest botanically because of its species diversity and the presence of 'rarities' for the region, such as Dense-flowered Orchid and Portland Spurge.

Other Biodiversity

The study area contains wooded areas to the south of the N25 and on both sides of the railway, particularly on its northern side. These wooded areas may be suitable habitat for bats, a species protected under the Habitats Directive. It would be necessary to assess the importance of the study area for bats and breeding birds.

Fisheries

The nearest fishery river is the Glashaboy River, the estuary of which is located 2.5km to the west of the study area. There is sea angling from the harbourside towns, of which Passage West, 4km to the south of the site, is the closest. The proposed project is unlikely to have any effect on fisheries. There are some small watercourses/drains in the vicinity of the existing N25. Evidence of otters has been recorded in these areas previously.

6.2.2 Archaeological, Architectural and Cultural Heritage

Cultural heritage features in the vicinity of the study area are shown in Figure 8. There are a number of cultural heritage features in the general area, including the Little Island Railway Station, Register No. 20907528, the station master’s house, Register No. 20907529, and the foot bridge at Little Island Railway Station, Register No. 20907530, in the National Inventory of Archaeological Heritage. The Radisson Blu Hotel, Register No. 20907527, is also in the Inventory. Excavation of undeveloped land has the potential to uncover unknown cultural heritage features.

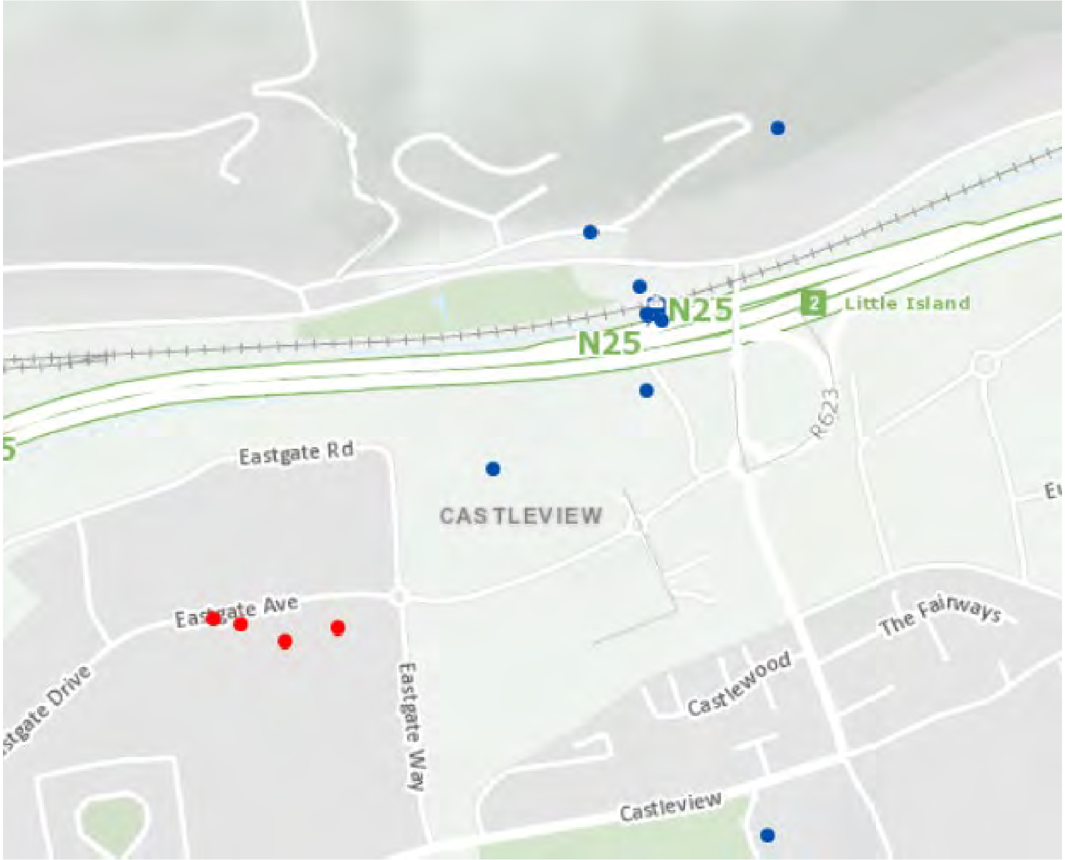


Figure 8 Cultural Heritage Features in Study Area (source: https://maps.archaeology.ie/HistoricEnvironment/ accessed December 2020)

The red dots are records held by the National Monuments Service and have identified fulacht fia and kilns. Blue dots are records held in the National Inventory of Architectural Heritage and are identifying buildings and structures. There is no known site of archaeological significance within the study area.

Two protected structures in close proximity to the study area are listed in the Cork County Development Plan 2014 - 2020. These are Ditchley House, RPS ID 00502, in the area marked Castleview on Figure 8 and Rockgrove House, RPS – 00490, to the north of the Railway Station.

There are no architectural conservation areas in the vicinity of the study area.

6.2.3 Geological and Hydrogeological

Ground conditions in this area were inferred from online maps provided by the Geological Society of Ireland (GSI), online maps provided by Ordnance Survey Ireland (OSI) and historic ground investigations. The information gathered from these sources indicate that ground conditions primarily consist of alluvial deposits underlain by glacial till or gravels, which rest on sandstone and siltstone bedrock.

A review of historic maps from OSI indicates that the site is bisected by the historic watercourse separating Little Island and Caharlag, which accounts for the presence of alluvial deposits in this area. It should also be noted that bedrock maps from GSI indicate the presence of faulting between the Gyleen Formation (siltstone) and Cuskinny Member (sandstone).

There are no geological heritage areas of significant importance in the proximity of the proposed bridge and it is unlikely that there are any public or private water supply sources. The groundwater at the site is designated as high vulnerability aquifer and described as a high permeability subsoil, sand and gravels overlain by poorly drained soil. Given the proximity to the estuary there is likelihood of brackish water in the area. This designation of vulnerability has the potential to be further reduced based on site specific risk assessments and investigations.

The groundwater level is unknown, but likely to be close to the ground surface.

Ground investigation data in this area were obtained from three historic projects: (i) Gas Pipeline Route from Powerhead Bay to Cork, Aghada and Marino Point, undertaken in 1976; (ii) Little Island Bridge, undertaken in 1994; and (iii) Little Island Bridge Widening, undertaken in 2018. The 1976 investigation works contain 2 no. boreholes in the western part of the site, which recorded soft organic clay and silt to depths of 6.5m and 7.5m. The 1994 investigation works contain 2 no. boreholes, located c. 100m west of the site and recorded rock fill to a depth of 1.2–2m, underlain by firm sandy gravelly clay to a depth of 3.5m, which rests on soft organic silt to a depth of 9.5–10m, underlain by compact sandy gravels. The boreholes terminated at depth of 13–14m and did not confirm bedrock. The most recent investigation works comprised 2 no. boreholes, 4 no. trial pits and 12 no. slit trenches, located c. 250m southwest of the site. The ground conditions in this location consist of made ground (similar to a Class 1 / Class 2 material) to a depth of 2–4.5 m, underlain by medium dense gravel and firm to stiff glacial till. The boreholes terminated at depths of 15 m and did not confirm bedrock.

The ground conditions are likely to consist of soft alluvial or organic soils overlying glacial till or gravels, overlying rock. The depth and extent of soft soils are variable in the area, and hence may vary at the bridge foundation locations.

Available ground investigation data in the area suggests it may vary from 3.5m to 10m in depth. It is recommended that piled foundations extending to the gravels, till, or rock are used to support the bridge abutments. The potential for differential settlement due to varying ground conditions at the foundations should also be considered in the design. If piles are founded in rock, the risk of fracturing due to faulting should be considered. A detailed site investigation is required to confirm the foundation conditions of the proposed bridge abutments and approach ramp supports/embankments.

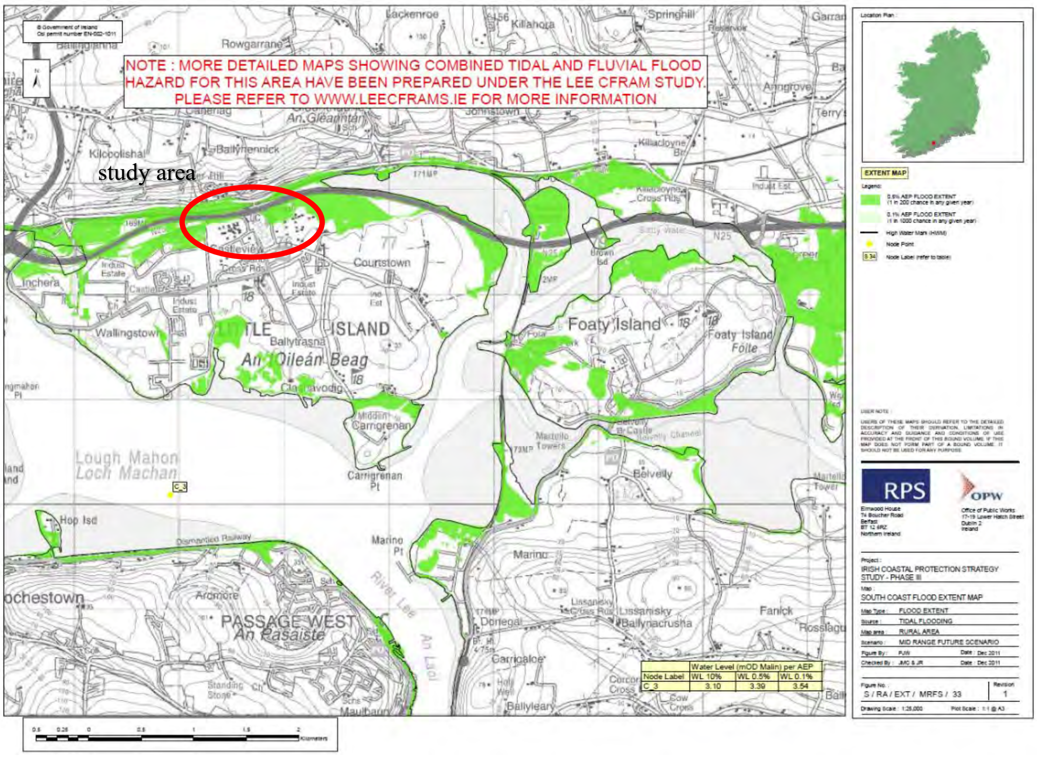
6.2.4 Hydrology and Water Quality

Hydrology

The website https://www.floodinfo.ie/map/floodmaps/ provides information on past flood events and current flood risk. Figure 9 shows an extract from this website for the study area. The low-lying land to the north of the railway is currently at risk to flooding. The closest recorded past flood event, indicated by the yellow triangle on Figure 9, was to the east of the study area.

The M25 and railway corridor are indicated as at risk of flooding in the Mid-Range Future Scenario (assumes a sea level rise of 0.5m) in the Irish Coastal Protection Strategy Study 2011. Refer to Figure 10 below, which is an extract from map 33, in that study, and which shows the flood extent in the Mid-Range Future Scenario.

Figure 9 Current Flood Risk Extent and Past Flood Events (Source: https://www.floodinfo.ie/map/floodmaps/ accessed December 2020)



	Water Level (mOD Malin) per AEP		
Node Label	WL 10%	WL 0.5%	WL 0.1%
C_3	3.10	3.39	3.54

Figure 10 Extract from ICPSS Map 33 showing Mid-Range Future Scenario (Source: https://www.gov.ie/en/collection/be54a0-irish-coastal-protection-strategy-study-phase-3-south-coast/ accessed December 2020.)

It should be noted that these flood risk maps are for guidance only. A site-specific flood risk assessment should be carried out to determine the flood risk in the study area.

Water Quality

Lough Mahon to the south, North Channel Great Island to the east and Glashaboy Estuary to the west are the nearest water bodies to the study area. These water bodies are classified as "transitional and coastal". In the EPA report[3] chapter 2, Section 2.1.2, summarises the surface water ecological status of water bodies in the River Lee catchment.

> "*Three have deteriorated, including Glashaboy Estuary which has declined from Good in 2007-09 to Poor in 2010-15. Lough Mahon and Owennacurra Estuary both declined from Good to Moderate status. Three have improved, two coastal Outer Cork and Cork Harbour and one transitional North Channel Great Island have improved from Moderate in 2007-09 to Good in 2010-15.*"

Lough Mahon is indicated as at risk of not meeting surface water environmental objectives, in Section 2.3.2 of the Report.

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[3] EPA, Lee-Cork Harbour Catchment Assessment 2010 – 2015 (HA 19), 2018, Version no. 3

6.2.5 Landscape and Visual

The entire area surrounding the study area, from the western limits of Cork City to just east of Midleton and from the top of the ridgeline to the north, in the townland of Knockraha, to the mouth of Cork Harbour, is designated a High Value Scenic Landscape in the Cork County Development Plan 2014 - 2020. In relation to High Value Landscapes, the Plan states:

> *" 13.6.9 Within these High Value Landscapes considerable care will be needed to successfully locate large scale developments without them becoming unduly obtrusive. Therefore, the location, siting and design of large scale developments within these areas will need careful consideration and any such developments should generally be supported by an assessment including a visual impact assessment which would involve an evaluation of visibility and prominence of the proposed development in its immediate environs and in the wider landscape*."

The landscape character from the Glashaboy River valley in the west to east of Midleton, and from the top of the ridgeline to the north, in the townland of Knockraha, to the mouth of Cork Harbour, is type "City Harbour and Estuary".

The road from Dunkettle to Glanmire and eastwards to Caherlag and Glounthaune is designated scenic route S41. The road from Caherlag eastwards to Cashnagarriffe, northwest of Carrigtwohill, is designated scenic route S42. The proposed development is likely to be visible from parts of these routes. There are scenic routes on Great Island and from Passage West to Monkstown and further southwards, from which the proposed development is unlikely to be visible. The policies and objectives of the County Development Plan in relation to scenic routes is as follows:

> *"13.7.2 Each of the scenic routes was examined individually and their location related to the landscape character type traversed and some of the features lending themselves to the attractive nature of these particular routes identified. Scenic routes highlight the quality of the overall environment and landscape experienced within Cork County. It is important to protect the character and quality of those particular stretches of scenic routes that have special views and prospects particularly those associated with High Value Landscapes.*
>
> *"13.7.3 Whilst advocating the protection of such scenic resources the plan also recognises the fact that all landscapes are living and changing, and therefore in principle it is not proposed that this should give rise to the prohibition of development along these routes, but development, where permitted, should not hinder or obstruct these views and prospects and should be designed and located to minimise their impact. This principle will encourage appropriate landscaping and screen planting of developments along scenic routes."*
>
> *"**County Development Plan Objective GI 7-2: Scenic Routes***
>
> *Protect the character of those views and prospects obtainable from scenic routes and in particular stretches of scenic routes that have very special views and prospects identified in this plan. The scenic routes identified in*

> *this plan are shown on the scenic amenity maps in the CDP Map Browser and are listed in Volume 2 Chapter 5 Scenic Routes of this plan."*

The County Development Plan 2014 – 2020 Volume 2: Heritage and Amenity, Chapter 5[4], *Scenic Routes – Views and Prospects & Scenic Route Profiles* provides a description of the views and prospects from the scenic routes which are protected.

S41 Description and General Views Being Protected:

> *"R639 regional road and local road from Dunkettle to Glanmire and eastwards to Caherlag and Glounthaune; Views of the Estuary and Harbour, wooded landscape, open countryside and hillsides*"

S42 Description and General Views Being Protected:

> *"Local road at Forest-town, NW. Carrigtwohill and westwards to Caherlag; Views of the Harbour, wooded landscape, open countryside and hillsides"*

6.2.6 Noise and Vibration

There is a significant number of dwellings located on Factory Hill and Tower Hill, the hillside to the north and northwest of the study area. The Radisson Blu Hotel is located on the southern boundary. These are the closest noise sensitive receptors.

The existing noise environment of the area is that of one near an industrial estate, a dual carriageway with a speed limit of 120 km/h and a train station. The main noise and vibration impact of the proposed development will relate primarily to the construction stage and the significance of the impact will depend on the construction methodology, such as the use of piling for foundations. The noise and vibration of these activities is considered to be short term.

6.2.7 Air Quality and Climate

There is a significant number of dwellings located on Factory Hill and Tower Hill, the hillside to the north and northwest of the study area. The Radisson Blu Hotel is located on the southern boundary. These are the closest receptors sensitive to air quality impacts.

As with noise and vibration, the existing air quality in the study area is typical of similar urban settings. Little Island is designated as Zone B under the Air Quality Standards Regulations, 2011. The air quality index for Little Island, according to the EPA, is good, with the nearest monitoring stations located in Cobh and the South Link Road in Cork City.

There are likely to be temporary impacts on air quality during construction of the pedestrian/cyclist bridge, which can be controlled by the implementation of standard best construction measures.

In terms of climate change, the construction of a new pedestrian bridge, is seen as a positive measure, encouraging a modal shift from other forms of transport.

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[4] https://epublishbyus.com/volume_two_heritage_and_amenity/10039836#

6.3 Little Island Train Station and Railway

The Little Island train station is on the Cork to Cobh/Midleton commuter service and is located to the north of the N25 National Primary Road at the off ramp to Little Island. Entrance to the train station is made via a regional road to the north of the train station. A separate pedestrian access from the N25 eastbound off ramp is also present with a footpath connecting the train station to the An Crompan overbridge. The railway itself follows roughly parallel to the Glounthaune road in both the eastern and western directions from the train station.

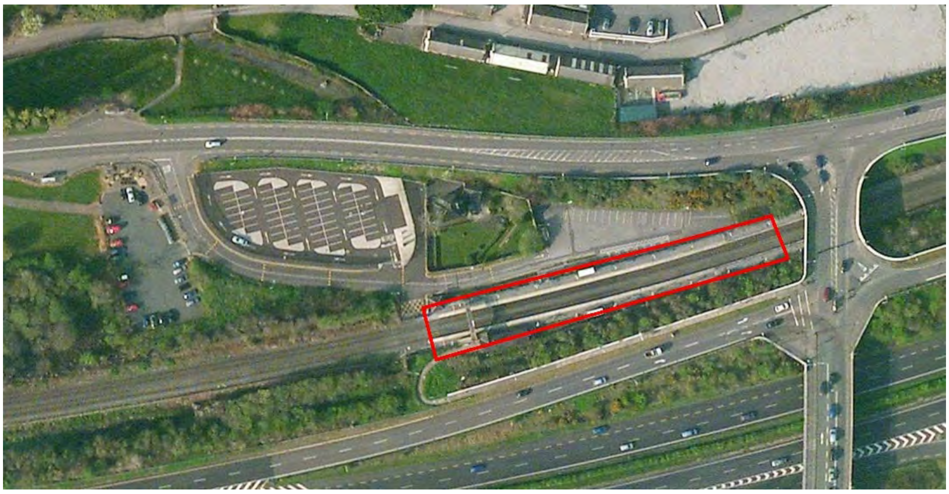

Figure 11: Little Island Train Station

The proposed bridge will need to adhere to any design constraints imposed by Iarnród Éireann (IÉ). It should be noted that at the time of writing this report, initial discussions between Cork County Council and IÉ have been held and all parties have indicated that they consider the provision of a new bridge to be feasible.

6.4 National Primary Road N25

The N25 road is a national primary road forming part of the route from Cork to Rosslare Europort via Waterford City. The road is part of the E30 European route and a short section is also part of the E01 European route. It forms part of the proposed Atlantic Corridor.

At the point of interest for the proposed pedestrian bridge, nearest the Little Island Train Station, the national primary road consists of six lanes. There are two lanes each for eastbound and westbound traffic as well as slipways to the north of the main N25 that provide access to/from Little Island. The proposed bridge will need to adhere to any design constraints imposed by Transport Infrastructure Ireland (TII).

6.5 Utilities

The following utility companies have been contacted in relation to the location of their assets within the feasibility study area. The results of which are summarised below in Table 2.

Table 2: Utilities found within study area

Utility Provider	**Asset**
Virgin Media	No services present
BT	Cable duct running from train station, along off ramp to Little Island and across existing bridge and into Eastgate Business Park
Gas Networks Ireland	600mm 19 bar transmission pipeline crosses through park under N25 to Eastgate Business Park 180mm 4 bar PE distribution pipe crosses the N25 between the train station and Eastgate Business Park
Aurora	Duct running parallel to the railway on area in between the railway and N25 road.
Electricity Supply Board	Buried and overhead services in vicinity 10kV overhead cable crosses through the park on the northern side of the N25, spans over the N25 before going underground and distributed through the Eastgate Business Park.
Irish Water/CCC (Foul and Water)	Gravity Foul main crosses the N25 through the park to a pumping station within the Eastgate Business Park 750mm Asbestos watermain running East-West across the existing park and then under the N25 to the Eastgate Business Park
E-net	Duct running through median of N25 road and into Eastgate Business Park
Eir	Several buried 50-100mm ducts Ducts cross under N25 road between the train station and Eastgate Business Park

It is proposed that further investigation be completed during design phases to verify with utilities companies their asset locations and to confirm these with trial pit/slit trenches as part of any site investigation works.

6.6 Foundation Construction and Ramps

The foundations for the bridge and approach ramps will be a key consideration for the success of the project. With a height constraint between the carriageway/railway and the soffit of the bridge of 5.7m in accordance with TII Design Criteria for Footbridges document DN-STR-03005, there will be a significant height difference between any proposed start/end points to the bridge itself.

Given the relatively flat level difference between both sides and the existing carriageway there is very little opportunity to incorporate this level change into the existing landscape. As a result, the level difference will need to be achieved through stairs, ramps, lifts or a combination of all three. DN-STR-03005 recommends that access to the deck of the footbridge should be provided by both ramps and stairs where access by stairs alone only be considered in exceptional circumstances and in consultation with the overseeing organisation for disability groups.

As a result, the access to the bridge is likely to be provided by ramps as opposed to stairs. A proposed maximum gradient of 1:20 as requested by the NTA or shallower could be utilised to facilitate pedestrians and cyclists. Given the height difference between existing ground levels and the deck level of the proposed bridge and requirements for landings, the ramps are likely to be approximately 130m long. Further analysis would need to be completed during the design phase to accurately measure the length of the approach ramps, minimise their footprint and adhere to requirements for pedestrians and cyclists.

The support structure for these ramps will need to be minimal in size to mitigate the effect on the surrounding environment and animal habitats and be aesthetically pleasing to minimise visual impact of the structure. See Figure 12 and Figure 13 below comparing an elegant approach ramp to a standard approach ramp.

Figure 12 Example Elegant Bridge Ramp Design

Figure 13: Standard Approach Ramp Design - Hermitage Bridge Ramps Design © Google

The ability to construct a foundation on the land located between the N25 primary road and existing railway will also be a significant factor on the bridge form. Figure 14 shows the area of land that is potentially available for the construction of an intermediate pier based on the preferred bridge alignment option.

The ability to construct in this area will turn a single span bridge into a bridge composed of two segments of shorter spans. These shorter spans involve less construction materials being used for the bridge superstructure and therefore are slenderer than the single span option. This will aid in all bridge options but more so the below deck structures as a shallower superstructure will reduce the height of the approach ramps.

Figure 14: Land between Railway and N25 Road

As identified previously, there are currently utilities in this area that would likely need to be relocated. The area is also heavily wooded and is likely to contain some animal habitats which will need to be considered further.

6.7 Landownership

A cursory inspection of the available landowner information in the vicinity of the proposal was completed to identify key landowners for the successful delivery of the project. The owners of the train station, railway and the N25 dual carriageway have been identified as being affected by the proposed project.

The inspection is not considered to be exhaustive and any doubt in ownership and further investigation will be required if the project should progress.

7 Potential Bridge Options

7.1 Structural Span Options Overview

The total length between the park on the northern side of the N25 and the Eastgate Business Park boundary on the southern side is approximately 85m.

A number of different span arrangement options exist by using the land between the existing railway and the N25 for locations of supports. Locating foundations within these lands will allow two span bridge options to be considered as well as the single span option.

The single span option would potentially be a 90-95m span crossing over the existing railway, the N25 eastbound diverge lane and the N25 dual carriageway.

For the double span option, any bridge spanning the proposed alignment could potentially have a main span of 60m depending on where the bridge supports are and the degree of skew. The piece of land between the railway and the N25 is approximately 22.5m wide. If this land can be used for an intermediate support then it would allow a two-span bridge to be constructed consisting of a span of approximately 35m crossing the railway and a 60m span crossing the N25 road.

This results in span options as follows:

- Span Option 1 – 95m Bridge Length
- Span Option 2 – 95m Bridge length comprising a span of 60m over the N25 road and 35m over the IÉ railway

Spans in the order of magnitude quoted above do not present significant structural problems and can be achieved using a range of bridge options outlined below.

7.2 Bridge Options Overview

Given the constraints indicated in the previous section and the potential span of the bridge, six potential bridge options have been identified.

The evaluation of options is limited to the main bridge span only with consideration of the approach spans considered separately. A significant constraint is the constructability of the bridge and the need to construct the bridge quickly avoiding major traffic disruption. As a result, all options considered are assumed to be constructed off-site and installed over a weekend overnight road closure.

The potential bridge options are listed below and summarised in the following sections. It should be noted that all figures and diagrams are indicative at this stage and may not represent the final design.

- Bridge Option 1 – Double Span Through Girder;
- Bridge Option 2 – Single Span Half Through Truss;
- Bridge Option 3 – Double Span Half Through Truss;
- Bridge Option 4 – Single Span Tied Arch;

- Bridge Option 5 – Double Span Tied Arch;
- Bridge Option 6 – Double Span Cable Stay;

7.2.1 Option 1 – Double Span Through Girder

Figure 15: Double Span Through Girder

The supporting structure of a through girder bridge consists of a steel or concrete girder supporting the deck. The girders themselves are the primary support for the deck and are responsible for transferring the load down to the foundations. Material type, shape, and weight all affect how much weight a beam can hold and the depth of the girder itself.

With concrete girder options, they can either be pretensioned precast beams or post tensioned precast beams although it is extremely unlikely that a precast concrete span could be fabricated offsite and transported to site with a span of 60m. In addition, a 90m single span through girder is likely to be in the region of 3.5m deep which would make this option extremely challenging given the height requirements over the existing dual carriageway. As a result, both single span through girders and concrete double span girders are not considered further.

The steel girder option can incorporate a composite concrete deck which, while adding additional weight, can increase the stiffness of the system resulting in a shallower section. The advantage of the double span through girder is the provision of the back span over the existing railway helps to reduce the depth of the main span through the provision of a monolithic pier between the existing railway and the eastbound diverge ramp. The benefit of this will be limited due to the relative stiffness of this pier due to the height of the deck above the ground.

The advantage of the through girder option is that it comprises of relatively simple construction which can be fabricated offsite and lifted into position in a single lift during an overnight road closure.

The disadvantages of the through girder option is the depth required for the support structure and the limitation to efficiently achieve spans of this length. At 60m span a though girder would need to be in the region of 2.5m to 3m deep as a continuous double span. This combined with the depth of handrailing results in a very deep structure which will have a negative aesthetic impact on the surrounding environment. In addition, the depth of the girder below the walking level sets the walking level higher above the roadway requiring longer ramps to achieve a tie in with the existing levels.

7.2.2 Option 2 – Single Span Half Through Truss

Figure 16: Single Span Through Girder – A2 Midhurst Warren Truss, UK

Half-through steel bridges are a common solution for pedestrian and cycleway bridges. The footway/cycleway is relatively narrow and a stiffened steel plate deck can easily span between the main beams on each side.

There are two options for the open web girders – a triangulated truss (usually Warren type) and a Vierendeel girder. In the latter case, the parapet is often incorporated into the edge beams, with handrails within each panel. In both cases, the deck is usually a thin steel plate with transverse and longitudinal stiffeners.

A positive attribute of this type of bridge is that it does not depend on horizontal compression forces for its integrity which allows them to be built off-site and then transported into place and nearly all the superstructure is above deck which aids with clearances for highways and railways reducing the length of ramps.

For the single span option, a truss depth in the region of 2.5m to 3m is feasible with all of the structure above deck and the handrail incorporated into the structure itself as shown in Figure 16.

7.2.3 Option 3 – Double Span Through Truss

The advantage of the double span through truss is the ability to reduce the overall depth of the truss by utilising the reduced main span moment provided by the presence of a back span and the continuous truss over the intermediate support.

Another positive attribute of this option is the ability to fabricate each span off site and transport to site in more manageable lengths.

The disadvantage of this option is the construction of the intermediate pier in close proximity to the existing railway line and N25 dual carriageway.

7.2.4 Option 4 – Single Span Tied Arch

Figure 17: Shouldered Tied Arch Bridge Example – N19 Co. Clare

A tied arch bridge (also called bowstring-arch) is a type of bridge that has an arch on each side of the deck of which its outward direction horizontal forces are tied together by a chord tying the arch ends, usually the deck itself. The deck itself is then hung by vertical tie beams connected to the arches support the deck from above.

A positive attribute of this type of bridge is that all the superstructure is above deck which aids with clearances for highways and railways reducing the length of ramps.

The structural system allows for a very slender deck and can form a very aesthetically pleasing structure through the provision of tubular arches and vertical or crisscross cable arrangements.

Although transportation of a 90m long single span arch is unlikely given the existing constraints on the existing N25, it could be assembled north of the existing railway and push launched or craned into position. This will require further investigations into the available lands for assembly and launching but is seen as a viable option at this stage.

7.2.5 Option 5 – Double Span Tied Arch

Figure 18: Double Span Tied Arch Bridge Example – Infinity Footbridge, Stockton-on-Tees, UK

Multi-span continuous tied arches are also a potential option with the 30m – 65m span ratios supported by two arches of varying span and height. In this example the continuous deck spans over the support tying the arches together.

The advantage of this option over Option 4 is that the spans can be reduced giving more flexibility in terms of assembly and erection however it is still unlikely that these spans could be transported to site and would require assembly north of the existing railway.

The disadvantage of this option over Option 4 is the construction of the intermediate pier in close proximity to the existing railway line and N25 dual carriageway.

7.2.6 Option 6 – Double Span Cable Stayed

Figure 19 Cable Stayed Bridge Example

A cable-stayed bridge has one or more towers from which cables support the bridge deck. A distinctive feature are the cables or stays, which run directly from the tower to the deck, normally forming a fan-like pattern or a series of parallel lines.

The tower of a cable-stayed bridge is responsible for absorbing and dealing with compressional forces and the cables attach to both the deck and the tower at several separate points. This offers the advantage of keeping the supporting structure all above the deck level which aids with clearances for highways and railways reducing the length of approach ramps.

In the case of this proposed bridge the 30m – 65m span ratio suits the cable stayed bridge system with a single tower located on the land between the existing railway line and the N25 eastbound diverge. The back span could span over the existing railway line with modest foundations at the interface with both on the north and south ramps.

The disadvantage of the cable stayed option is the requirement for a temporary support within the central verge of the dual carriageway to facilitate construction. This constraint would not rule out this option but would require acceptance from TII.

8 Construction Methodology

This section outlines the proposed method for construction for each bridge option with similarities present for most options. The purpose of this section is to identify differences in how each bridge option is constructed which is a primary constraint for the project and is influential on the cost of the structure and likely disruption to the existing traffic network during construction.

8.1 Span Construction and Installation

It is envisaged that all options are fabricated off site with large sections of the span transported to site via road during overnight transportation operations. Given the length of the spans, it is not possible to transport the spans in their entirety so it will be necessary to procure a nearby offsite assembly area to facilitate final fabrication/assembly. There appears to be a number of areas in the vicinity of the proposed bridge that would be suitable.

A potential alternative option for assembly and installation of Bridge Options 4 and 5 is to assemble the bridge in the public park north of the existing bridge and launch the bridge over the existing railway and over the existing N25 dual carriageway. A full assessment of the area and its ground levels to the north will need to be completed before this can be confirmed as viable.

For Options 1, 2, 3, 4 and potentially Option 5 final erection would be carried out using one or two large mobile cranes during a night time road closure as shown in Figure 20.

Figure 20: Bridge Erection during Road Closure

Installation of Option 6 would not be possible in a single lift and would require either launching of the deck from the north with a temporary pier in the central median or a segment by segment erection with the main span temporarily supported using that same temporary pier. There appears to be adequate space in the region to perform this.

8.2 Abutments and Piers

It is envisaged that due to the ground conditions in the area, all abutments and piers would need to have a piled foundation. Access appears to be possible to all locations required for foundations for a piling rig. For the two span options, where an intermediate pier would be required, the construction of a foundation/pier in the land between the existing railway and N25 dual carriageway would be more complex. However, it is not deemed unachievable at this stage with the necessary design development and engagement with TII and IÉ.

9 Statutory Consent Processes

9.1 Environmental Impact Assessment (EIA) Screening Process

The competent authority, in considering a decision to grant permission for the proposed bridge may be required to carry out an environmental impact assessment, in compliance with the EIA Directive (2011/92/EU), as amended by Directive 2014/52/EC. An EIA screening assessment should be carried out, in compliance with EU and Irish EIA legislation, to determine if an EIA is required.

Article 8 of the Roads Regulations 1994 (Road development prescribed for the purposes of Section 50(1)(a) of the Roads Act, 1993 (as amended) specifies the classes of development which require an EIA, including:

'The construction of a new bridge or tunnel which would be 100 metres or more in length'

If the ramps are deemed to be integral to the main span, the proposed bridge is likely to exceed this threshold, Section 50(1)(a) of the Roads Act, 1993, as amended, provides that an EIA will be required.

In addition, Section 50(1)(c) of the Roads Act, 1993 (as amended) specifies the following:

'Where a road authority considers that any proposed road development (other than development to which paragraph (a) applies) .....would be likely to have significant effects on the environment…'

Cork County Council will determine whether an EIA is required. This will also determine the statutory consent route. It is possible, given the length of the proposed bridge, that an EIAR will be required in accordance with Section 50(1)(a).

9.2 Appropriate Assessment Screening Process

Articles 6(3) and 6(4) of the Habitats Directive set out the requirement for an assessment of proposed plans and projects, which are not directly connected with the management of a Natura 2000 site, and which are likely to have a negative effect on Natura 2000 sites.

Article 6(3) establishes the requirement to screen all plans and projects and to carry out a further assessment if required.

The Appropriate Assessment (AA) screening assessment will consider whether the proposed development has the potential to have a significant impact on the conservation objectives of any relevant Natura 2000 sites. The screening assessment must be in accordance with the relevant EU and Irish legislation and best practice guidance.

While the proposed bridge is not located in close proximity a Natura 2000 site, there are two Natura 2000 sites in the vicinity. There may be a hydrological pathway from the proposed bridge to the Natura 2000 sites. However, an Appropriate

Assessment will be required given the potential impact of the southern approach ramps on the woodland habitats and hydrological pathways to the Natura 2000 sites.

The ecological and habitat surveys will be required to ascertain the sensitivity of the biodiversity of the area to the proposed bridge and construction works.

9.3 Transport Infrastructure Ireland (DN-STR-03001)

All structures built within the footprint of motorways and national roads are subject to Technical Acceptance by TII. As the proposed bridge will cross the N25 national primary road, the bridge design and approval will need to comply with TII's standard "Technical Acceptance of Road Structures on Motorways and Other National Roads" DN-STR-03001.

This will be an ongoing interaction with TII seeking approval of the structure at various stages of the design. No construction can begin before technical acceptance is issued by TII.

It is deemed at this stage that Technical Acceptance by TII is achievable subject to due process, further design development and further engagement.

9.4 Iarnród Éireann (CCE-TMS-310)

The proposed bridge will also need to cross the existing railway. In a similar fashion as engaging with TII, IÉ will need to be consulted in relation to the bridge crossing their asset. The design of the bridge should be in compliance with "Guidance on Third Part Works" CCE -TMS-310.

This will be an ongoing interaction with IÉ seeking approval of the structure at various stages of the design.

Like TII Technical Acceptance, it is deemed at this stage that technical acceptance from IÉ is achievable subject to due process, design development and further engagement.

In addition to technical acceptance it will also be necessary to acquire the air rights above the railway by agreement with IÉ.

10 Cost

The construction cost estimate at this stage is a high-level cost estimate based on industry experience.

A more detailed cost estimate should be carried out on the emerging preferred option for a more accurate reflection of the construction costs. To account for the high-level nature of the cost estimate a +/- 30% factor was applied to get an appropriate cost range for this stage of the assessment.

The construction cost estimate is based on rates per m^2 for both the main span and approach ramps from industry experience and previous projects of a similar nature. Two options are considered in the cost estimate for different widths of ramps and bridges. Option A outlines a cost estimate for a 4m wide bridge and ramps while Option B is for a 5m wide bridge and ramps. Similarly, a cost per unit was assigned to the foundation costs. It is noted that foundation construction adjacent to the existing rail line will be significantly more than the other foundations and this has been accounted for in the cost estimate.

It is noted that a cost per m^2 for the approach ramps of €1,500 was used which is high however this was selected to account for the higher than normal architectural requirement of the approach ramps to minimise the impact both on the existing park to the north and the existing wooded area to the south.

An allowance has also been made for contractor preliminaries, relocation of the existing services and road and rail possessions for final installation.

An indicative cost estimate for the two width options (Option A and B) are provided in Table 3 and Table 4 below.

Table 3: Estimate Costs – Option A (4m Deck Width)

Option A - 4m Deck Width														
Opt	**Deck Area (m^2)**	**Rate/m^2 Main Span**	**Cost of Main Span**	**Foundations**	**Foundation Costs/unit**	**Foundation Costs**	**Ramp Length (m)**	**Deck Area (m^2)**	**Rate/m^2 Ramps**	**Cost of Ramps**	**Prelims, Service Diversions & Possessions**	**Provisional Cost**	**Total Cost**	
	A (95*4)	B	C (A*B)	D	E	F (D*E)	G	H (G*4)	I	J	K	L (C+F+J+K)	- 30% (L*0.7)	+ 30% (L*1.3)
1	380	€3,500	€1,330,000	3	€100,000	€300,000	260	1,040	€1,500	€1,560,000	€450,000	€3,640,000	€2,548,000	€4,732,000
2	380	€4,500	€1,710,000	2	€100,000	€200,000	260	1,040	€1,500	€1,560,000	€450,000	€3,920,000	€2,744,000	€5,096,000
3	380	€4,000	€1,520,000	3	€100,000	€300,000	260	1,040	€1,500	€1,560,000	€450,000	€3,830,000	€2,681,000	€4,979,000
4	380	€5,000	€1,900,000	2	€100,000	€200,000	260	1,040	€1,500	€1,560,000	€450,000	€4,110,000	€2,877,000	€5,343,000
5	380	€5,000	€1,900,000	3	€150,000	€450,000	260	1,040	€1,500	€1,560,000	€450,000	€4,360,000	€3,052,000	€5,668,000
6	380	€4,500	€1,710,000	3	€125,000	€375,000	260	1,040	€1,500	€1,560,000	€450,000	€4,095,000	€2,866,500	€5,323,500

Table 4: Estimate Costs – Option B (5m Deck Width)

Option B - 5m Deck Width														
Opt	**Deck Area (m^2)**	**Rate/m^2 Main Span**	**Cost of Main Span**	**Found-ations (no.)**	**Found-ation Costs/unit**	**Found-ation Costs**	**Ramp Length (m)**	**Deck Area (m^2)**	**Rate/m^2 Ramps**	**Cost of Ramps**	**Prelims, Service Diversions & Possessions**	**Provisional Cost**	**Total Cost**	
	A (95*5)	B	C (A*B)	D	E	F (D*E)	G	H (G*5)	I	J	K	L (C+F+J+K)	- 30% (L*0.7)	+ 30% (L*1.3)
1	475	€3,500	€1,662,500	3	€100,000	€300,000	260	1,300	€1,500	€1,950,000	€450,000	€4,362,500	€3,053,750	€5,671,250
2	475	€4,500	€2,137,500	2	€100,000	€200,000	260	1,300	€1,500	€1,950,000	€450,000	€4,737,500	€3,316,250	€6,158,750
3	475	€4,000	€1,900,000	3	€100,000	€300,000	260	1,300	€1,500	€1,950,000	€450,000	€4,600,000	€3,220,000	€5,980,000
4	475	€5,000	€2,375,000	2	€100,000	€200,000	260	1,300	€1,500	€1,950,000	€450,000	€4,975,000	€3,482,500	€6,467,500
5	475	€5,000	€2,375,000	3	€150,000	€450,000	260	1,300	€1,500	€1,950,000	€450,000	€5,225,000	€3,657,500	€6,792,500
6	475	€4,500	€2,137,500	3	€125,000	€375,000	260	1,300	€1,500	€1,950,000	€450,000	€4,912,500	€3,438,750	€6,386,250

11 Project Timescales

The approach outlined in Figure 21 represents a reasonable scenario as to how the proposed bridge may be delivered in terms of design, statutory consent, construction tendering, sequencing and duration.

Whilst the general requirements detailed will be followed, the Contractor, when appointed, will ultimately be responsible for the sequencing and implementation of the works in a safe and secure manner and in accordance with all statutory requirements.

Construction works such as removal of trees and vegetation will be restricted to winter months from October to February so the schedule would need to be adjusted to reflect these seasonal requirements depending on the likely construction start date.

Figure 21 provides an estimated design, statutory planning process, tender and construction programme with durations for each of the main elements of the project delivery outlined resulting in a total project duration of 32 months.

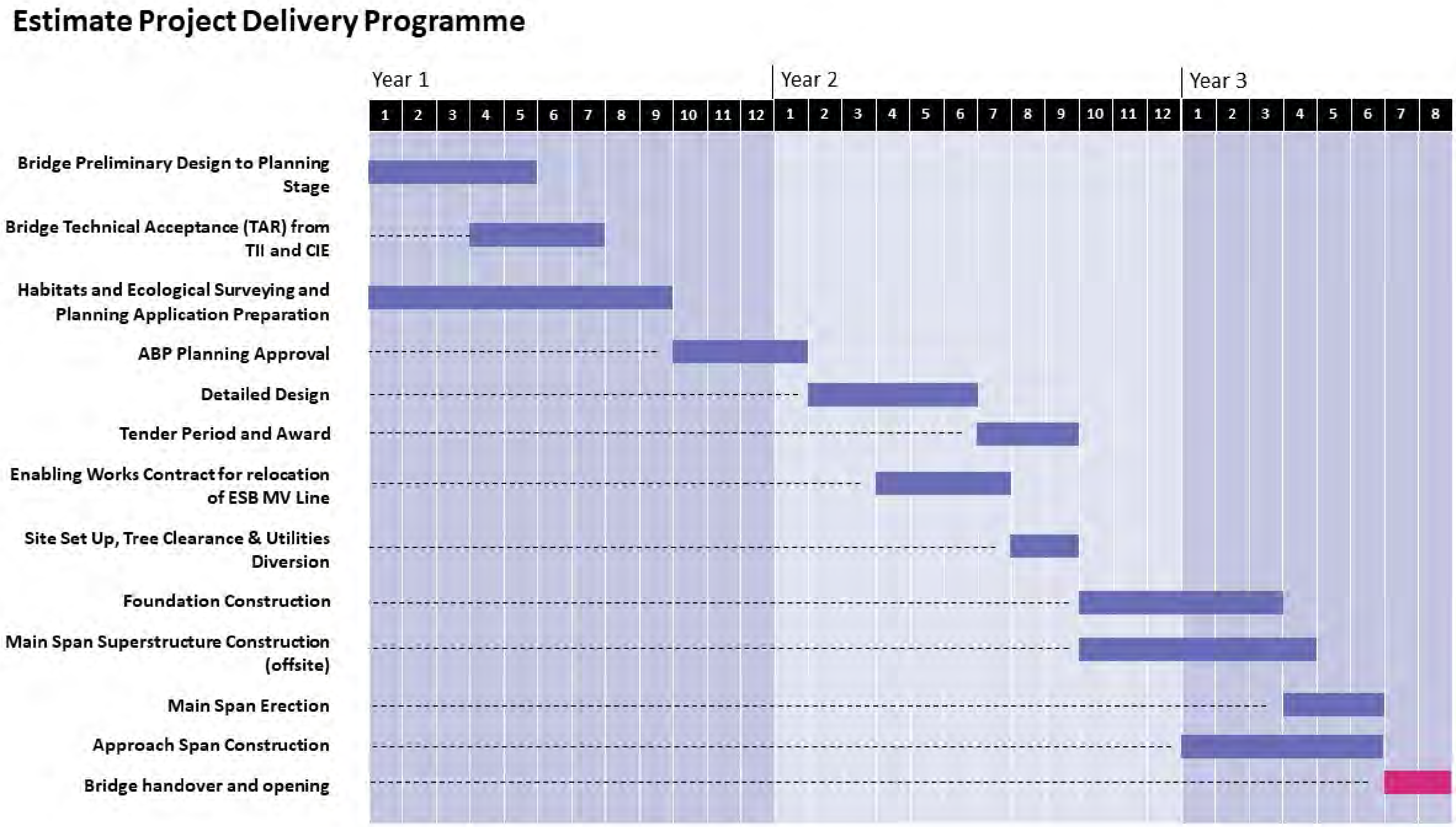

Figure 21: Estimate Project Delivery Programme

12 Conclusions

This report has assessed the feasibility of constructing a new pedestrian/cycle bridge with the chosen alignment under the criteria outlined in the report. It has concluded that the construction of the proposed bridge is feasible. The project should proceed to the next stage and recommendations have been given below which suggest the next steps for successful delivery of the project.

This report also outlines the key considerations which should be used when completing the next stages of the project. Further consideration should be given to include environmental, stakeholder and constructability aspects of the project.

The proposed alignment has been assessed with several potential bridge types and construction options for the bridge and has demonstrated that they are possible for this alignment.

13 Recommendations

It is recommended that a more detailed bridge options assessment be conducted to provide greater certainty on the alignment, landowners, structure types and cost.

It is also recommended that once this detailed assessment has been conducted and a bridge option chosen that draft reports on EIA Screening and AA Screening are prepared. This will allow the competent authority to undertake an assessment and determine whether either an EIAR or NIS, or both, is required for the proposed development and hence determine the route for statutory consent.

Engaging with TII and IÉ at an early stage will be critical to the project's success and it is recommended that these stakeholders be consulted at the onset of the project commencement.

Given the relatively flat terrain, an above deck structure appears to be most advantageous in limiting the extent of ramping. Therefore, it is recommended that the through girder option (Option 1) is not considered further.

The double span options reduce the complexity of the final bridge lift and offer the option to provide a third access point to Little Island Train Station south of the existing railway. However, it adds complexity to the foundation construction in relation to the constraints previously outlined and will impact on the delivery of this option. It is therefore recommended that further analysis be completed in advance of selecting a preferred bridge type option.

N25 Little Island Pedestrian and Cyclist Bridge
Environmental Impact Assessment Report

Appendix 3.2

Options Selection Report / Structures Options Report

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Appendices

1. Introduction

1.1 Scope of Report

Cork County Council (CCC), the National Transport Authority (NTA) and Arup have identified the benefits associated with the provision of a new pedestrian and cycle bridge to enhance sustainable transport and active transport within the Eastgate Business Park and the surrounding area. The proposed bridge will cross the N25 and connect the Little Island Train Station, the Glounthaune Road and future greenway to the Eastgate Business Park in Little Island, Cork. The objective of the proposed bridge is to provide efficient pedestrian and cycle connectivity between the Little Island Train Station and the Eastgate Business Park and to promote sustainable transport modes while minimising impacts on the surrounding area and environment.

The report builds on work carried out by Arup as part of the Little Island Sustainable Transport Interventions (LISTI) project where the benefits of a new pedestrian and cycle bridge were identified as part of the design interventions recommended on the existing public road network and East Gate Business Park. Arup were appointed by CCC in 2020 to undertake a preliminary feasibility report for this crossing. Subsequent to this, Arup were appointed in 2022 to progress the bridge design through Phases 2 and 3 of the NTA Project Appraisal Guidelines (PAG's) to include options assessment, preliminary design, and progression of the scheme through statutory planning.

This report encompasses the requirements of the Department of Transport (DOT) Common Appraisal Framework (CAF) in undertaking a Multi Criteria Appraisal (MCA) of Bridge options as per the requirements of the NTA Project Approval Guidelines for Phase 2 Concept Development and Options Selection. This report forms the basis of the NTA Phase 2 Options Selection Report (OSR).

Following the guidelines established in TII document DN-STR-03001 – Technical Acceptance of Structures, this document also presents the Structural Options Report for the Little Island/N25 Pedestrian and Cycle bridge.

1.2 Project Background

The Little Island Sustainable Transport Interventions Project (LISTI) Design Options Assessment Report provides the basis for the identification of the need for the proposed pedestrian and cycle bridge and the possible locations. The benefits of a new pedestrian and cycle bridge were identified as part of the design interventions recommended on the existing public road network and East Gate Business Park. These recommendations were to deliver enhanced access for public transport and pedestrians/cyclists to and within Little Island and between Little Island and the Little Island Railway Station.

Previous work was also undertaken in relation to the feasibility of a new bridge proposal adjacent to the existing R623 N25 overbridge completed by RPS Consultant Engineers (RPS) referred to as "Little Island Pedestrian / Cycle Bridge - High Level Feasibility Study" - December 2016. As part of that proposal, pedestrian steps and elevators were proposed to achieve the level difference with no allowance for ramps. Therefore the bridge would not accommodate cyclists unless cyclists dismounted and utilised the proposed elevators or stairs.

Arup were appointed in 2020 to undertake a feasibility report for the N25 Little Island Pedestrian and Cycle Bridge which is appended to this Report. This report found that bridge crossings were feasible and recommended a high-level preferred alignment option. The report also highlighted several feasible structural types and span options including a single span over the Irish Rail track and the N25 and a 2-span arrangement with a support between the railway and the N25. The feasibility report recommended the project should proceed to the next stage of defining the preferred structural option and completing preliminary design.

Further to the Feasibility Report a Bridge Alignment and Width Options Assessment was carried out to review the recommended bridge alignment in more detail and assess it against alternatives. This report also reviewed the Irish and international best practice regarding bridge width requirements and has been appended to this report for reference.

1.3 Multi criteria assessment scoring overview

A multi criteria assessment (MCA) has been carried out to compare and assess structural options for the main spans and the approach ramps. This is consistent with the requirements of the Department of Transport (DOT) Common Appraisal Framework (CAF) as required by the National Transport Authority Project Approval Guidelines.

Criteria to be assessed are taken from the requirements of the CAF qualitative appraisal criteria and Transport Infrastructure Ireland Structural Options Report (SOR) STA-1a model requirements given in DN-STR-03001.

The criteria have been assessed based on a scoring hierarchy from 1 to 5. An untenable solution, one which is unfeasible or detrimental to the progression of the project, scores a 1. While a characteristic which aligns with the core criteria of the brief and has a highly beneficial impact on the project receives a scoring of 5. An equal weighting has been given to all criteria.

1.3.1 Department of Transport Common Appraisal Framework Qualitative Appraisal Criteria

This project is proposed to be funded through the National Transport Authority (NTA) and as such is subject to the NTA Project Approval Guidelines. Phase 2, as outlined in the guidelines, comprises Concept Development and Option Selection. The purpose of this phase is to:

"…develop the project concept through the options selection, including appraisal of the alternatives and options, and selection of the Preferred Option."

Part of Phase 2 is the Options Selection Report required for projects in Band 2 (0.5million to 10million). As the requirements of this report broadly aligns with the TII Structure Options Report this report is intended to function also as the Structure Options Report.

The requirements of the Option Selection Report require that optioneering process to consider the realistic alternatives which may involve different modes, routes or alignments, alternative designs, or substitute approaches that could also deliver the core project objectives. In the case of this project, the earlier Feasibility Report and LISTI report have identified the requirements for a new pedestrian and cycling crossing joining Little Island Station and the Eastgate Business Park area. The first phase of the optioneering process as documented in the Alignment and Width Options Assessment Report (Appended) proposed a preferred bridge alignment based on a multi criteria assessment, see Section 3. As a result, this report will focus primarily on the options assessment of the crossing structural form *'alternative designs'*.

The NTA Project Approval Guidelines require the Sponsoring Agent (CCC) to consider the Department of Transport (DOT) Common Appraisal Framework in assessing options. See appraisal in accordance with the Qualitative guidance outlined in Section 4.3 of the DOT Common Appraisal Framework in the following sections.

The project scope also lays out the requirement for a multi criteria assessment of the options. In accordance with the DOT common appraisal framework a simple appraisal is required.

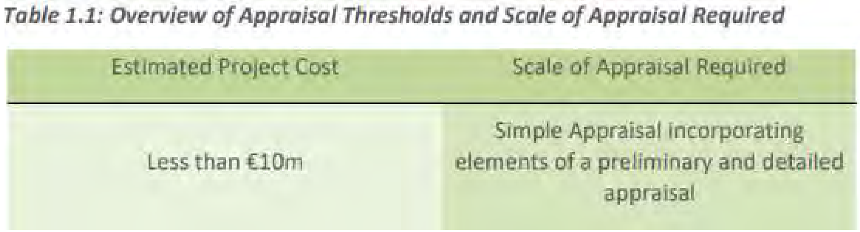


Table 1.1: Overview of Appraisal Thresholds and Scale of Appraisal Required

Estimated Project Cost	Scale of Appraisal Required
Less than €10m	Simple Appraisal incorporating elements of a preliminary and detailed appraisal

Figure 1.1: Department of Transport Common Appraisal Framework scale of appraisal

A comparative cost calculation is completed in Section 6 of this report. Further to this, a qualitative multi criteria analysis is carried out to the Project Appraisal Criteria.

Table 4.3: Project Appraisal Criteria

Economy	The impacts of a transport investment on economic growth and competitiveness are assessed under the economic impact and economic efficiency criteria.
Safety	Safety is concerned with the impact of the investment on the number of transport related accidents.
Integration	Integration considers the extent to which the project being evaluated promotes integration of transport networks and is compatible with Government policies, including national spatial and planning policy.
Environment	Environment embraces a range of impacts, such as emissions to air, noise, and ecological and architectural impacts.
Accessibility and Social Inclusion	Accessibility and social inclusion embraces the notion that some priority should be given to benefits that accrue to those suffering from social deprivation, geographic isolation and mobility and sensory deprivation.
Physical Activity (where applicable)	This relates to the health benefits derived from using different transport modes

Figure 1.2: Department of Transport Common Appraisal Framework Project Appraisal Criteria

Previous reports have identified the need for a bridge crossing in this location and the scope of this report is to develop this further to recommend a preferred bridge alignment and structural form. Therefore, an assessment of the ‘do nothing’ approach has not been completed as part of this report.

1.3.2 Transport Infrastructure Ireland Structural Options Report appraisal criteria

The following are the model criteria given by TII in DN-STR-03001 for the assessment of structural options. Many of these criteria are common with the DOT CAF criteria.

- Technical Evaluation
- Economic Evaluation
- Aesthetic Evaluation
- Evaluation of Durability and Maintenance Requirements
- Hydraulic Considerations (where applicable)
- Environmental Considerations
- Health & Safety Considerations
- Construction and Buildability
- Ground Conditions

2. Site and Location

The proposed bridge will cross the N25 and the Cork to Middleton/Cobh train line approximately 10km to the East of Cork City centre, see Figure 2.1. The high-level preferred bridge alignment as identified by the Arup feasibility report is shown in Figure 3.2

The N25 in this location is approximately 50m wide. To the North of this the Irish Rail land is approx. 30m wide with a CCC owned parkland and woodland to the north.

To the south of the N25 there is an existing woodland and the Radisson Blu hotel. The southern woodland is partly owned by the Radisson Blu and partly by a private landowner, see Figure 2.2.

A crossing in this location will provide a high-quality pedestrian and cycle link between little island station, the proposed Middleton to Cork greenway and the wider environs with Eastgate Business Park and the wider little Island area. For further details on the crossing location selected refer to the Arup Feasibility Report and the bridge Alignment and Width Options Assessment Report.

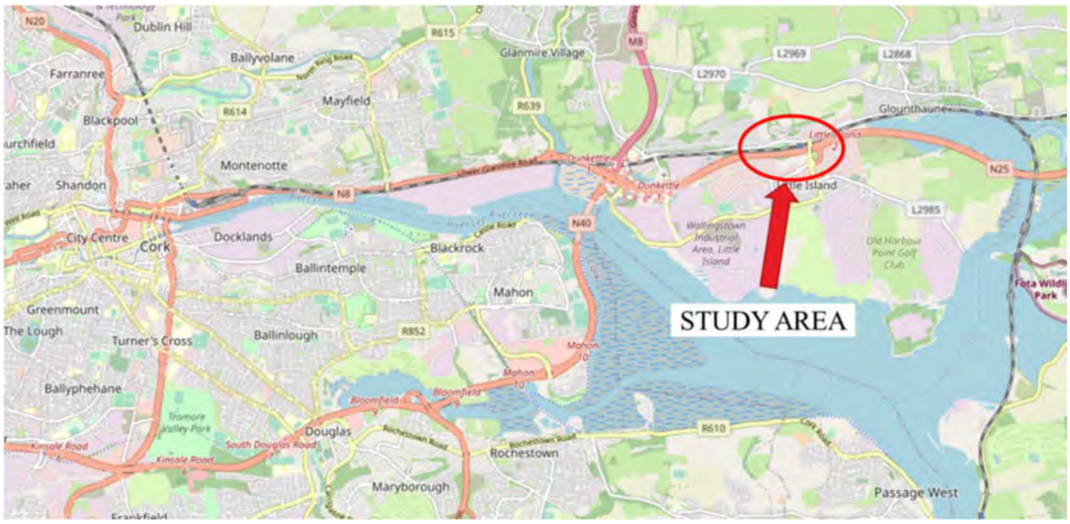


Figure 2.1: General location of proposed bridge crossing @OpenStreetMap contributors

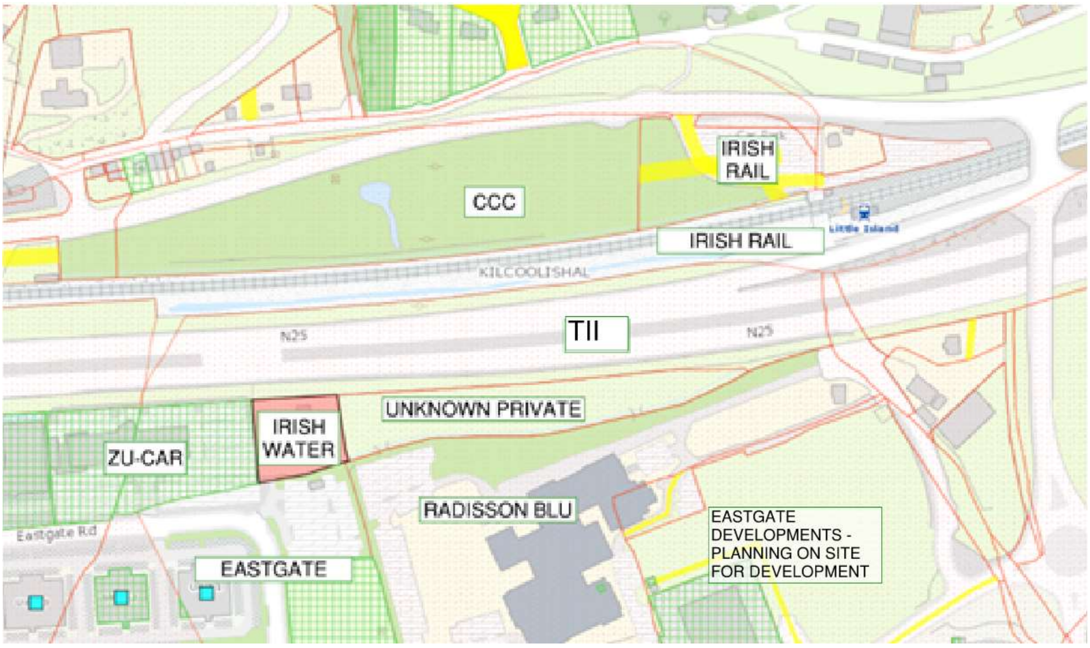


Figure 2.2: Details of Landowner/occupiers at bridge location (from land registry)

3. Alignment

The first phase of the options assessment is to determine the preferred alignment and has been documented in the Arup Feasibility Report which recommended alignment Option 2 as the preferred option, see Figure 3.1.

The alignment options were assessed further during this stage of design in the Alignment and Width Options Assessment Report LIPD-ARUP-ZZ-XX-RP-CB-001 (Appended) with more detailed topographical information available and following initial discussions regarding clearance envelopes with Transport Infrastructure Ireland (TII) and Irish Rail.

Based on the assessments carried out in these reports Alignment Option 2 (Figure 3.2) has been taken forward as the preferred alignment option for consideration of bridge structural options. The primary distinguishing factors which lead to the selection of alignment option 2 are summarised below.

- This option presents the most direct route of options considered along the primary desire line from Little Island Train Station to Eastgate Business Park.
- The southern tie in of this option services the largest working population as per the Little Island Sustainable Transport Improvements Planning Report. This option also services the Radisson Blu hotel directly through the intermediate landing near the existing carpark area
- This option is placed at the bottom of the east bound off ramp to minimise the vertical elevation of the bridge whilst achieving the required clearances to the N25. This has an impact on minimising the length of ramping and overall environmental impact on the area.
- This option minimises disruption to existing developments, for example the Irish Water building to the south of the N25. It also allows for tie in on the north and south which do not cross other roads, minimising the overall ramp length.
- This option can tie in with proposed LISTI works in the Eastgate business park without disrupting current proposals.
- Provides sufficient distance east of the existing TII VMS Gantries to ensure adequate recognition time of the existing portal gantry signage on the westbound approach.

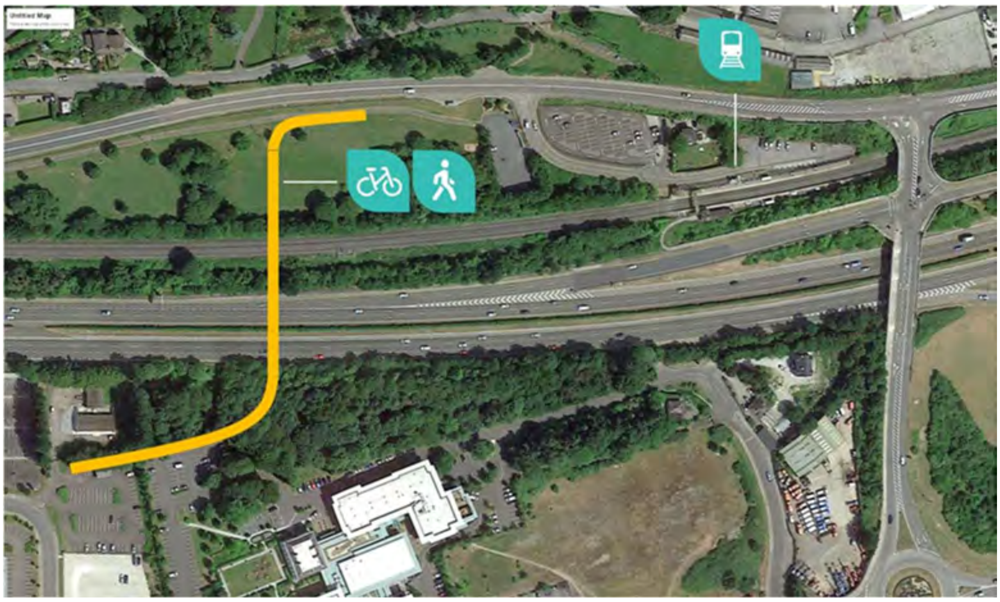


Figure 3.1: Preferred high level alignment recommended by from feasibility study

Figure 3.2: Preferred alignment, see alignment and width technical note appended

4. Description of the Structure and Options Considered

4.1 Constraints Identified

The key constraints contributing to the assessment of bridge options and the selection of the emerging preferred option are highlighted below. Constraints associated with the preferred alignment (route selection) have been considered in detail in both the Arup Feasibility Report (appended) and the Alignment and Width Options Assessment Report (appended). For further information on the constraints leading to the preferred alignment refer to these documents.

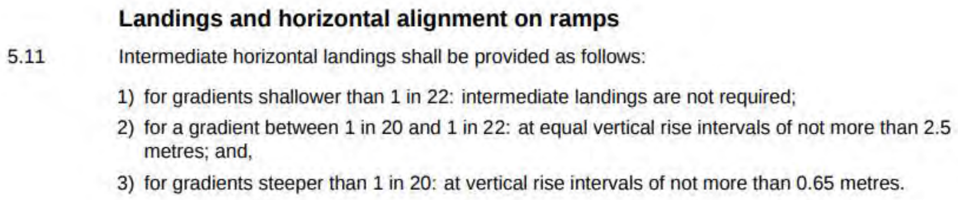
4.1.1 Geometric constraints

Irish Rail have advised a clearance from the structure’s soffit to the rail of 5.3m minimum is required.

TII require a clearance from highway level to the structure’s soffit of 5.7m minimum. In accordance with DN-GEO-03036 Cross Sections and Headroom.

There is a new portal gantry to the west of the proposed bridge location in the westbound lane. TII have advised that they require a minimum 200m site line to be maintained to this in a westbound direction. The preferred bridge alignment has taken account of this, see the Alignment and Width Options Assessment (appended) for more information.

TII STR-03005 recommends a maximum gradient of the structure of 1 in 20 (5%). TII-STR-03005 Section 6.1 notes landings are not required for structures with gradient flatter than 1 in 20. DMRB CD353 Section 5.11 (below) which has been updated more recently clarifies that for gradients of 1 in 22 no intermediate landings are required. As the overall structural length for a 1 in 20 gradient including landings is very similar to that of a 1 in 22 gradient with no landings it is proposed that the design proceeds based on a maximum 1 in 22 gradient (4.5%).



Landings and horizontal alignment on ramps

5.11 Intermediate horizontal landings shall be provided as follows:

1) for gradients shallower than 1 in 22: intermediate landings are not required;
2) for a gradient between 1 in 20 and 1 in 22: at equal vertical rise intervals of not more than 2.5 metres; and,
3) for gradients steeper than 1 in 20: at vertical rise intervals of not more than 0.65 metres.

4.1.2 Parapet/guarding constraints

Irish Rail standard CCE-TMS-410 Civil Engineering Structures Design Standard Section 5.3.6, requires a 1.8m high parapet over the rail. Irish rail has advised that this should consist of a 1.2m high solid infill section with 0.6m mesh infill above to allow for the potential of future overhead electrical on this line.

TII require a 1.4m high cycle parapet to be provided for the span(s) crossing the N25, in accordance with DN-STR-03005 Design Criteria for Footbridges. It is proposed that this parapet requirement be implemented on the approach ramp elevated sections also.

4.1.3 Existing Services

During the Feasibility Report stage utility companies were contacted in relation to the location of assets within the feasibility study area. The results are summarised in the table below.

Table 4.1: Location of assets

Utility Provider	Asset
Virgin Media	No services present
BT	Cable duct running from train station, along off ramp to Little Island and across existing bridge and into Eastgate Business Park
Gas Networks Ireland	600mm 19 bar transmission pipeline crosses through park under N25 to Eastgate Business Park 180mm 4 bar PE distribution pipe crosses the N25 between the train station and Eastgate Business Park
Aurora	Duct running parallel to the railway on area in between the railway and N25 road.
Electricity Supply Board	Buried and overhead services in vicinity 10kV overhead cable crosses through the park on the northern side of the N25, spans over the N25 before going underground and distributed through the Eastgate Business Park.
Irish Water/CCC (Foul and Water)	Gravity Foul main crosses the N25 through the park to a pumping station within the Eastgate Business Park 750mm Asbestos watermain running East-West across the existing park and then under the N25 to the Eastgate Business Park
E-net	Duct running through median of N25 road and into Eastgate Business Park
Eir	Several buried 50-100mm ducts Ducts cross under N25 road between the train station and Eastgate Business Park

During this stage of the works a GPR survey of the northern park area was conducted. The primary reason for this was to determine the location of the gas pipeline, water main and foul main crossing the park. Irish Rail land and the N25 was not surveyed at this point. It is recommended that local surveys be caried out during detailed design along the bridge alignment to determine the requirement for any diversions that may be required .

4.1.4 Environmental Constraints

A detailed study of Environmental constraints has been included in section 6.2 of the Arup Feasibility Report. This constraints study was considered in the recommendation of the preferred bridge alignment in the Feasibility Report and further in the Alignment and Bridge Width Options Assessment Report in selecting the preferred alignment option.

Further to this an Environmental Impact Assessment and Appropriate Assessment screening will take place of the emerging preferred structural option and alignment. Some key items to be considered in this study are

- Impacts to migratory and non-migratory birds flight paths.
- Potential hydrological linkages to nearby protected sites.
- Impacts to southern wooded area and wooded area surrounding Irish Rail track.
- Impacts to Northern Park area where ramped connections to bridge crossing are required.
- Impacts of flooding to bridge construction and detailing

For further details of environmental constraints refer to Feasibility Report.

4.1.5 Flooding

The website flooodinfo.ie provides flood maps which show a medium probability of coastal flooding in the northern park area and the lower areas surrounding the Irish Rail track at the location of the preferred alignment. Consideration shall be given to this is the options assessment and preliminary design of the preferred option. Consideration shall also be given to the mix of embankment vs elevated structure in areas at risk of flooding to minimise the maintenance liability for components in this area. Further consideration will be given to flood risk in the Environmental Impact Assessment.

Figure 4.1: Screenshot from floodinfo.ie showing extent of potential coastal flooding at location of proposed alignment

4.1.6 Aesthetics

Aesthetics, visual and user experience of the bridge has been identified by Cork County Council as a key factor to be considered. Some primary considerations of the optioneering process regarding aesthetics are given below:

- The main span of the structure crossing the N25 will be a signature piece of the overall structure that will be viewed by users of the N25 and from the surrounding area. An emphasis on high aesthetic quality is considered for this signature span to encourage members of the public to use the structure and resulting in increased active travel in the area.

- The aesthetic and feel of the structure for bridge users from deck level should be consistent across the entire crossing, where possible, regardless of different structural types used.

- Users of the northern amenity park area, Little Island train station, the Cork City to Middleton greenway and the adjacent highway will be able to view the northern approach ramp. Consideration needs to be given to the high aesthetic integrity of this section and integration of the approach ramp within the amenity park itself.

- The soffit of the structure over the railway line is not as visible to users of the public due to screening with the trees and lack of access for the public can be considered of lower priority for Aesthetic purposes. Similarly, the soffit of the section through the southern wooded area will not be visible to the public.

4.1.7 N25 and Irish Rail Boundary

Both Irish Rail and TII require physical setbacks from edge of railway and edge of roadway to foundations/substructures. This foundation free zone is 4.5m from the edge of track and the edge of the road respectively. No abutment/pier is allowed in the central median of the N25 in accordance with TII DN-STR-03005. This will dictate feasible span arrangements.

4.1.8 Constructability

The proposed bridge site has several physical constraints that will affect constructability. Section 12 of this report discusses feasible construction methodologies in more detail. Some key constraints are as follows:

- Works within N25, night and weekend working during road and lane closures will be required.

- Clearance under adjacent bridges for transporting prefabricated structures to site.

- Exclusion zones surrounding the railway line for construction works.

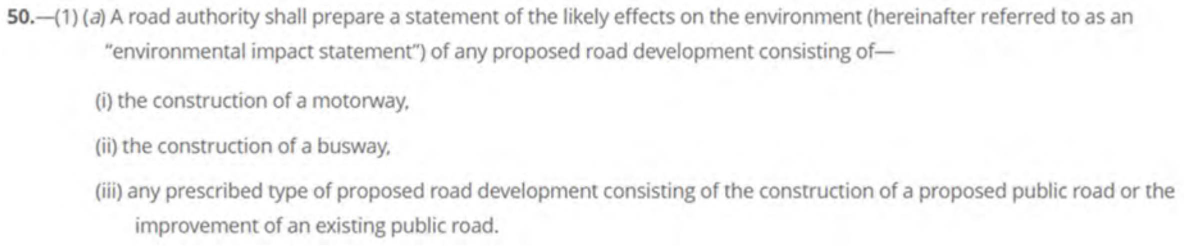
- Staging zones available for onsite fabrication.

- Access and clearance of wooded area to south of N25 for construction works.

On selection of the preferred structural option a more detailed constructability assessment will be carried out in the next preliminary design phase of the project.

4.1.9 Planning Considerations

Section 50(1)(a) of the Roads Act, 1993 (as amended) specifies the classes of development which require an EIA.



50.—(1) (*a*) A road authority shall prepare a statement of the likely effects on the environment (hereinafter referred to as an "environmental impact statement") of any proposed road development consisting of—

(i) the construction of a motorway,

(ii) the construction of a busway,

(iii) any prescribed type of proposed road development consisting of the construction of a proposed public road or the improvement of an existing public road.

Article 8 of the Roads Regulations 1994 (Road development prescribed for the purposes of Section 50(1)(a) of the Roads Act, 1993 (as amended) specifies the classes of development which require an EIA, including:

'The construction of a new bridge or tunnel which would be 100 metres or more in length'

Additionally, Section 50(1)(c) of the Roads Act, 1993 (as amended) specifies the following:

'Where a road authority considers that any proposed road development (other than development to which paragraph (a) applies) …. would be likely to have significant effects on the environment…'

Due to the total length of this bridge crossing at over 100m and the location of the proposed southern approach ramp in a currently wooded area an EAIR is required. Due to the proximity of the

Therefore, under the assumption that a Natura Impact Statement (NIS) and Environmental Impact Assessment (EIA) are screened in, based on the above, it will be required to submit planning to An Bord Pleanála (ABP) under Sections 175 and 177AE of the planning regulations.

4.2 Description of Bridge Options

The following section provides structural options for the N25 and Irish Rail spans. For approach ramp options see Section 4.3.

4.2.1 Option 1 – Single span steel through truss

Structural Option 1 consists of a single span steel through truss structure crossing both the N25 and the Irish Rail line in a single span. The structure, shown in Figure 4.2, is an arched Howe truss structure. The span of this structure will be approximately 82m. The steel structure would be of painted steel construction. Weathering steel is not suitable as the location is close to the ocean. Figure 4.3 gives an indicative example of a similar structure while Figure 4.4 gives an indicative example of a similar structure with a higher aesthetic quality.

Foundations for this option will be set back from the highway on the south and to the north of the Irish Rail track. Foundations are anticipated to be of reinforced concrete piled construction.

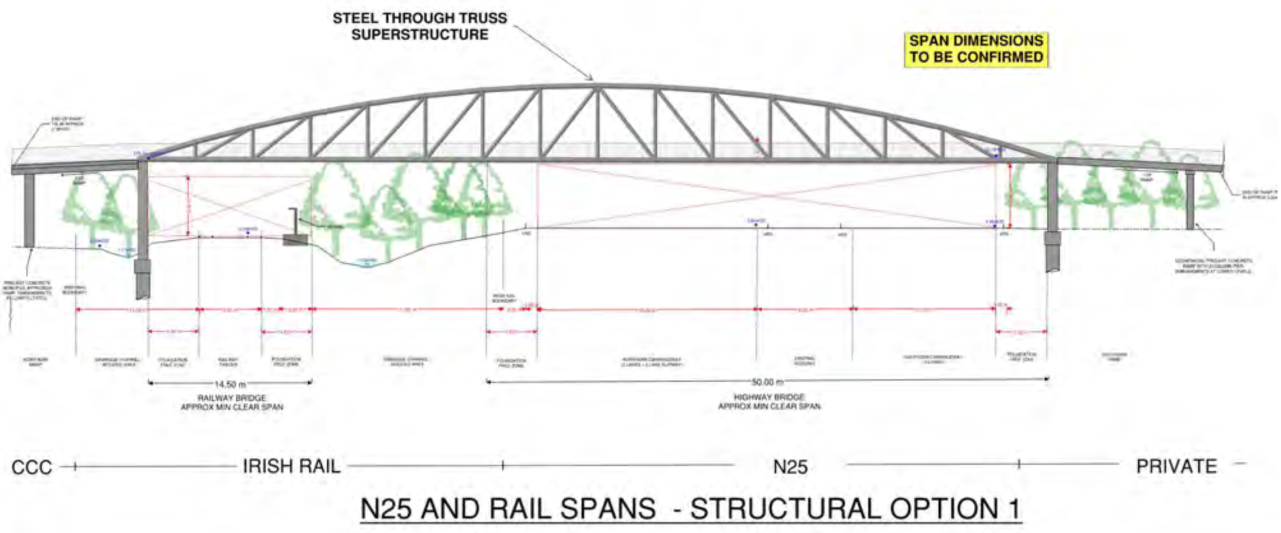


Figure 4.2: Structural option 3 indicative elevation with N25 span, Irish Rail span and start of approach ramps

Figure 4.3: Example of through truss pedestrian and cycle bridge

Figure 4.4: Example of through truss pedestrian and cycle bridge of higher aesthetic (note weathering steel not expected applicable for this project, architectural option would be painted steel)

4.2.2 Option 2 - Two span steel through truss

Structural option 2 consists of a 2-span steel through truss structure crossing the N25 and the Irish Rail line in separate spans. The structures shown in Figure 4.5 are arched Howe truss structures. The spans of these structures will be approximately 50m (N25) and 30m (Irish Rail). The steel structures would be of painted steel construction. Weathering steel is not suitable as the location is close to the ocean. Figure 4.6 and Figure 4.7 give an indicative example of a similar structures.

Foundations for this option will be set back from the highway on both sides and to the north of Irish Rail track. Foundations are anticipated to be of reinforced concrete piled construction.

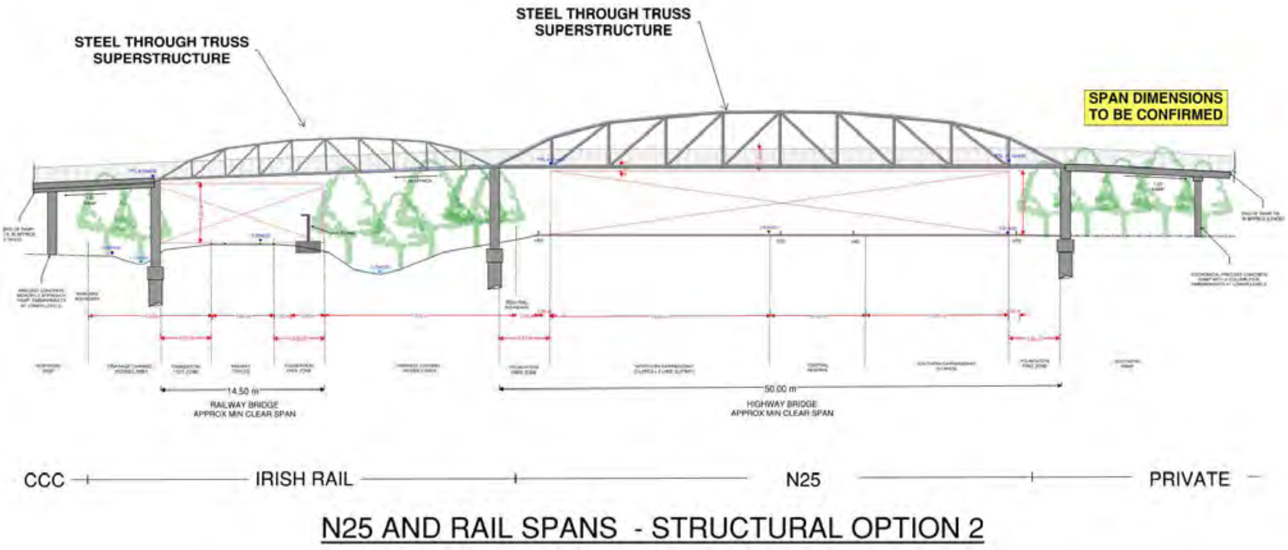


Figure 4.5: Structural option 2 indicative elevation with N25 span, Irish Rail span and start of approach ramps

Figure 4.6: Example of multiple span through truss footbridge structure

Figure 4.7: Example of shorter span steel through truss over road

4.2.3 Option 3 – Steel network arch N25 span with reinforced concrete portal frame over rail.

Structural option 3 consists of a single span steel network arch structure over the N25 and a 2-span precast segmental portal frame structure over the Irish Rail track and adjacent land to the south. Both a steel deck and a concrete deck can be considered for this option should it be selected. A steel deck would be more lightweight however a concrete deck would help to maintain the aesthetic link to the Irish Rail span and would reduce maintenance requirements. The spans of these structures will be approximately 50m (N25) and 2x15m (Irish Rail). The steel structures would be of painted steel construction. Weathering steel is not suitable as the location is close to the ocean. Figure 4.9 and Figure 4.10 give an indicative example of a similar structures.

Foundations for the N25 structure will be set back from the highway on both sides and are expected to be of reinforced concrete piled construction. Foundations for the portal frame structures are proposed to be within the Irish Rail land as shown in Figure 4.8. Foundations for the portal frame structure are yet to be defined but may be shallow foundations or reinforced concrete piled foundations.

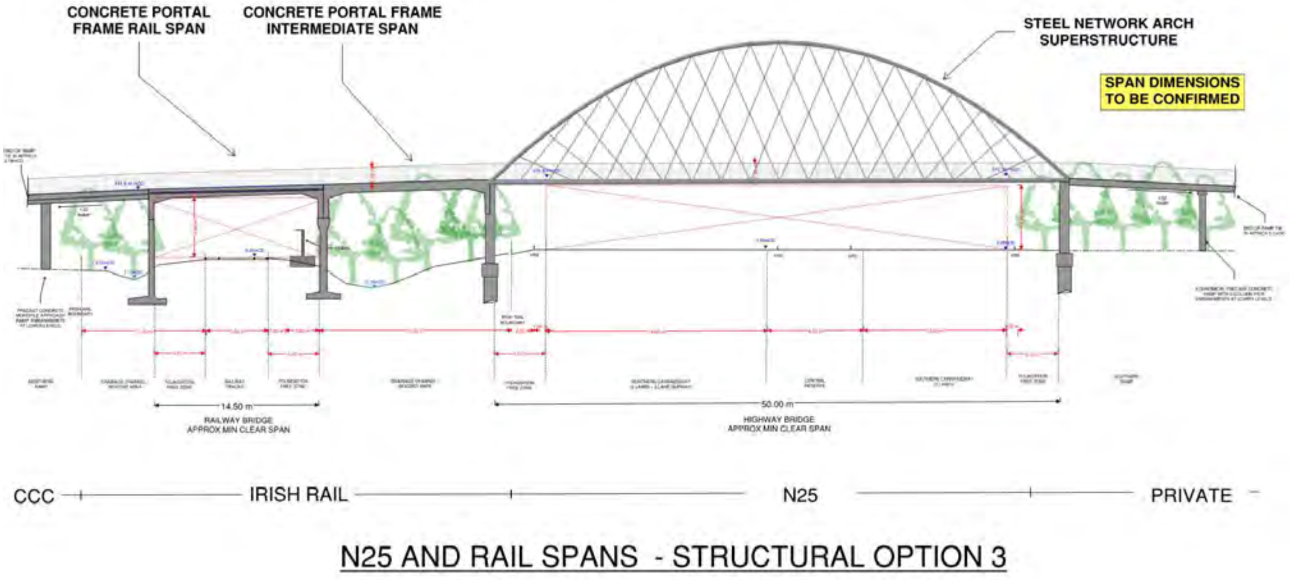


Figure 4.8: Structural option 3 indicative elevation with N25 span, Irish Rail span and start of approach ramps

Figure 4.9: Example of steel network arch pedestrian and cycle bridge with concrete deck

Figure 4.10: Example of segmental precast reinforced concrete porta frame structure over rail

4.3 Approach ramps

Due to the requirements for adequate clearance over the N25 and the Irish rail track and the required gradient for approach ramps, ramp structures for this crossing will be significant. A ramp gradient of 1 in 22 is proposed. This leads to ramped approaches to reach existing ground level of approximately 160m to the north and 130m to the south, in addition to lengths of at grade walkways/cycleways to tie in to end points of the crossing at Little Island station and the Eastgate Business Park.

Ramp structures are likely to consist of a combination of elevated structure, embankments, landscaping and at grade sections. The following sections outline feasible structural forms selected for consideration. It is proposed that the ramped structures are considered independently to the main crossings of the N25 and Irish Rail track as the considerations and constraints differ.

The elevated section of the ramp approach on the north will be prominent feature and visible from the underside by users of the Northern Park area, the adjacent road, and the new greenway. Therefore, the aesthetic quality of this structure from deck level and from below should be considered strongly. By comparison, the southern elevated ramp section will travel through a heavily wooded area that is not accessible by the public currently. For this structure, the importance is more so on the user experience from the deck and not from the underside. This gives opportunities for a more economic structure to be used in this section.

It is proposed for the north approach ramp that the lower ramp section is to be an embankment to a height above ground level of approximately 2m. This is consistent with recommendations in TII-STR-03005 to avoid confined crawl spaces under elevated structures.

The southern ramp section between the Radisson blue car park and the N25 bridge tie in is proposed as elevated structure due to the fall off in level to the north and east of the Radisson car park. A retained embankment is also proposed on the west side tie in to the Radisson car park. See section 4.3.3.

4.3.1 Elevated Ramp Structure Option 1: Steel Elevated Ramp

This option considers the use of a painted steel elevated ramp structure. Weathering steel was not considered due to the structure's proximity to the ocean. Steelwork can easily achieve the required span lengths for the approach ramps in a relatively lightweight form. This has advantages for construction and lifting of components. Steelwork sections can also come prefabricated with parapets included prior to being lifted into place and require less on-site construction works generally.

As there are no specific headroom requirements under the elevated ramp sections the main structural elements can be placed under the deck allowing for a more open parapet/edge of the structure for the user in comparison to a truss. For this reason, two structural forms are considered for this option.

A spine beam structure with single piers for the northern elevated ramp section and a more economical edge beam design with 2 column piers and crossheads for the southern ramp sections. See Figure 4.11 for indicative cross sections of both structural forms. Both options would allow for a consistent deck aesthetic for the user.

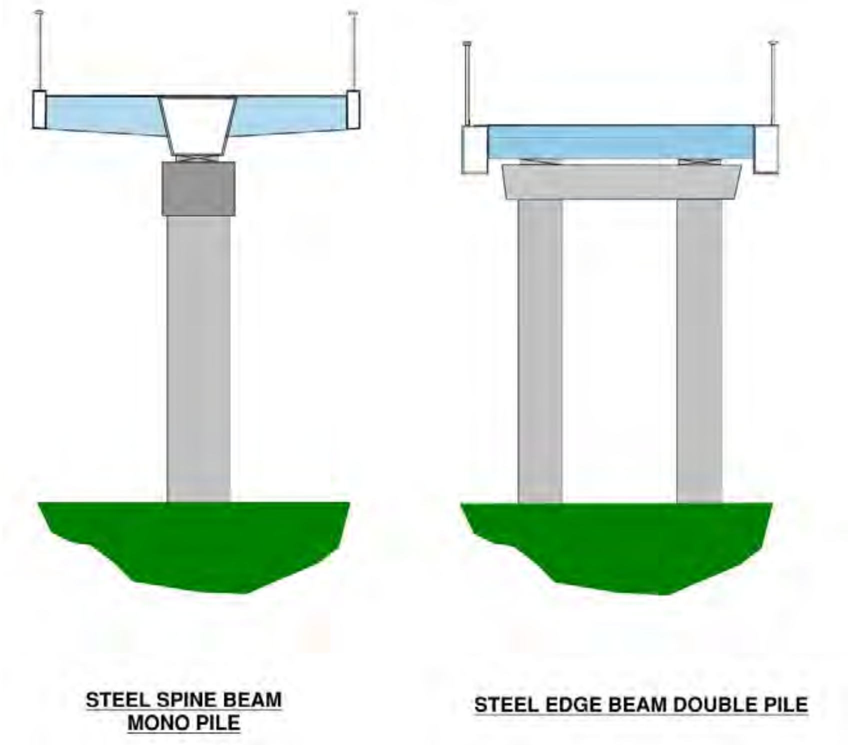


Figure 4.11: Indicative Cross sections of Steel Elevated Ramp Structural Forms

Figure 4.12: Example of steel elevated ramp/cycleway structure with spine beam and monopiles/columns

Figure 4.13: Steel edge beam bridge

4.3.2 Elevated Ramp Structure Option 2: Precast Prestressed Concrete

This option considers the use of a precast prestressed concrete spans. Precast concrete systems are widely available in Ireland and can easily reach the spans required. They are also extremely durable once constructed and with very low or no major maintenance required over their required design life of 120 years.

As there are no specific headroom requirements under the elevated ramp sections the main structural elements can be placed under the deck allowing for a more open parapet/edge of the structure for the user. For this reason, two structural forms are considered for this option. A bespoke concrete structure with single piers for the northern elevated ramp section and a more economical precast prestressed bridge beam bridge design with 2 column piers and crossheads for the southern ramp sections.

Precast bridge beams such as MY bridge beams are available in single beams with spans of 15m-25m leading to flexibility in design and construction. Once placed on the southern ramp structure works on the in-situ deck section are possible from the deck. Where access is easier in the northern park area a more bespoke architectural design is possible. Major strides have also been made in concrete mixes which allow for lower carbon forms of concrete to be used which can reduce the overall carbon footprint of the structure.

See Figure 4.14 for indicative cross sections of both structural forms. Both options would allow for a consistent deck aesthetic for the user.

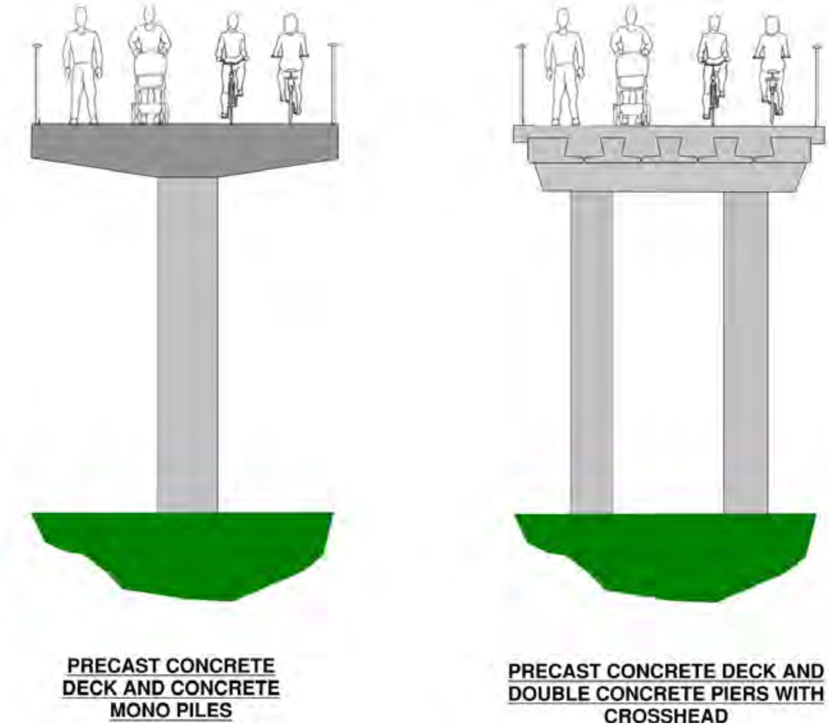


Figure 4.14: Indicative cross section for reinforced concrete structural forms for elevated ramp structure

Figure 4.15: Example of reinforced concrete elevated ramp structure with monopiles/columns (northern approach ramp)

Figure 4.16: Economical precast prestressed concrete bridge beam option for approach ramp elevated structure (southern approach ramp)

4.3.3 Embankments and Landscaping

Embankments and landscaping will be common to all ramp approach options for lower sections. This form of ramp is generally less expensive and intensive to construct than an equivalent elevated structure. They are also generally more robust and lower maintenance than an elevated structure.

Figure 4.17 gives an example of a landscaping proposal used to blend an approach ramp for the Blackrock Greenway in Cork into the surrounding landscape. Proposals similar to this will be developed further during preliminary design for the tie in point of the ramp on the northern approach.

On the southern side of the crossing, it is proposed that the ramp would tie into the carpark directly North of the Radisson Blu Hotel. (Figure 3.1). There are steep drop-offs in level on the north and east of this carpark and therefore a piled elevated structure is proposed to be used to connect to the bridge on the south side in lieu of embankments and landscaping. A section of embankment/retaining wall will be required however between this carpark and the lower carpark to the West for the crossing to tie in to the wider LISTI works in Eastgate Business Park. A segmental reinforced soil retaining structure such as that shown in Figure 4.17 is proposed here to minimise land take from the carparks. This is common to all options for main crossing structural type and elevated ramp structure structural form.

Figure 4.17: Example of landscaped ramp (left) and soil reinforcement retaining wall (right)

Figure 4.18: Vegetated green wall retaining solution, prior to vegetation growth

Figure 4.19: Vegetated green wall retaining solution, following vegetation growth

5. Technical Evaluation

5.1 Technical Challenges

The following is an evaluation of the technical considerations for each of the three options considered.

5.1.1 Option 1 – Single Span Steel Through Truss

A through truss pedestrian and cycle bridge is a relatively simple and efficient structural form and has been widely used throughout Ireland for similar applications. A number of contractors and fabricators would be familiar with the construction and design challenges associated with this type of structure. As the longest spanning and heaviest single span of the options challenges exist around craneage and steelwork erection of the steelwork superstructure.

This option reduces the number of piers which will reduce the land take and vegetation clearance. The main span bridge abutments would however be larger than other options.

Due to the single span nature of this structure, and the requirement for a higher clearance over the N25 relative to the Irish Rail track, this option would sit higher at the northern side of the Irish Rail track than other options. This would lead to an increased length of northern approach ramp relative to other options.

The design of such a bridge is relatively straightforward. The analysis is completed using standard modelling techniques such as grillage modelling, the results of which are also relatively simple to assess. The longer span nature of this structure and the relatively lightweight structural form can lead to vibrations in the structure which may be perceptible to users. Whilst this is not a safety concern this will need to be considered at design stage to ensure the structure is suitable stiff to meet the code requirements with regards to vibrations.

5.1.2 Option 2 - Two Span Steel Through Truss

A two-span steel through truss structure is a relatively simple and efficient structural form and has been widely used throughout Ireland for similar applications. A number of contractors and fabricators would be familiar with the construction and design challenges associated with this type of structure. Steelwork erection of this option would be much simpler than Option 1 with reduced span lengths and weights for craneage. Additionally, the height of the structure would be lower making it easier for delivery by road.

This option adds an additional support between the N25 and Irish Rail line relative to Option 1 requiring increased land access and works under lane closures and traffic management. Abutments are expected to be smaller than Option 1, however. The down slope for this option on the north side can commence at the end of the N25 span, therefore reducing the overall length required for the northern approach ramp.

The design of such a bridge is similarly to option 1 relatively straightforward. The analysis is completed using standard modelling techniques such as grillage modelling, the results of which are also relatively simple to assess. The smaller span length has the advantage of simplifying calculations regarding vibrations perceptible to bridge users.

5.1.3 Option 3 – Steel Network Arch & RC Precast Portal Frames

In Option 3, an RC precast segmental portal frame structure, over the Irish Rail line, is proposed and are straightforward structures that are widely used in this and similar applications. This type of structure is generally fabricated and erected by specialist precast producers with well-developed systems. The design risk of this type of structure is therefore relatively low and technical risk sits more on the construction side. The construction methodology for this type of system however is well developed and would also be considered low.

A steel network arch span is proposed over the N25. This is an efficient structural form of a tied arch bridge where inclined ‘hangers’ cross each other at least twice. This is not a new form of construction and has been widely used, including recently on similar pedestrian and cycle bridges in Ireland and in Europe. A well-designed network arch structure should be lighter than through truss structures of a similar span, although the height of the span is typically higher than a through truss structure to gain structural efficiency.

Similar to Option 1 the lightweight nature of this structure will require careful assessment of vibrations in the structure to meet code requirements for user comfort.

The design of a network arch bridge will be completed using standard modelling techniques such as grillage modelling with the use of parametric modelling helping to optimise the arch shape and number/spacing of cables. The design and detailing of this structure is expected to be more complicated than Options 1 and 2, however it would be expected that a competent consultant with experience in bridge design should be able to complete the design to a high standard.

5.1.4 Ramp Option 1: Steel Ramp Elevated Structure

While the same aesthetic appearance from the top of deck is proposed for both north and south elevated approach ramp structures, it is proposed that the north and south elevated approach ramp structures have different construction due to the accessibility and visual requirements of the underside of the deck. The north approach elevated ramp section would be constructed from a more architectural spine beam option (or similar structure) sitting on monopile type foundations while the southern sections are proposed to be of a simpler edge beam construction sitting on 2 pile piers with reinforced concrete crossheads.

It is expected that the technical design of the southern approach elevated ramp would be relatively straightforward using standard modelling and design approaches. The northern elevated sections would also use standard approaches however it is expected that the design detailing of this section would be more challenging.

Steel structures are generally more lightweight than concrete and allow the possibility of longer spans and less foundations. They also allow for prefabrication and modular construction to increase quality and limit programme risks on site.

5.1.5 Ramp option 2: Concrete Ramp Elevated Structure

Similar to ramp Option 1, from the top of deck it is proposed the aesthetic appearance on the northern and southern elevated approach ramp sections will be the same. The structural form will vary however, to provide a more architectural structure through the northern park area where it is more visible.

For the northern park, a prestressed/post tensioned concrete deck is proposed sitting on single monopile type piers. It is expected that there will be challenges associated with the design and detailing of this type of structure and the design consultant would need to have suitable experience in the design and detailing of reinforced concrete bridge structures.

The proposed design of the southern elevated ramp structures in this option is a straightforward commonly used design of prestressed bridge beams with an in-situ concrete deck. Limited formwork is required for this form of construction as the bridge beams act as permanent formwork. This type of design is well developed by several precast concrete suppliers and is expected to be a simpler design than the northern approach. Substructures are proposed to be 2 pile piers with a reinforced concrete crossbeam.

Prefabricated concrete structures allow for modular construction which increases overall build quality and reduces risks on site.

5.2 Summary of Technical Evaluation Main Bridge Crossing

All options are technically feasible. Option 1 presents a risk for construction from a technical perspective due to increased span, weight and rail/road possessions for span erection. Option 2 is the most preferrable option from a technical perspective due to the simplified construction process and the reduced northern ramp length relative to Option 1. Option 3, similar to Option 2 would have a simplified design however transportation to site, construction and erection would have added technical challenges due to the height of the arch.

Table 5.1: Technical Evaluation – Main Span Structure

Criterion	Option 1 Single span steel through truss	Option 2 Two span steel through truss	Option 3 Steel network arch & RC precast portal frame
Technical Merit	2	4	3

5.3 Summary of Technical Evaluation Elevated Ramp Structure

From a technical perspective both these options are technically feasible and widely used. For the northern park area there are potential technical challenges associated with the design and construction of more architectural monopile supported structures, however these challenges are expected to be similar for both options. For the southern approach ramp more economical steelwork or concrete structures on 2 pile piers with crossheads are technically straightforward and would be considered to have similar technical construction challenges. Therefore, both options have the same score.

Table 5.2: Technical Evaluation – Ramp Structure

Criterion	Option 1: Steel Elevated Ramp Structure	Option 2: Precast Prestressed Concrete Elevated Ramp Structure
Technical Merit	3	3

6. Economic Evaluation (Economy)

The economic evaluation is based on the comparative cost estimate as required by the NTA project appraisal guidelines at this stage, by comparing approximate costs for the construction of each bridge and ramp option. These costs are calculated based on estimated rates per square meter of deck area. The rates vary depending on the type of bridge structure proposed, influenced by span arrangements, materials, construction methodology and maintenance aspects. A more detailed cost estimate of the preferred option will be completed at the next stage. See appendices for detailed breakdown of the comparative cost estimate.

It should be noted that the below estimated costs are higher than those contained in the feasibility report cost estimate. The key reasons for this are inflation in the construction market since the feasibility report was completed and an increase in the proposed bridge width.

The SCSI (Society of Chartered Surveyor) publish a tender price index twice a year. According to this latest report there has been an increase in construction costs of 22% since the feasibility report for this project was completed (second half of 2020 to first half of 2022). The increase in costs for the second half of 2022 is not yet available. It is expected that there would be an inflationary cost increase as a result over and above what was estimated in the Feasibility Report.

As per the Alignment and Bridge Width Options Assessment (appended) the recommended bridge effective width (between parapets) is 5m. With allowance for parapet fixings and the structure the overall bridge width is expected to be approximately 6m. This is an increase of 20% on the structural width considered in the feasibility report and would be expected to increase the overall construction cost also.

The combined expected increase based on the above inflation estimate and the increase in bridge width is 1.46 (1.22 x 1.2). The maximum estimated construction cost from the Feasibility Report was € 5.225 million. Factored by 1.46 it would be expected an equivalent estimate would now be approximately € 7.65 million.

6.1 Estimated Bridge Costs

The comparative costs for each bridge are summarised in Table 6.1 below. These costs include the cost of ramps. Both ramp options are assumed to be of a similar cost and are not distinguished between steel and concrete options.

Table 6.1: Comparative cost estimate – bridges

Option	Estimated construction cost	Estimated construction cost + 30%	Estimated construction cost + 30%
Option 1: Single span steel truss.	€ 7.504 Million	€ 5.253 Million	€ 9.756 Million
Option 2: Two span steel through truss.	€ 6.956 Million	€ 4.869 Million	€ 9.043 Million
Option 3: Steel network arch & RC precast portal frames.	€ 7.723 Million	€ 5.406 Million	€ 10.040 Million

6.2 Summary of Economic Evaluation Main Bridge Crossing

The table below summarises the scores assigned to each bridge option based on the above economic evaluation.

Table 6.2: Economic Evaluation – Main Span Structure

Criterion	Option 1 Single span steel through truss	Option 2 Two span steel through truss	Option 3 Steel network arch & RC precast portal frame
Economic Merit	3	4	3

6.3 Summary of Economic Evaluation Elevated Ramp Structure

The table below summarises the scores assigned to each ramp option based on the above economic evaluation. Both options are considered to be of a similar cost and have both been awarded the same assessment score on this basis.

Table 6.3: Technical Evaluation – Ramp Structure

Criterion	Option 1: Steel Elevated Ramp Structure	Option 2: Precast Prestressed Concrete Elevated Ramp Structure
Economic Merit	3	3

7. Aesthetic Evaluation

Whilst the key focus of this structure is to provide an effective crossing of the Irish Rail line and N25 to connect Little Island train station and the Eastgate Business Park, the aesthetic appearance was identified as a key factor in placemaking and to encourage the use of the crossing, promoting sustainable transport modes in the surrounding area.

This is consistent with the guidance given in TII DN-STR-03005 03 Cl.3.20 to provide a structure that should be aesthetically pleasing, enhance the environment and encourage people to use the bridge.

7.1 Compositional Strategy

DMRB CD 351 The design and appearance of highway structures (formerly BA41/98) gives guidance on the design approach to consider bridge aesthetics.

It recommends that evaluation should consider all aspects that affect the aesthetic quality of the completed structure, its position in the landscape and its impact on social, cultural and heritage sensitivities within the community.

The aesthetic influence on the design is therefore largely focused on material choice, span arrangement and structural form. The choice of bridge components for different sections is also set based on a combination of economy, constructability, environmental, long-term durability and maintenance requirements.

It is proposed that the user experience from the deck will retain a similar level of high-quality aesthetic throughout the crossing. From the underside, a high emphasis has been placed on the aesthetic design of the northern approach ramp and the main N25 span as these will be visible from surrounding areas. In comparison, the aesthetics of the southern approach ramp and the Irish Rail span soffits, which will be largely shielded from view by trees and vegetation, are not seen as being as critical.

One of the key elements in encouraging use of this structure will be the main span crossing the N25. This span will be viewed by users of the N25 on exiting and entering Cork City and has the potential to be a landmark signature structure that both encourages active travel modes on the bridge itself but also promotes active travel modes in the wider area.

7.2 Concept Development

Several engagement sessions with CCC, at early stages of the optioneering process, identified suitable structural forms and assessed examples of similar structures. The presented structural options and examples in Section 4.2 of this report are the outcome of these discussions. Further development of the preferred option will take place at the next stage. Further development of the aesthetic of the tie ins to the north and south and landscaping surrounding the structure will also be considered in further detail at the next stage.

7.3 Summary of Aesthetic Evaluation Main Bridge Crossing

The table below summarises the scores assigned to each bridge option based on the above aesthetic evaluation. Structural Option 3 is deemed to be the most preferred option. The use of slim cable elements and a high arched profile is considered to provide a landmark structure for entering and exiting Cork City and is considered to have the highest likelihood of encouraging increased use of the crossing. The concrete portal frame over the Irish rail track is proposed to be screened by trees and vegetation and is considered to be aesthetically neutral as a result.

Structural Option 1 is considered to be the next most preferable option as it is an impressive long span structure and could be formed from an architectural truss. The long span nature of this structure is however slightly lost in the section that is screened by the trees between the Irish Rail line and N25.

Structural Option 2 is considered the least preferable superstructure option in terms of aesthetics. The span over the N25 is shorter than Option 1 and the structural form is more utilitarian and less striking than structural Option 3.

Table 7.1: Aesthetic Evaluation – Main Span Structure

Criterion	Option 1 Single span steel through truss	Option 2 Two span steel through truss	Option 3 Steel network arch & RC precast portal frame
Aesthetic Merit	3	2	5

7.4 Summary of Aesthetic Evaluation Elevated Ramp Structure

The aesthetics of the approach ramp elevated structures are considered neutral for both options as there is no major distinguishing factors between them as structural span lengths and forms will be similar for either option.

Table 7.2: Aesthetic Evaluation – Ramp Structure

Criterion	Steel Elevated Ramp Structure	Precast Prestressed Concrete Elevated Ramp Structure
Aesthetic Merit	3	3

8. Durability and Maintenance Requirements

Bridge structures in Ireland are designed and detailed to Eurocode Standards and TII specifications, which require a 120-year design life.

The durability and maintenance requirements of bridges is particularly important due to the long design life and outdoor environments bridges structures are exposed to. This is particularly relevant for structures close to marine environments, where the increased quantity of chlorides due to coastal waters present an additional corrosion risk.

The location of the proposed crossing in this case also passes through several heavily vegetated areas. The moist environment, lack of direct sunlight, and falling vegetation can also lead to increased maintenance requirements and accelerated corrosion of some forms of construction. This has been considered in the development of structural options for this structure.

Minimising maintenance requirements was considered as a key driver in developing the structural options and will be considered further in the next stages of design for the chosen option. Key considerations in the next stage will be to minimise the use of bridge bearings which have a shorter design life, provide appropriate paint systems to protect the structure where appropriate and to select materials and details which reduce maintenance liabilities.

When properly detailed, concrete elements are more favourable to steel due to the lower levels of maintenance required to achieve the designated design life. Concrete structures however are not always possible to achieve for a given span and structural depth.

For example, based on the preferred alignment structures options for the N25 span are all steel options with the main bridge structure above the deck level. This has allowed for the minimising of the structural depth. This is turn has helped to minimise the ramp lengths with consideration of the required gradients and the clearance envelopes required over the N25.

8.1 Construction Materials

8.1.1 Concrete Bridges

Concrete is an alkaline material which acts to protect steel from corrosion in reinforced concrete structures. Therefore, these structures are durable and require little maintenance over their lifetime if they have been properly detailed and constructed to a high standard in accordance with construction best practice.

Particular care should be taken in the design of prestressed concrete structures. In prestressed bridges, the prestressing tendons are under high stress and, subsequently will corrode more rapidly than ordinary steel reinforcement. However, it should be noted that compliance with current standards ensure that the 120-year design life of a structure can be achieved.

8.1.2 Steel Bridges

Structures comprising steel are subject to corrosion. Routine maintenance such as protective coat painting is required to ensure the steel structure remains in a satisfactory condition over its lifetime. Typically, a steel structure requires protective coating to be reapplied every 20 to 25 years.

Weathering steel is a material which is not painted but is formulated to develop an oxide patina which protects it from further corrosion. This is a suitable material for many highway structures as it retains the benefits of steelwork in terms of the longer span and lightweight structure abilities whilst not requiring as much maintenance as painted steel structures. In this case however, due to the proximity of the proposed structure to Cork Harbour weathering steel would not be suitable and has not been considered.

Stainless steel has a much higher resistance than painted mild steel to corrosion. The use of stainless steel for parapet components will be considered in the next stages of design but is not considered appropriate for the main structural elements due to the typically higher cost and lower strength.

8.1.3 Cables

Cables can consist of an assortment of steel strands or wires in varying arrangements. The strands and wires are produced from high strength steel and are typically subject to high stresses and, therefore have the potential to corrode more rapidly than ordinary steel reinforcement. However, a series of measures are provided to protect the steel in cables from corroding. It is therefore possible that the cables may not need replacement over the life of the structure.

In some cases, it is also possible for steel rods to be used in place of cables to act as tension members. These rods can be formed of stainless-steel material which is not subject to corrosion to the same extent and could be specified to achieve a 120-year design life without maintenance.

8.1.4 Expansion Joints and Bearings

The least durable components of the options considered above are the joints and bearings, which are required to accommodate the movement of the structure. These components are difficult to seal effectively to prevent the ingress of water and other corrosive materials. Where feasible, bearings and joints are removed by making the superstructure integral with the substructure. However, this approach has its limits. Particularly for multiple span structures.

Bearings can however be detailed to provide a life of approx. 40 years or more and allowances are made in the design of the superstructure and substructure for bearing replacement as part of a maintenance strategy.

Steelwork spans for this structure will have bearings minimised where possible which is consistent with TII and Irish Rail guidance.

8.2 Summary of Durability & Maintenance Evaluation

8.2.1 Option 1 – Single Span Steel Through Truss

This option consists of a steelwork superstructure crossing both the N25 and Irish Rail line. The volume of steelwork on this option is the largest of all options and will require maintenance in the form of cleaning and repainting at intervals of 20-25 years across its design life.

Access for maintenance of this structure will likely require temporary rail track and road closures. Bearings will be required for this option which will require temporary jacking of the structure to replace bearings at the end of their design life which will require both rail track and road closures during the works.

For main superstructure options this is considered the least preferable in terms of durability and maintenance.

8.2.2 Option 2 - Two Span Steel Through Truss

This option consists of two steelwork superstructures crossing both the N25 and Irish Rail line. These spans will require maintenance in the form of cleaning and repainting at intervals of 20-25 years across their design life.

Access for maintenance of this structure will likely require temporary rail track and road closures. Bearings will be required for this option which will require temporary jacking of the structure to replace bearings at the end of their design life during temporary rail track and road closures during the works.

This option is considered slightly more preferable to structural Option 1 in terms of durability and maintenance due to a smaller overall volume of steelwork requiring maintenance and the ability to potential construct the span over the rail line without bearings due to the reduce span length

8.2.3 Option 3 – Steel network arch & RC precast portal frames

This option consists of concrete portal frame structures over the Irish Rail track. This is a low maintenance option. No maintenance of the concrete structure would be required over the course of the design life with the exception of cleaning and periodic bridge inspection works.

A single span steel network arch structure is proposed for this option over the N25. Tension cables/bars in this structure are expected to require little maintenance over their design life if stainless steel elements are chosen. Main steelwork for this span will require repainting at intervals throughout the design life which may take place during temporary road closures. With this option the possibility of using a concrete deck can be assessed which will minimise the maintenance required of the deck but will increase the overall volume of steelwork required to support the concrete deck relative to a lighter steelwork deck. Bearings will be required for this option which will require temporary jacking of the structure to replace bearings at the end of their design life which will require road closures during the works.

This option is considered the most preferable main spans option in terms of durability and maintenance due to the significantly reduced maintenance requirement over the rail line.

8.2.4 Ramp Option 1: Steel Ramp Elevated Structure

This option consists of steel superstructures which may be preferable in terms of ease of construction and span lengths available but will require ongoing maintenance and repainting over their design life. For the southern approach ramp the environment is expected to be moist with falling vegetation which may accelerate the rate of corrosion for steel spans.

Access for the southern approach ramp for maintenance and repainting will also be difficult as vegetation grows back after the ramp has been constructed. Based on recent experience, maintenance of structures in similar locations have required regulatory approval in order to mitigate against environmental damage.

This option is considered less preferable in terms of durability and maintenance.

8.2.5 Ramp Option 2: Concrete Ramp Elevated Structure

This option consists of reinforced concrete superstructures and substructures. For the southern ramp area precast segmental bridge beam construction with infill concrete deck is proposed. This option does not require bridge bearings. For the northern park area, a monopile substructure with a concrete deck is proposed due to the ability of users to view the soffit from the below park.

Both these options, if detailed correctly will need minimal ongoing maintenance to the structure with the exception of cleaning of the structure and deck. This option will require maintenance to the surfacing although this is common with other options and can be completed from the deck level.

This option is considered the most preferable elevated ramp option in terms of maintenance and durability.

8.2.6 Landscaping/Embankments and Retaining Walls

Lower sections of ramps will be of embankments and landscaping as well as some sections of retaining walls. Low maintenance systems are proposed for these elements and they are common to both structural forms for elevated ramp structures. They are therefore considered neutral for the assessment of ramp options below.

8.3 Summary of Durability and Maintenance Evaluation Main Bridge Crossing

Table 8.1: Durability and Maintenance Evaluation – Main Span Structure

Criterion	Option 1 Single span steel through truss	Option 2 Two span steel through truss	Option 3 Steel network arch & RC precast portal frame
Technical Merit	2	3	4

8.4 Summary of Durability and Maintenance Evaluation Elevated Ramp Structure

Table 8.2: Durability and Maintenence Evaluation – Ramp Structure

Criterion	Option 1: Steel Elevated Ramp Structure	Option 2: Precast Prestressed Concrete Elevated Ramp Structure
Durability and Maintenance Merit	2	5

9. Hydraulic Considerations

9.1 Overview

All options for ramps and main structures span over ditches and waterways/streams that have been identified. No options have been identified to interfere with these streams at this stage. Further assessment of the preferred option will be made during the Environmental Impact Assessment and Flood Risk Assessment however for now, there is not deemed to be any distinction between options from a hydraulic perspective. The scoring below reflects this. The required bridge drainage via connection to a drainage network or direct outfall to adjacent streams and ditches will be reviewed further during the Environmental Impact Assessment.

9.2 Summary of Hydraulic Evaluation Main Bridge Structure

The table below summarises the scores assigned to each bridge option based on the above hydraulic evaluation.

Table 9.1: Hydraulic Evaluation – Main Span Structure

Criterion	Option 1 Single span steel through truss	Option 2 Two span steel through truss	Option 3 Steel network arch & RC precast portal frame
Hydraulic Merit	4	4	4

9.3 Summary of Hydraulic Evaluation Elevated Ramp Structure

Table 9.2: Hydraulic Evaluation – Ramp Structure

Criterion	Option 1: Steel Elevated Ramp Structure	Option 2: Precast Prestressed Concrete Elevated Ramp Structure
Hydraulic Merit	4	4

10. Environmental Considerations (Environment)

10.1 Environmental Risks

Several environmental risks have been identified over the course of the feasibility and optioneering study. Key environmental risks are discussed briefly below. It is not considered that there are significant difference between structural options in relation to environmental risks. There have been no environmental risks identified at this point that would preclude the use of any of the proposed structural options for the main spans or the approach ramps. As part of the environmental screening process environmental risks pertinent to the preferred option will be identified in more detail and mitigated accordingly during the next stage of design.

Potential Hydraulic linkages to Cork Harbour SPA

Streams and ditches have been identified either side of the N25 in early investigations. When setting the locations of potential abutments for the structural options these water bodies have been avoided. The potential linkages of these water bodies to the Cork Harbour SPA will be considered in the Environmental Impact Assessment and appropriate mitigations made for the chosen structural option.

Risk of bird strike

A risk of bird strike has been identified for structures crossing the N25, in particular due to the structure for all options being above the deck level. It should be noted that there are currently large gantries crossing the N25 at close proximity where this issue has not been identified. As part of the Environmental Impact Assessment the requirement for winter bird surveys and bird collision impact assessments will be investigated.

Embodied Carbon and sustainability

Due to the scale of the proposed crossing an amount of embodied carbon will be generated by all options. It is not considered that there are significant distinguishing factors between steel and concrete construction in this regard. Concrete with a higher proportion of admixtures to reduce carbon can be considered. While structural steel is currently more easily recycled, it is generally not produced as close to site as the equivalent concrete product meaning transport emissions are likely larger. For all options it is considered that the promotion of sustainable transport will help to mitigate the embodied carbon generated over the service life of the structure.

Vegetation and biodiversity

From an environmental perspective all options pose a similar level of risk.

Overall, and in light of the above considerations, it is concluded at this point that structural options score neutral with regard to environmental risks.

10.2 Summary of Environmental Evaluation Structure

The table below summarises the scores assigned to each bridge option based on the above environmental evaluation.

Table 10.1: Environmental Evaluation – Main span structure

Criterion	Option 1 Single span steel through truss	Option 2 Two span steel through truss	Option 3 Steel network arch & RC precast portal frame
Environmental Merit	3	3	3

10.3 Summary of Environmental Evaluation Elevated Ramp Structure

The table below summarises the scores assigned to each ramp option based on the above environmental evaluation.

Table 10.2: Environmental Evaluation – Ramp structure

Criterion	Option 1: Steel Elevated Ramp Structure	Option 2: Precast Prestressed Concrete Elevated Ramp Structure
Environmental Merit	3	3

11. Health and Safety Considerations

This section considers the health and safety risks associated with the construction and maintenance during service of the different bridge options. The safety aspects for the end user are considered negligible between the different bridge options considered.

11.1 Safety during Construction

A detailed discussion of constructability is contained for each option in Section 12 of this report. All options can be constructed and appropriate measures can be taken for all options to maintain safety during construction of foundations and abutments.

The proposed indicative construction methodology for all options allows for the erection of spans over the N25 and Irish Rail tracks in short construction windows. As a result, there are no major distinguishing factors for safety during construction between the options.

11.2 Safety during Maintenance

As considered previously, maintenance requirements for concrete structures are considered lower than steel elements and, as a result, lowers the associated risks.

Any bridge option with steel elements requires extra maintenance introducing additional risks to maintenance operatives and members of the public during the working life of the structure. Structures with cables also include additional risks working at height inspecting cables however this risk can be minimised by the use of stainless-steel elements which require lower maintenance.

However, best practice maintenance methods will ensure the highest safety standards for all options during maintenance works.

Due to the use of durable cable elements in the N25 span structure and a concrete structure over the Irish Rail line and the associated need for less maintenance Option 3 scores higher than Option 2. Option 2 scores higher than Option 1 also due to the reduced height of structure helping to make the structure more easily maintainable. Maintenance can also take place on the N25 span without impacting the Irish Rail span and vice versa.

11.3 Summary of Health and Safety Evaluation Main Bridge Structure

The table below summarises the scores assigned to each bridge option based on the above health & safety evaluation.

Table 11.1: Health & Safety Evaluation

Criterion	Option 1 Single span steel through truss	Option 2 Two span steel through truss	Option 3 Steel network arch & RC precast portal frame
Health & Safety Merit	2	3	4

11.4 Summary of Health and Safety Evaluation Elevated Ramp Structure

The table below summarises the scores assigned to each bridge option based on the above health & safety evaluation. Option 1 scores slightly lower due to the increased need for maintenance and the inherent safety risks of working at height during maintenance operations.

Table 11.2: Environmental Evaluation – Ramp structure

Criterion	Option 1: Steel Elevated Ramp Structure	Option 2: Precast Prestressed Concrete Elevated Ramp Structure
Health & Safety Merit	3	4

12. Construction and buildability

The below sections give a high-level indication of feasible construction methodologies for different options. A more detailed possible construction sequence for the preferred option will be developed during the preliminary design stage.

12.1 Foundation/Substructure Construction Sequence

Indicative construction sequences for main bridge foundations/substructures are given below:

Adjacent N25

- Offline site clearance, using overnight lane closures if required.
- Piling of foundations adjacent to N25 during night and/or weekend lane closures or using traffic management.
- Fixing of reinforcement and temporary works for abutments using traffic management.
- Pouring of concrete for abutments during lane closures.

Adjacent Irish rail track

- Offline site clearance, using overnight track closures if required.
- Piling works using rigs staying outside the Irish Rail exclusion zone during night closures of the rail line.
- Fixing of reinforcement and temporary works for abutments using traffic management.
- Pouring of concrete for abutments outside the Irish Rail exclusion zone.

12.2 Structural Option 1

Indicative steelwork erection sequence for the main superstructure for Option 1 is as follows:

- Bridge spans assembled off site and driven on N25 using trailer or self-propelled modular transporters (SPMTs), overall trailer + structure height to be less than 5.7m to clear under bridges and gantry's on N25.
- Tandem crane lift for main span over N25 using mobile cranes.

This option is the largest single structural option with an estimated steelwork tonnage of 150 tonnes. Required cranes will need to be reviewed in detail at the next stage should this be selected as the preferred option.

12.3 Structural Option 2

Indicative steelwork erection sequence for the main superstructure for Option 2 spans is as follows:

- Bridge spans assembled off site and driven on N25 using trailer or SPMTs, overall trailer + structure height to be less than 5.7m to clear bridges and gantry's on N25
- Tandem crane lift for main span over N25 using mobile cranes.
- Single crane lift from centre of Irish Rail span, note crane will need reach of approx. 30m.

The bridge superstructures steelwork tonnage is estimated at approximately 30 tonnes for the Irish Rail Span and 60 tonnes for the N25 span.

12.4 Structural Option 3

Indicative steelwork erection sequence for the main N25 superstructure for Option 3 is as follows:

- Bridge fabricated off site in northern park area.
- Bridge superstructure lifted onto 6m wide northern approach ramp and Irish Rail spans. Weight distributed through SPMT groups.
- Bridge launched from ramp with nose picked up over N25 with SPMTs and temporary works steel frame. Temporary works steelwork bracing required to arch.
- Median barriers to be removed during launch and reinstated.

The bridge superstructure steelwork tonnage is estimated at approximately 55-60 tonnes.

For the Irish Rail span a precast concrete segmental portal frame structure is proposed. These structures are designed to be erected in short windows of time using standardised processes and have been used over multiple rail lines, in particular in the UK. It is anticipated that the portal frame foundations and structure would be constructed over a single or multiple weekend track closure.

12.5 Elevated Ramp Structures

The likely construction sequence for both steel and concrete elevated ramp structural options will be largely similar. See indicative sequence below.

- Tree clearance along proposed southern ramp alignment to Radisson Blu carpark.
- Construction of temporary piling surfaces and crane pads on north and south.
- Construction of piles/piers and reinforced concrete pilecaps/crossheads.
- Construction of temporary crane pads adjacent to ramp positions.
- Erection of steelwork/precast concrete beams.
- Construction of in-situ deck sections for concrete option.

- Completion/installation of parapets, drainage, lighting and surfacing from deck level.

The construction of northern embankments and the southern retaining wall can take place in parallel with the above works. They are not expected to require any significant non-standard construction works and working space is easily accessible.

13. Ground Conditions

The following assessment of the geology of the site and ground conditions has been inferred from available information. No assurance is given to its accuracy and will be assessed further in the next stage of preliminary design following completion of the geotechnical investigation.

Northern Area:

Existing ground investigation data in this area extends to 7.5m below ground level. The ground conditions encountered typically consisted of soft and or loose alluvial/estuarine deposits to 1.5- 2.0m, underlain by cohesive alluvial/estuarine material to at least 7.5m BGL.

N25:

Existing ground investigation data in this area extends to 24m below ground level and was carried out after construction of the road. The ground conditions encountered were typically made ground (presumed to be cohesive engineered embankment fill) to 2.3m BGL underlain by a granular layer 0.4m thick presumed to be a crushed rock engineered fill. Underlying this made ground was approximately 5.5 – 6.0m of soft grey organic CLAY/SILT, underlain by approximately 9.5m of medium dense to very dense sandy GRAVEL. The final stratum encountered was a stiff sandy gravelly CLAY. Thickness of this stratum was not proven.

Southern Area:

Existing ground investigation data in this area extends to 19.5m below ground level. The ground conditions encountered typically consisted of cohesive made ground to a max depth of 2m BGL, underlain by approximately 4m of sandy gravelly CLAY/SILT with shell inclusions, organic lenses. The final stratum encountered was clayey sandy GRAVEL, becoming gravelly CLAY with depth. Thickness of this stratum was not proven.

14. Consultation with Relevant Authorities

Consultation during the optioneering stage has taken place with the following authorities

- Cork County Council.
- Transport Infrastructure Ireland.
- Irish Rail.

Consultation during the next stage of the project, preliminary design will take place with the above authorities and stakeholders and the following:

- National Transport Association.

- Irish Water.
- Utility Providers - ESB, Irish Water, Gas Networks Ireland, Eir.
- Radisson Blu Hotel owners/management.
- Private landowners.
- Eastgate Business Park owners/management.

15. Additional Department of Transport Common Appraisal Framework Qualitative Appraisal Criteria

15.1 Economy

See Section 6 of this report for a comparative cost estimate of different options.

15.2 Environment

See Section 10 of this report.

15.3 Integration

The proposed bridge structure will provide transport and modal integration on the north with the Little Island train station, local bus services and the Middleton to Cork City greenway which runs on the past the Little Island train station on the Glounthaune Road. On the southern side the proposed bridge will integrate with the Eastgate Business Park, the Radisson Blu hotel, and the wider Little Island Area. Transport integration on the southern tie in will be provided with connections to improved bus services provided within the Eastgate Business Park as part of the LISTI project.

The need for this integration and the north south connection over the Irish Rail line and the N25 has been identified by the previous Little Island Sustainable Transport Strategy improvements study. Section 7 of the Cork Metropolitan Area Transport Strategy has also identified the need for a connection from the Middleton-Dunkettle Interurban Cycle Route to Little Island which this bridge crossing will function as. The scheme also aligns with the Cork Cycle Network Plan (CCNP).

This crossing will provide greater walkability for the area and reduced walking and cycling times between Little Island train station and Eastgate promoting the use of sustainable transport modes.

All bridge options in this report provide the same level of integration with regard to land use integration, transport integration and modal integration. Therefore, there is no scoring allocated in the multi criteria assessment to differentiate between options presented.

15.4 Safety

See section 11 of this report.

15.5 Accessibility and Social Inclusion

The proposed scheme is inherently beneficial in terms of accessibility and social inclusion. With regards to social inclusion the scheme provides a major integration link which allows for safe transport by public transport, walking and cycling which is beneficial to more vulnerable and lower income groups.

Regarding accessibility, key constraints in the bridge alignment and ramp length have been to provide ramps of gradients which are suitable for use by people with disabilities in accordance with the latest TII and UK DMRS standards. Consideration has also been given in the Alignment and Width Options Assessment to the required widths for cycling, pedestrians, and wheelchair users.

Considerations have been given to SUSTRANs, TII standards, UK Local Transport Notes, the Inclusive mobility standard and other relevant standards as outlined in the appended report. In addition, visual segregation between the footway and cycleways have been proposed as well as a 2-way cycleway to improve the bridges accessibility for all users.

15.6 Physical activity

The main aim of this scheme is to provide an improved means of connection for pedestrians and cyclists between Little Island Train Station and Eastgate Business Park. All options presented in this report will meet this functional requirement and will encourage users to engage in physical activity as a means of transport. A key element in promoting and encouraging greater use is bridge aesthetics. A bridge with a high aesthetic value can be considered to be more likely to attract users. This has been considered in the multi criteria assessment under 'Aesthetics' in section 7 of this report.

15.7 Other Government Policy Integration

The need for investment in enhanced sustainable transport infrastructure generally is supported by European, national, regional and local public policy objectives. Transport access that encourages active travel and sustainable transport is important to reach sustainability goals. In addition, an improved pedestrian and cycle access to and through the Eastgate Business Park site is well established in policy as presented below:

- National Planning Framework (Government of Ireland, 2018);
- National Development Plan (Government of Ireland, 2021);
- National Investment Framework for Transport in Ireland (Department of Transport, 2021);
- UN Convention for the Rights of People with Disabilities (UNCRPD) (Government of Ireland, 2019);
- Climate Action Plan (Government of Ireland, 2021);
- Design Manual for Urban Roads and Streets (Government of Ireland, 2019);
- Cork County Development Plan 2014-2020.

15.8 Non-quantifiable economic impacts

Improved sustainable transport access to the Eastgate Business Park and linking the Little Island Train Station, Eastgate Business Park and Cork to Middleton Greenway with high quality active travel connections will lead to better geographic integration of the area. Active travel linkages that support sustainable mobility will protect against further local segregation and enable economic growth without encouraging increased car use. The improvement of connections to transport interchanges on the site provide for a greater local and regional connectivity through public transport options.

16. Conclusion

16.1 Comparison of Main Span Bridge Options

Table 16.1 below summarises the scorings for multi criteria assessment. The evaluation covers the main crossings over the Irish Rail line and the N25.

Table 16.1: Multi Criteria Assessment Scoring of Bridge Options

Assessment Criteria	Bridge Options		
	Option 1 Single span steel truss	Option 2 Two span steel truss	Option 3 Steel network arch & RC precast portal frames
Technical	2	4	3
Economic	3	4	3
Aesthetic	3	2	5
Durability and maintenance evaluation	2	3	4
Hydraulic	4	4	4
Environmental	3	3	3
Safety	2	3	4
Overall	19	23	26

16.2 Preferred Bridge Option – N25 and Irish Rail Spans

Based on the scoring matrix provided in Table 16.1, Structural Option 3 emerges as the preferred structural option for this bridge. See Figure 16.1 and Figure 16.2 for indicative details. This option consists of a steel network arch structure with a concrete deck over the N25, segmental precast concrete portal frame structures over the Irish rail land and reinforced concrete elevated structures forming the approach ramps. Lower sections of the approach ramps will be formed of at grade walkways and embankments/landscaping. The exact mixture of elevated structure and embankment is to be developed further at the preliminary design stage.

It is anticipated that foundations will be of piled construction with portal frame foundations potentially on shallow foundations. This will be confirmed in the preliminary design phase.

The bridge deck will have an effective width of 5m, as outlined in the Alignment and Width Options Assessment. The structural width will be approximately 6m to allow for parapets and fixings. Bridge approach ramps will have a maximum gradient of 1 in 22 as discussed in this report.

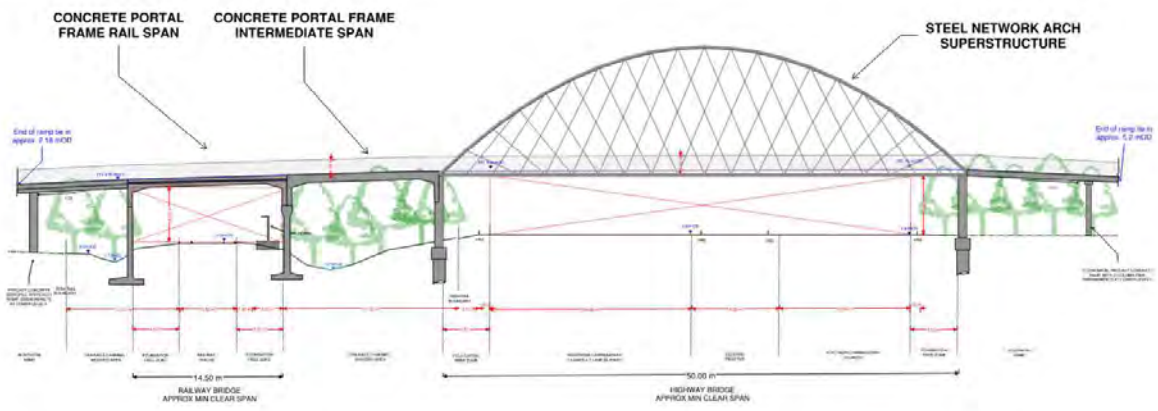


Figure 16.1: Indicative elevation of preferred option showing Irish Rail and N25 spans and beginning of approach ramps

Figure 16.2 shows the updated preferred alignment. Further to the Alignment and Width Options Assessment, detailed topographical survey information has led to the design developing on the southern approach. Northern and southern tie ins for the preferred design will continue to be developed in Phase 3, preliminary design.

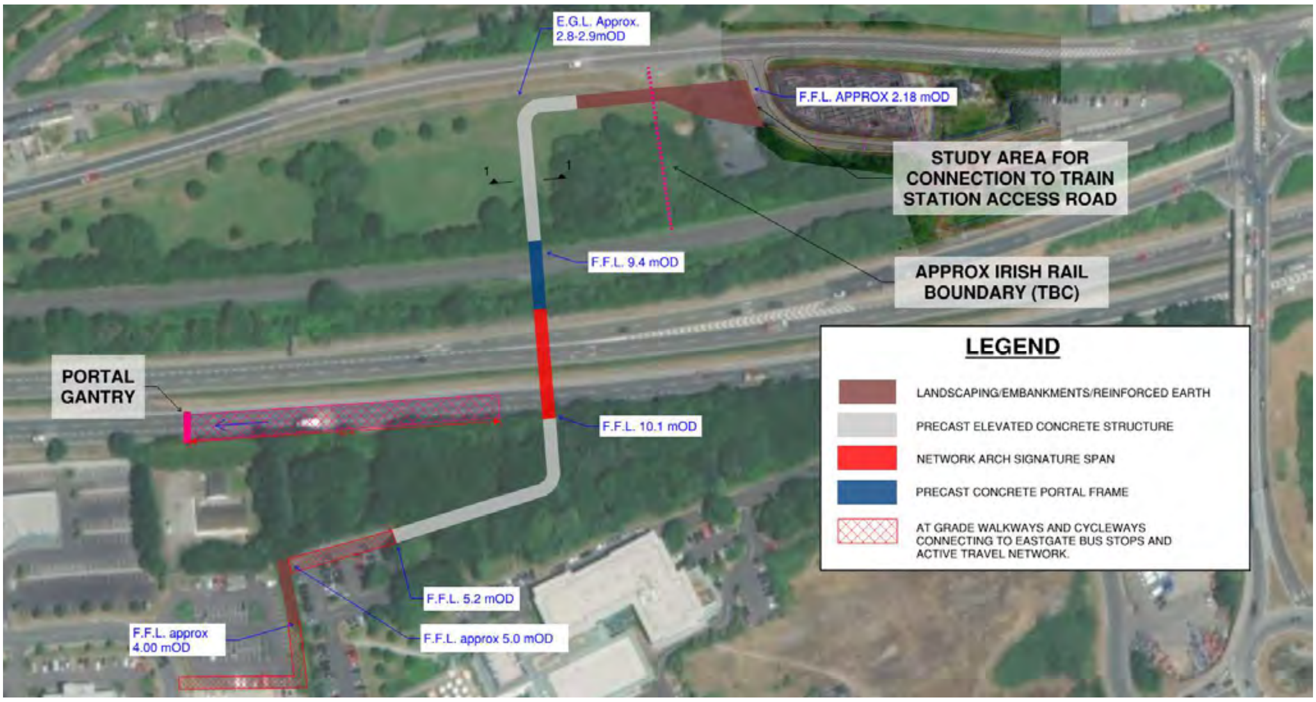


Figure 16.2: Indicative plan of preferred option with structure types

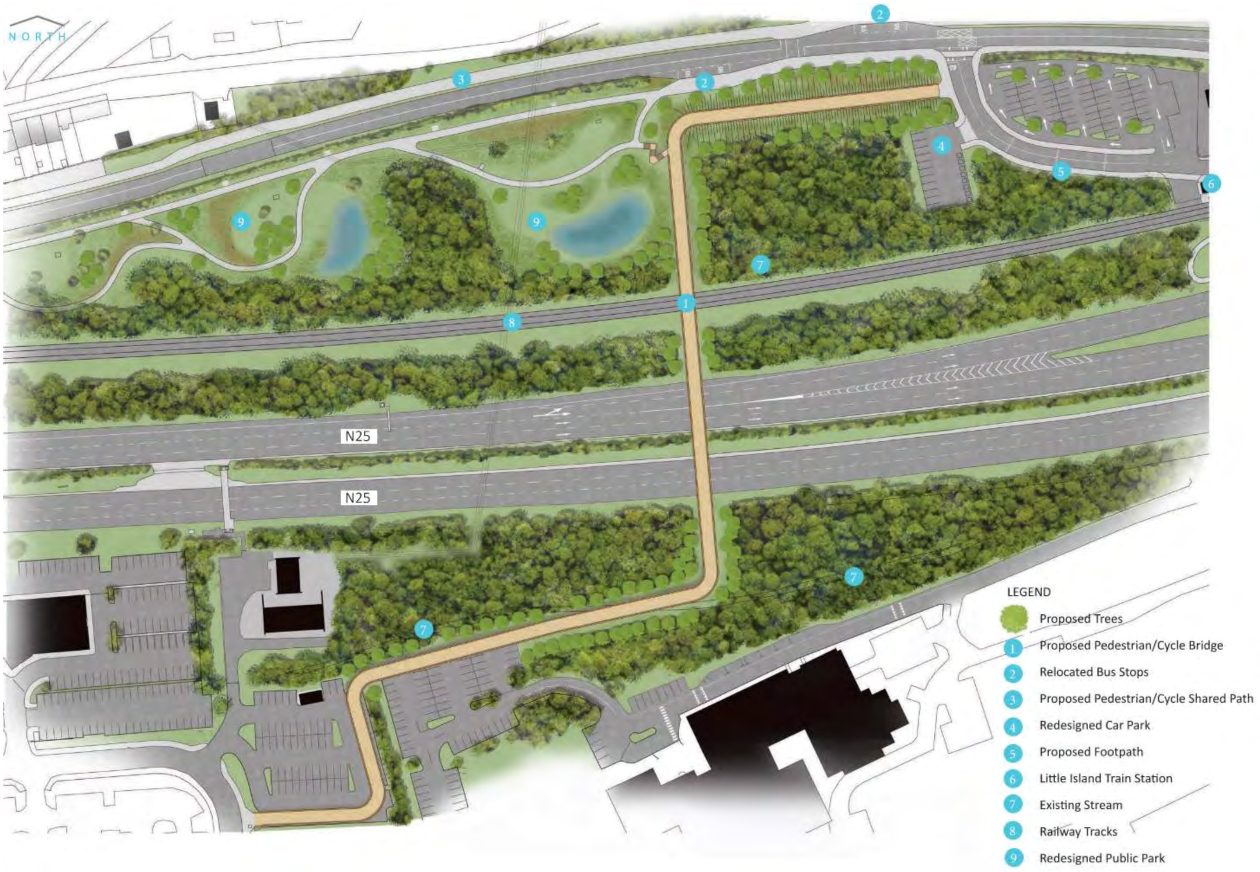


Figure 16.3: Landscape architecture sketch of preferred option

The proposed N25 span structural form will consist of a steel network arch structure with a reinforced concrete deck to ensure a consistent design aesthetic is maintained with the reinforced concrete decks provided on the approach ramps and Irish Rail span.

A reinforced concrete deck will also allow for a reduced maintenance liability on the main span for repainting over the lifetime of the structure. Indicative cross sections of the N25 span are provided in Figure 16.5.

Figure 16.4: Example of network arch structure with concrete deck

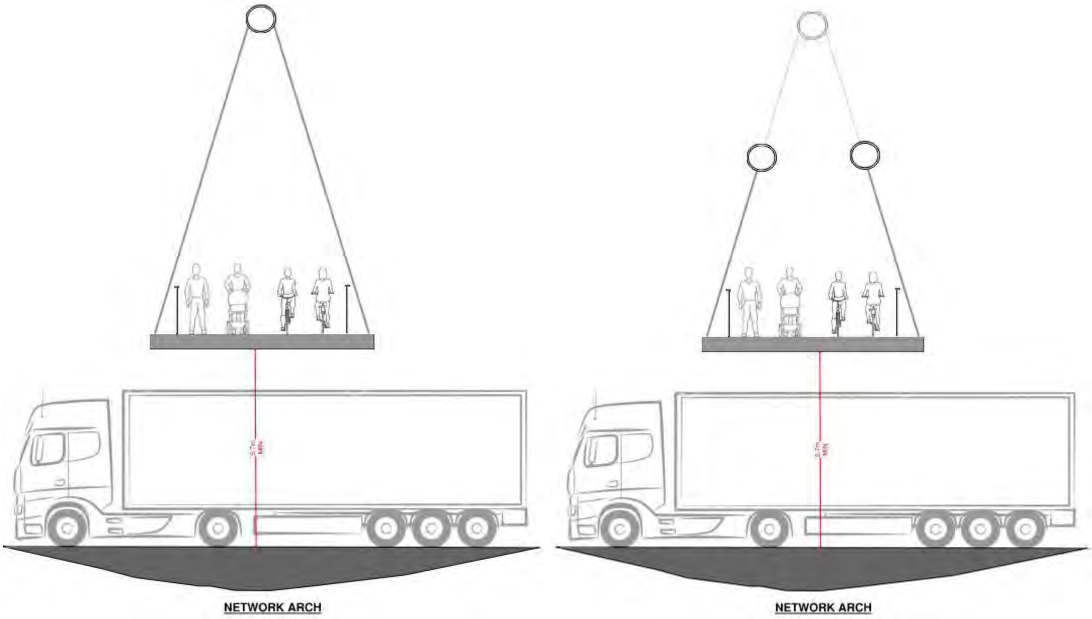


Figure 16.5: Indicative cross sections through network arch N25 span

16.3 Comparison of ramp options

The below table summarises the scorings for multi criteria assessment. The evaluation covers the elevated approach ramp structures.

Table 16.2: Multi Criteria Assessment Scoring of Bridge Options

Assessment Criteria	**Ramp Options**	
	Option 1 Elevated Steel ramp structures	Option 2 Elevated concrete ramp structure
Technical	3	3
Economic	3	3

Assessment Criteria	**Ramp Options**	
	Option 1 Elevated Steel ramp structures	Option 2 Elevated concrete ramp structure
Aesthetic	3	3
Durability and maintenance evaluation	2	5
Hydraulic	4	4
Environmental	3	3
Safety	3	4
Overall	19	25

16.4 Preferred approach ramp options

Based on the above scoring mechanism, for the elevated sections of both approach ramps concrete structures have been proposed. These have been proposed primarily to provide economical, low maintenance and durable structures given the location of the approach ramps close to the ocean and within a moist and vegetated wooded environment.

Figure 16.6 provides indicative cross sections of elevated ramp structures. For the northern approach ramp a concrete deck with a monopile/column is proposed to provide a higher aesthetic finish for users of the park below. As members of the public are not anticipated to use the southern wood, for the southern approach ramp (right) a precast prestressed concrete beam structure with in-situ reinforced concrete infill, sitting on 2 pile piers will be used as more economical structure that will retain a similar design aesthetic for the user from the deck.

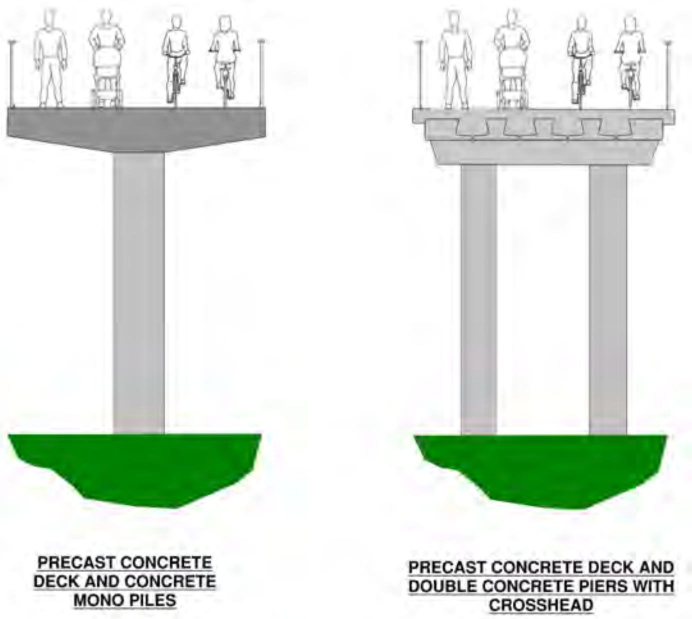
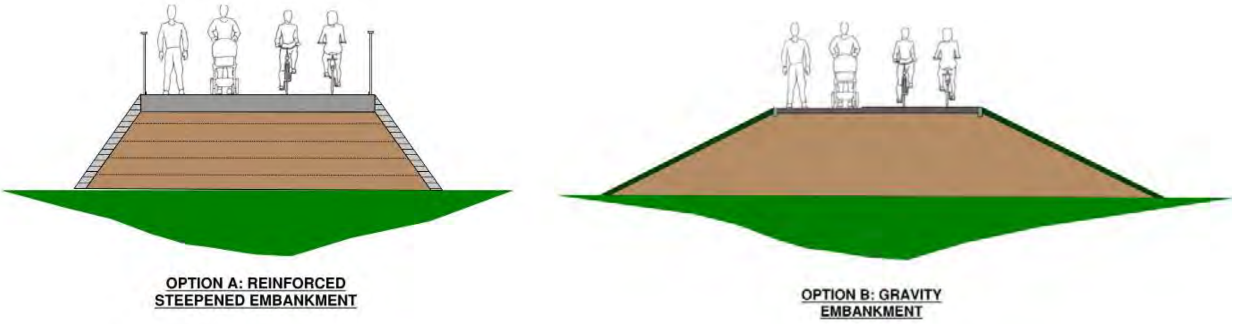


Figure 16.6: Indicative cross sections of elevated ramp structures

Indicative embankment types have been provided in Figure 16.7. Embankments and landscaping are to be used in lower sections of the approach ramps. Tie in details will be developed further in the preliminary design phase.



OPTION A: REINFORCED STEEPENED EMBANKMENT

OPTION B: GRAVITY EMBANKMENT

Figure 16.7: Indicative embankment types

16.5 Parapet options

For the N25 span and the approach ramps and steps several parapet types are possible. 1.4m high parapets will be required on these spans. The parapet type to be used will be confirmed at the next phase in consultation with CCC, TII and Irish Rail. Two types of parapets under consideration (outside of Irish Rail span) are post and rail with steel wire mesh infill (Figure 16.8) & vertical post infill at closely spaced centres (Figure 16.9).

For the Irish Rail span, as discussed in this report, a 1.8m high parapet is required, with the first 1.2m having solid infill and the top 0.6m having mesh infill. Achieving a consistent user experience and aesthetic treatment between the main span and Irish Rail span is important. Details of how the bridge parapets transition between each span will be developed in more detail at the next phase in consultation with Irish Rail.

Figure 16.8: Parapet type with vertical post and rail and steel mesh infill

Figure 16.9: Parapet type with vertical parapet infill

16.6 Parapet over Irish Rail

For the span over the Irish Rail track it is proposed that the same parapet height and type that is used elsewhere on the crossing will be used. Using a consistent and open parapet across the structure with adequate levels of lighting will greatly improve the aesthetic experience for the user and help to make the bridge a safe and inviting crossing option. This in turn will encourage greater use and an increased modal shift to sustainable active travel modes.

It is acknowledged that Irish Rail overbridges typically require 1.8m high parapets with the bottom 1.2m having solid infill and the top 0.6m having mesh infill. To mitigate against the reduced height of parapet and ‘open’ type infill it is proposed that an ancillary solid inclined underbridge protection screen will be used to shield users from the rail and potential future overhead electrical lines. The shield will also serve as a catch for rubbish and debris. A kicker plate will also be provided along the base of the parapet to prevent debris being kicked off the bridge.

The design approach of this underbridge screening shield is in keeping with international best practice and has been used recently on similar pedestrian and cycle bridges in the Netherlands and Denmark. Danish standards are less onerous and only require a parapet height of 1.2m where a screen is also use. It is proposed for this structure a parapet height is maintained at 1.4m height to meet TII cycle parapet requirements. See below images illustrating requirement from Danish Standard BaneDanmark BN1-105 and also an example of a recently completed bridge in Odense, Denmark showing the under-bridge screens.

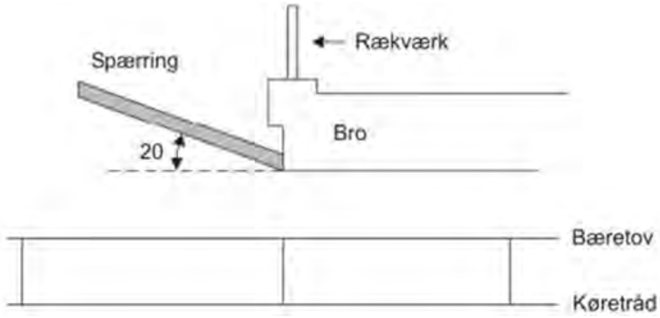


Figure 10 Requirement for inclined under bridge screen in Danisg Standard BaneDanmark BN1-105

Figure 11 Example of under bridge screening on new pedestrian and cycle bridge in Odense, Denmark with 1.2m high parapets with vertical bar infill

16.7 Security

A number of items will be considered during the development of the preliminary design for the preferred option. A key objective of the design will be to promote use and help to ensure the crossing feels safe to use and avoids anti-social behaviour here possible by design. The following will be considered

- Adequate lighting to ensure feeling of safety for users.
- High Aesthetic design to encourage footfall.
- CCTV cameras to enhance user safety and prevent anti-social behaviour.
- Adequate bins to prevent littering.
- Avoidance of concealed areas, in particular in the northern amenity park, with areas concealed from view of the existing roadway to prevent anti-social behaviour.
- High quality vandal proof parapets.
- Open parapet design to avoid bridge feeling ‘locked in’.
- Kick plates on the N25 span to avoid falling debris onto the road below.
- Anti-graffiti paint to allow ease of cleaning and maintenance.

Appendix A

Alignment and Bridge Width Options Assessment Report

Contents

Tables

Figures

1. Introduction

1.1 Background and overview

Cork County Council (CCC) and the National Transport Authority (CCC) are proposing a new pedestrian and cycle crossing linking Little Island train station with Eastgate business Park and the wider Little Island environs. The proposed bridge will cross the N25 and the Cork to Middleton/Cobh train line approximately 10km to the East of Cork City centre, see Figure 1.1. Arup were appointed by CCC in 2020 to undertake a feasibility report on this crossing and have now been appointed to progress the bridge design through Phases 2 and 3 (NTA PAG's), options assessment, preliminary design and statutory planning. This technical note forms the basis of the bridge alignment (route selection) evaluation and bridge usable width assessment.

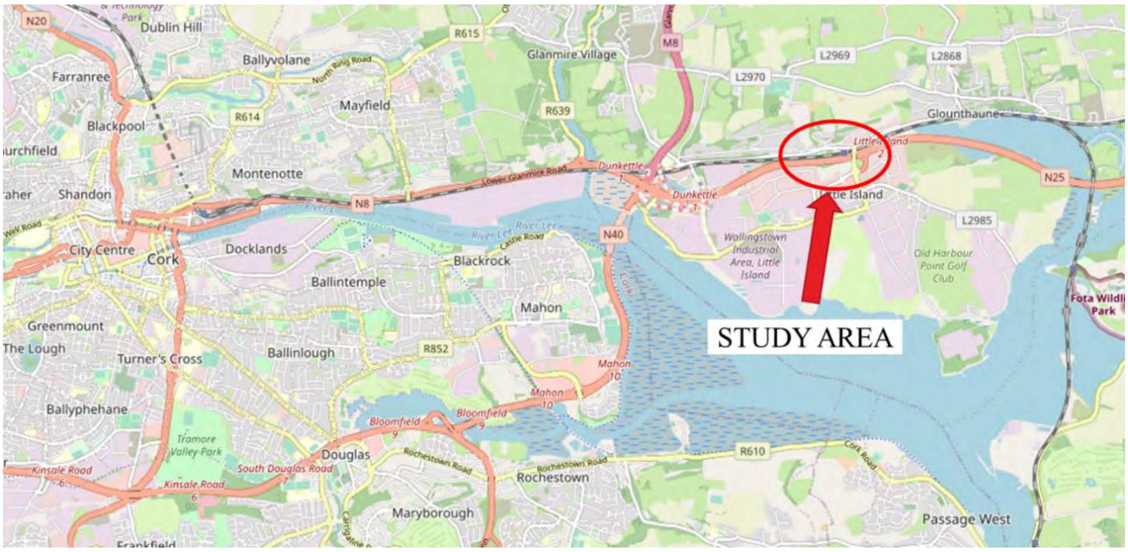


Figure 1.1: Location of proposed bridge crossing @OpenStreetMap contributors

Prior to the Arup feasibility report the requirement for a new pedestrian and cycle bridge in Little Island Co. Cork was identified as part of the Little Island Sustainable Transport Interventions Project (LISTI). The aim of the bridge is to provide efficient pedestrian and cycle connectivity between the Little Island Train Station and the Eastgate Business Park as well as Little Island as a whole and to promote sustainable transport modes while minimising impacts on the surrounding area and environment. The proposed bridge will provide safe access to the Eastgate business park and Little Island from the Little Island train station and from the planned Cork to Middleton greenway.

At present, the route for those travelling from the Little Island Train Station to the Eastgate Business Park is via the existing An Crompan Bridge to the east. The existing bridge has a single footpath on the western side and no cycle lanes, thus providing substandard active travel infrastructure. The location of the bridge, east of the Eastgate business park, also means that users travel a considerable additional distance between Eastgate business park and Little Island train station which discourages user travel to Eastgate by a combination of train and active travel means.

The Arup feasibility report highlighted several potential alignment options within the study area, given in Figure 1.2. This technical note is informed by this feasibility study and further develops alignment options for consideration with a view to determining the emerging preferred crossing alignment.

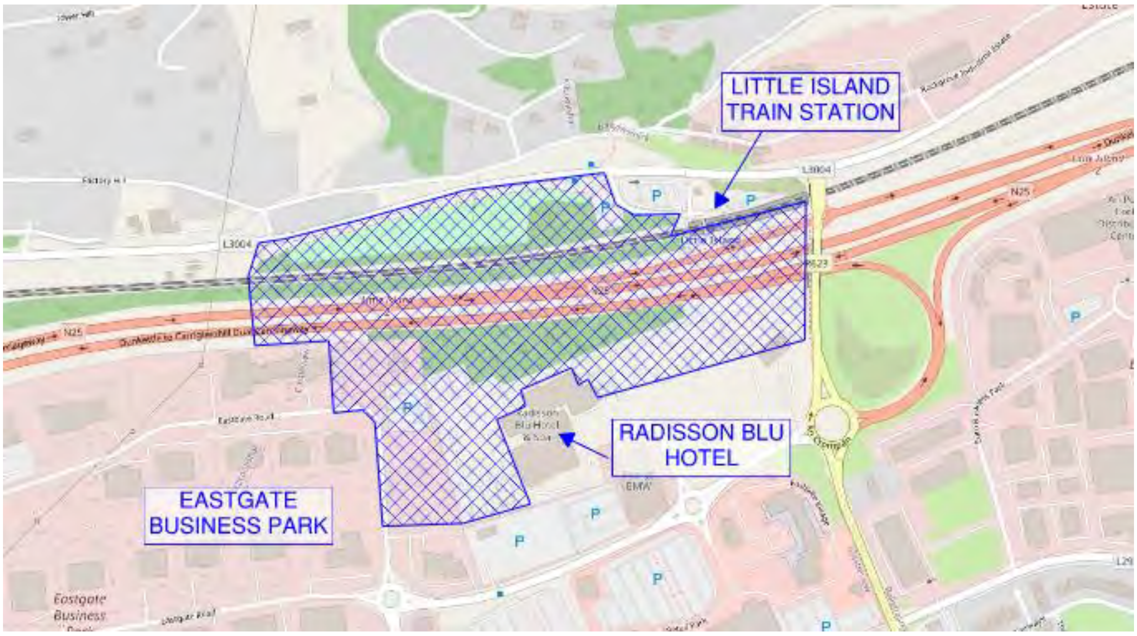


Figure 1.2: Crossing alignment study area @OpenStreetMap contributors

1.2 Scope of Technical note

The purpose of this note is to present the relevant information and constraints to recommend the emerging preferred bridge and approach ramp alignment for the proposed N25 Little Island Pedestrian and Cycle bridge.

This note also aims to specify the appropriate bridge width to be used in further optioneering and design. In this note, the bridge width refers to the internal/user width of the bridge. The overall bridge structural width will be dependent on the structural form selected and will be wider than the usable width.

The bridge width recommendation will be determined using relevant Irish codes and standards and taking guidance from current international best practice, to help ensure the bridge is future proofed for potential increased pedestrian and cycle traffic.

Additionally, this note will consider the requirements for pedestrian/cyclist segregation on the proposed bridge and approach ramps and provide a recommendation to be taken forward based on codes, standards and best practice.

The bridge structural form will not be evaluated in this note. This note will be appended to the Structural Options Report and will form the basis of the justification for preferred bridge/ramp alignment and width.

2. Alignment

2.1 Background

As part of the LISTI project, an initial examination of 4 potential bridge landing locations were identified and examined across the N25 into Little Island. The 2021 Arup feasibility report narrowed down the feasible alignment to 3 high level options in the preliminary options assessment.

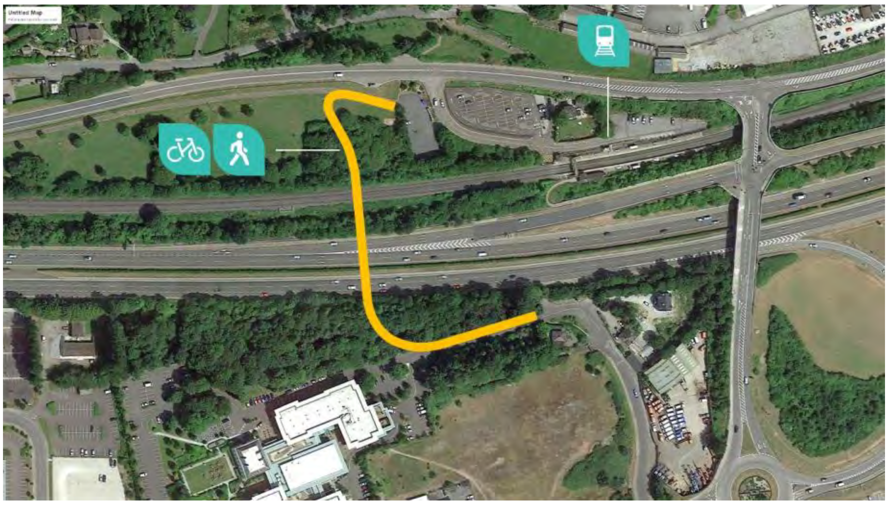


Figure 2.1: Feasibility study alignment option 1

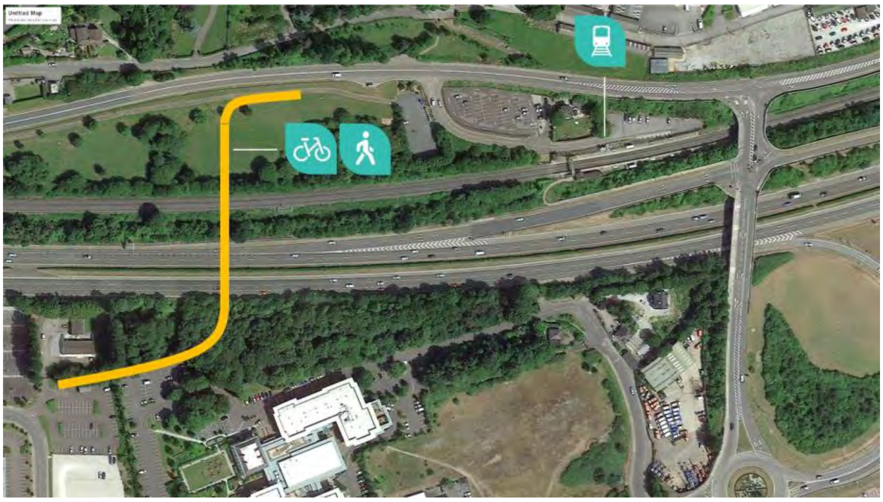


Figure 2.2: Feasibility study alignment option 2

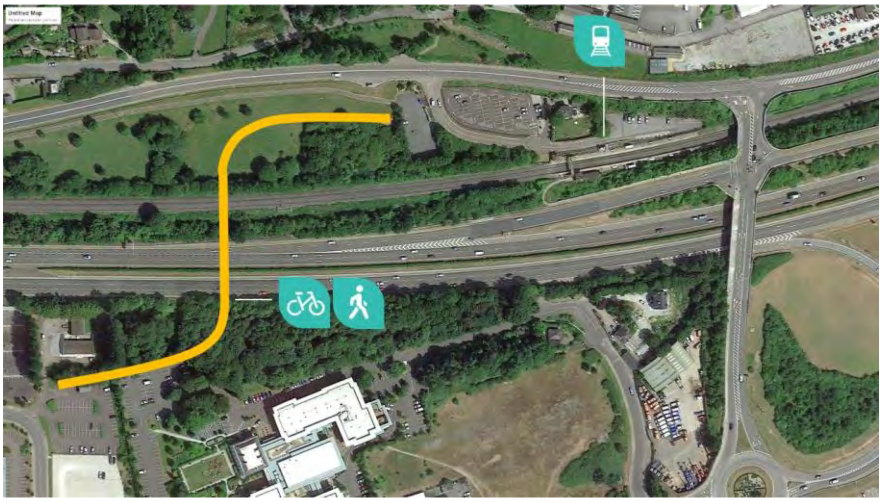


Figure 2.3: Feasibility study alignment option 3

The above alignment options were analysed against site constraints as part of the preliminary options assessment. Topographical survey information was not available at this time however and as a result a further alignment evaluation with more detailed information is given in this report. As alignment options 2 and 3 from the feasibility report are very similar and ramp location will be largely dependent on topography and ramp length they have been combined in this study as option 2 for consideration.

2.2 Alignment Options for Assessment

With the information gathered during the feasibility phase of this project as well as the information obtained at the current phase of the project, the following 3 bridge alignment options have been brought forward for consideration.

An alternative crossing option to the west of the study area has now been considered. This option is deemed to be worthy of consideration due to its southern ramp location away from the wooded areas south of the N25. This is given in this note as alignment Option 3. See Figure 2.4 for indicative alignment options to be further reviewed in this note.

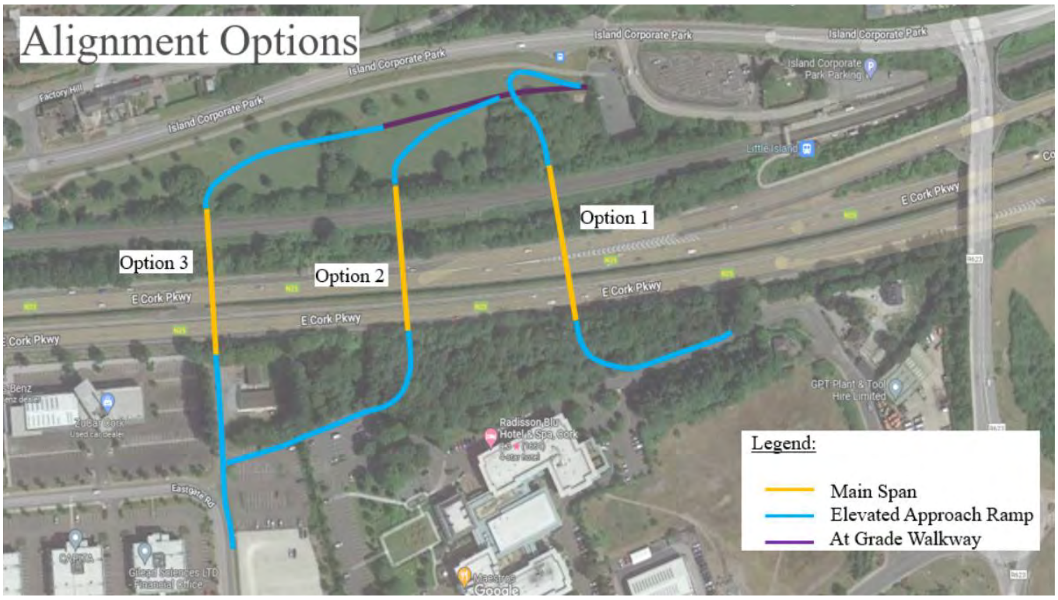


Figure 2.4: Options assessment bridge alignment options

2.3 Alignment Constraints

2.3.1 Vertical alignment

The vertical alignment of the structure over the N25 and Irish rail land is set by the required clearance envelopes of Transport Infrastructure Ireland and Irish Rail (IÉ). From discussions with both these stakeholders TII require 5.7m vertical clearance to the bridge soffit over the highway and IÉ require 5.3m vertical clearance to the bridge soffit above top of track level. These constraints and the required structural depth below finished footway level dictate the top of approach ramp levels on the north and south approaches.

For the purposes of this report a vertical clearance of 5.7m to internal Eastgate business park roads will also be deemed necessary to allow access for service and delivery vehicles.

TII DN-STR-03005 Design Criteria for Footbridges requires a maximum slope on approach ramps of 1:20 (5%) which dictates the minimum ramp length. DMRB CD353 Section 5.11 (below) which has been updated more recently clarifies that for gradients of 1 in 22 no intermediate landings are required. As the overall structural length for a 1 in 20 gradient including landings is very similar to that of a 1 in 22 gradient with no landings it is proposed that the design proceeds based on a maximum 1 in 22 gradient (4.5%).

2.3.2 Topography

A topographical survey specific to this project has not yet been completed however the design team have obtained a LIDAR survey of the Irish Rail land and track (IÉ), topographical information for roads in the Eastgate business park (Arup) and topographical information for the N25 Dunkettle scheme (TII). Inputs from these surveys has allowed for an estimate of ramp lengths and tie in points to be made for the alignment evaluation. Further development of the emerging preferred alignment option will be made when full topographical information is available.

2.3.3 Catchment and desire lines

A key constraint of the alignment evaluation is to promote the use of active travel modes between the Little Island train station area and the Eastgate Business Park. Long detours which deter users from using the railway station or the proposed structures are undesirable.

Developing an alignment which caters well for key catchments and increases the potential for modal shift to active and sustainable transport modes is critical. Also, choosing an alignment which integrates well with other sustainable transport hubs at the little Island Train station and planned facilities being provided under the Little Island Sustainable Transport Improvements is essential.

The main centre of employment on the south side to be targeted is considered the Eastgate Business Park which contains the majority of existing and planned employment in the Little Island area which has been identified by the Little Island Sustainable Transport Improvements planning report. On the north side the main integration hub to connect to is the Little Island train station area.

Irish Rail are currently designing upgrades to the pedestrian bridge at the Little Island train station and there is a link from the south platform of the station to the An Crompan bridge. It is acknowledged that this link will continue to be used by some pedestrians accessing the East side of Little Island. As a result, a connection with a similar southern end point to the east side of little Island is not considered to be as effective in creating modal shift as a connection to the Eastgate area.

Mapping

2.3.4 Environmental constraints (Statutory consents)

Article 8 of the Roads Regulations 1994 (Road development prescribed for the purposes of Section 50(1)(a) of the Roads Act, 1993 (as amended) specifies the classes of development which require an EIA, including:

‘The construction of a new bridge or tunnel which would be 100 metres or more in length’

In addition, Section 50(1)(c) of the Roads Act, 1993 (as amended) specifies the following:

‘Where a road authority considers that any proposed road development (other than development to which paragraph (a) applies) ….would be likely to have significant effects on the environment…’

For all alignment options the overall length will be more than 100m and an EIAR will be required, therefore it is difficult to compare alignment options based on this constraint. It may be possible that some options will have greater environmental impact than others however it is not possible to quantify this until EIA screening has taken place.

As outlined in the feasibility report the study area is not in a Natura 2000 site, however there are two sites in the vicinity. An appropriate Assessment (AA) screening assessment ill take place following the selection of a bridge alignment to determine the likely impact on a Natura 2000 site and to determine if a Natura Impact Statement is required.

2.3.5 Road/rail signage and gantries

To the West of the study area there are two new sign gantries over the N25. A cantilever gantry on the North and a portal gantry on the south. Further to initial discussions with TII a site line of absolute minimum 200m, but preferably 250m will be required to both gantries and signs. The proposed bridge structure cannot obscure this site line. See Figure 2.5, which gives an indicative set back required from both gantries. This offset will need to be confirmed and agreed with TII once road levels are confirmed by the topographical survey. If a bridge is too close to the gantry TII will likely require this gantry to be moved which will require the reconstruction of foundations etc. During the next stage of this project, preliminary design, the preferred alignment option will be reviewed further to ensure adequate recognition time for signs and legibility is not obscured in accordance with EN 12966.

At an early engagement meeting IÉ identified a signal box approximately at the location of alignment option 2 on the southern side. IÉ has verbally confirmed that this should not pose a constraint to the bridge alignment as it is located at a lower level and on the outside of the curve. The preferred alignment will need to be agreed with IÉ.

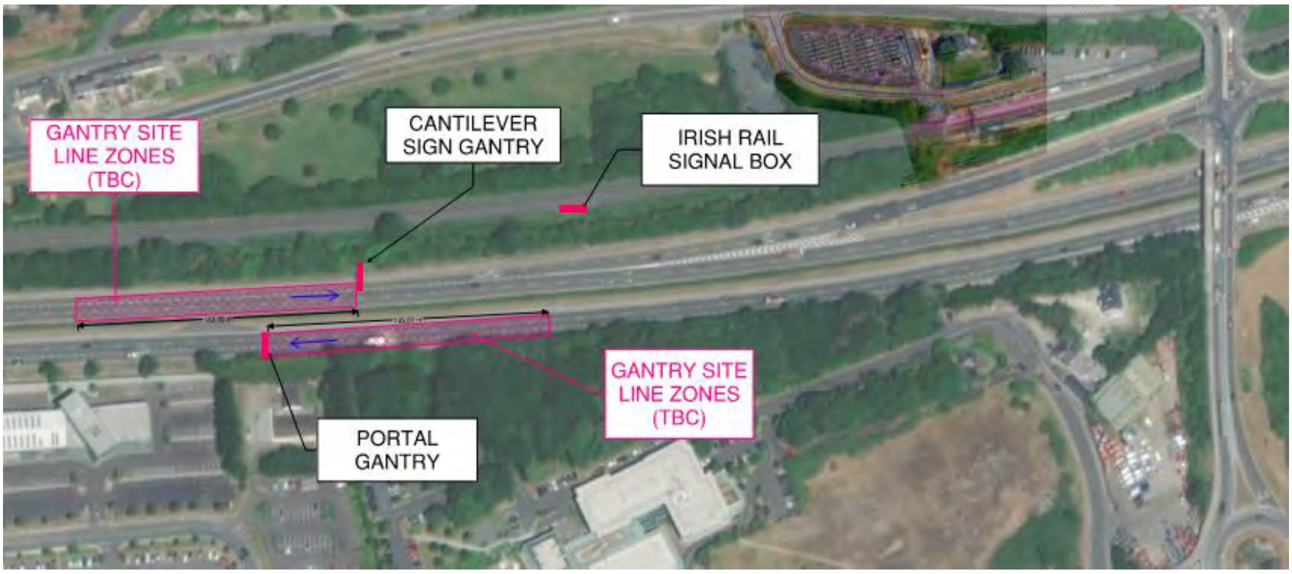


Figure 2.5: N25 Gantries Locations and site line zones & Irish Rail signal location

2.3.6 Landowners and stakeholders

Figure 2.6 provides info of the landowners/stakeholders to be considered in the evaluation of different alignment options. Details of private landowners are to be confirmed and appropriate consultation made by CCC following a selection of the emerging preferred alignment option. Efforts have been made in setting alignments to minimise clashes with existing and proposed developments.

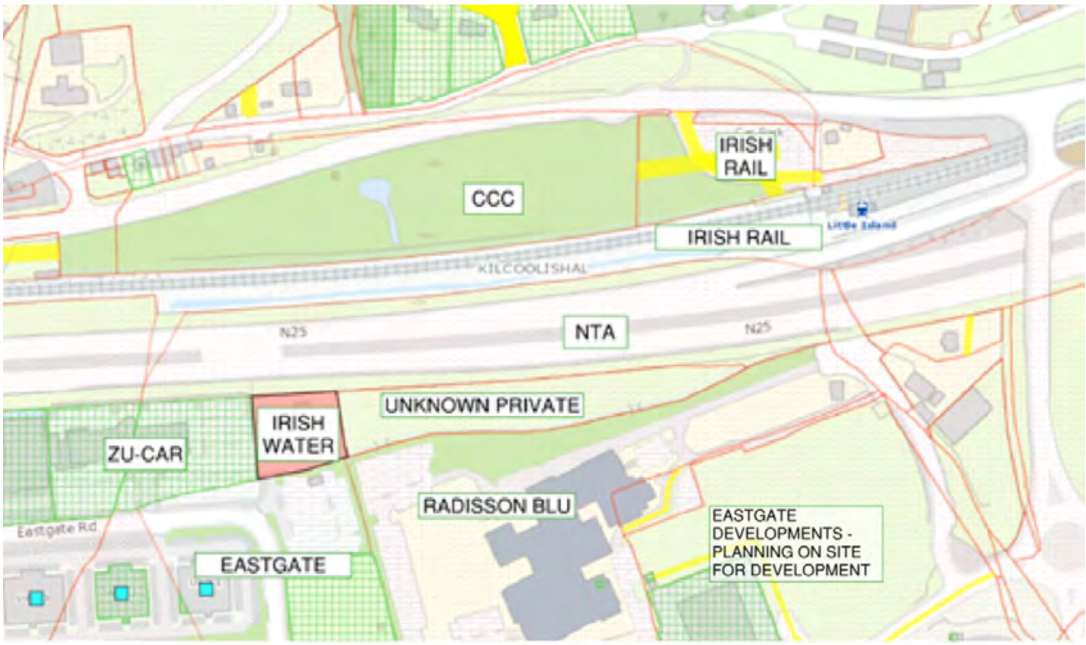


Figure 2.6: Landowner/occupiers from land registry

2.3.7 Cost and buildability

Relative costs of construction and buildability will be considered as part of the evaluation of alignment options by consideration of bridge and ramp lengths. A comparative cost assessment of bridge options will be completed as part of the Options Selection Report.

2.3.8 Services and utilities

Figure 2.7 gives indicative location of services and utilities in the study area as identified by the 2021 feasibility report. This image also shows indicative relative level differences on site based on a site walkover to be confirmed by the topographical survey. This level information as well as topographical information obtained from stakeholders is considered in the alignment options evaluation.

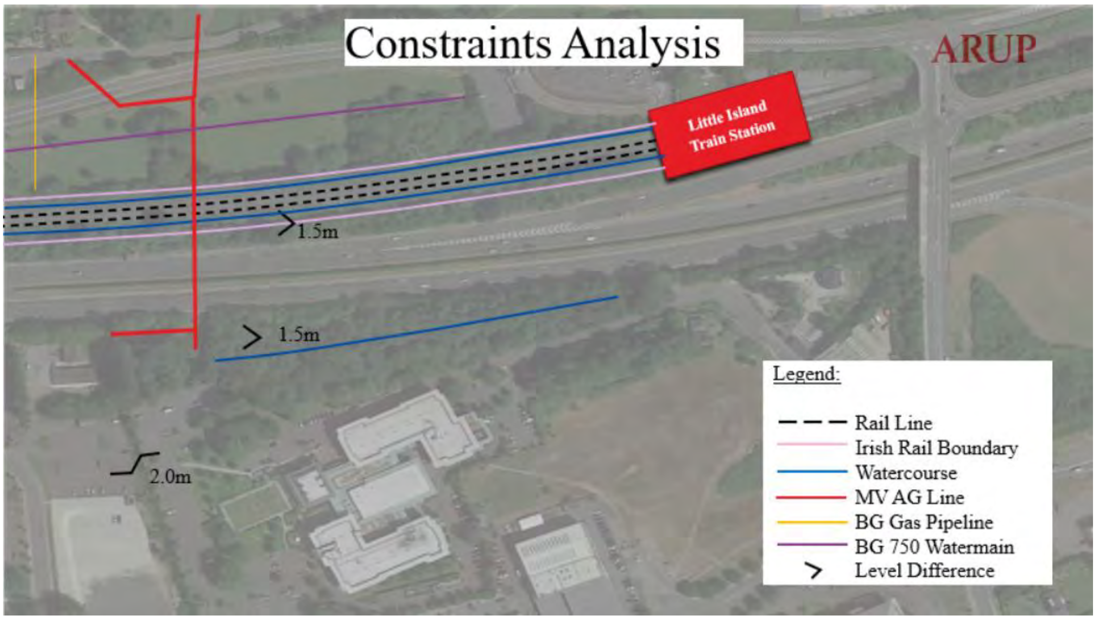


Figure 2.7: Indicative services and level constraints

2.4 Alignment Option 1

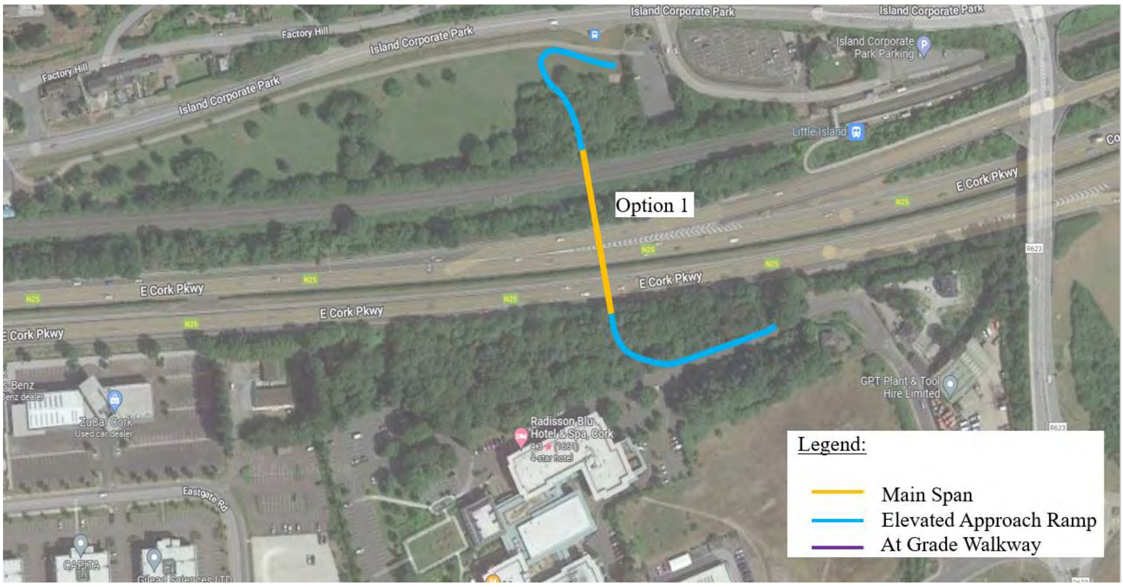


Figure 2.8: Bridge Alignment Option 1

Alignment Option 1 aims at keeping the proposed bridge as close as possible to the Little Island train station and existing An Crompan Bridge. The key considerations of this option have been outlined below.

The overall structure length is approximately 380m subject to review of ground levels when topographical survey is available.

Advantages:

- Shortest distance from the Little Island Train Station.
- Provides possibility for multi modal interchange at northern landing (rail, bus, cycling and pedestrian).

Disadvantages:

- Highest crossing over N25 due to raised off ramps leading to longer approach ramps than other options.

- Landing point not towards East gate business park, poor pedestrian, and cycle catchment, and tie in to Eastgate Business Park from south. Some pedestrians may continue using An Crompan Bridge.
- Length of northern ramp required does not distinguish crossing location greatly from option 2. Due to proposed location of crossing, there may be difficulty achieving length required for northern habitat.
- Tree felling and site clearance required for north and south ramps. Potential habitat disturbance.
- More difficult to construct and maintain southern ramp within wooded area.
- Sharp bend in northern ramp not preferred for cyclists.

Further to the feasibility assessment review of this option and further assessment at this stage, this option is not deemed to meet the basis requirements of encouraging active travel between Little Island train station and Eastgate Business Park and environs, as it is deemed to be off the desire line and would not provide a significantly different route to that already available via An Crompan Bridge.

Additionally, following review of the currently available topographical survey information and consultation with TII and IÉ it is clear that, to achieve a sufficient ramp length on the northern approach, the main crossing location would be very similar to that of alignment option 2. In this case there would not be an obvious advantage in terms of cost, buildability, statutory consents or desire lines for proceeding with Alignment Option 1 over alignment option 2. Therefore, Alignment Option 1 will not be considered further.

2.5 Alignment Option 2

Figure 2.9: Bridge Alignment Option 2

Alignment Option 2 main crossing moves further to the east from the Little Island train station however, the landing point of the bridge is towards the hub of the Eastgate Business park. Due to the required length of ramps the northern approach ramp still lands close to the Little Island train station. Key considerations of this option are outlined below.

The overall structure length is approximately 350m subject to review of ground levels when topographical survey is available.

Advantages:

- Landing points link Little Island Train Station to the business park providing a better desire line.
- Has been positioned so as not to affect gantry sight lines i.e., does not require gantries to be moved.
- Shorter sections of straight ramps may aid in slowing cyclist speeds.

- Shortest overall structure length. Lower structure relative to Option 1 over N25, avoids rising section of N25 off ramp. Can potentially utilise higher length of cheaper embankment on southern approach.
- Least interference with internal Eastgate Business Park roads and infrastructure. Instead uses currently unused wooded area for southern approach.
- Not expected to require gantries to be moved (TBC with TII).
- Provides possibility for multi modal interchange at northern landing (rail, bus, cycling and pedestrian);

Disadvantages:

- Tree felling and site clearance required for south ramp required. Potential habitat disturbance.
- More difficult to construct and maintain southern ramp within wooded area.
- Secondary approach ramp/embankment required between Radisson Blu carpark and Eastgate.
- Utility diversions may be necessary.

2.6 Alignment Option 3

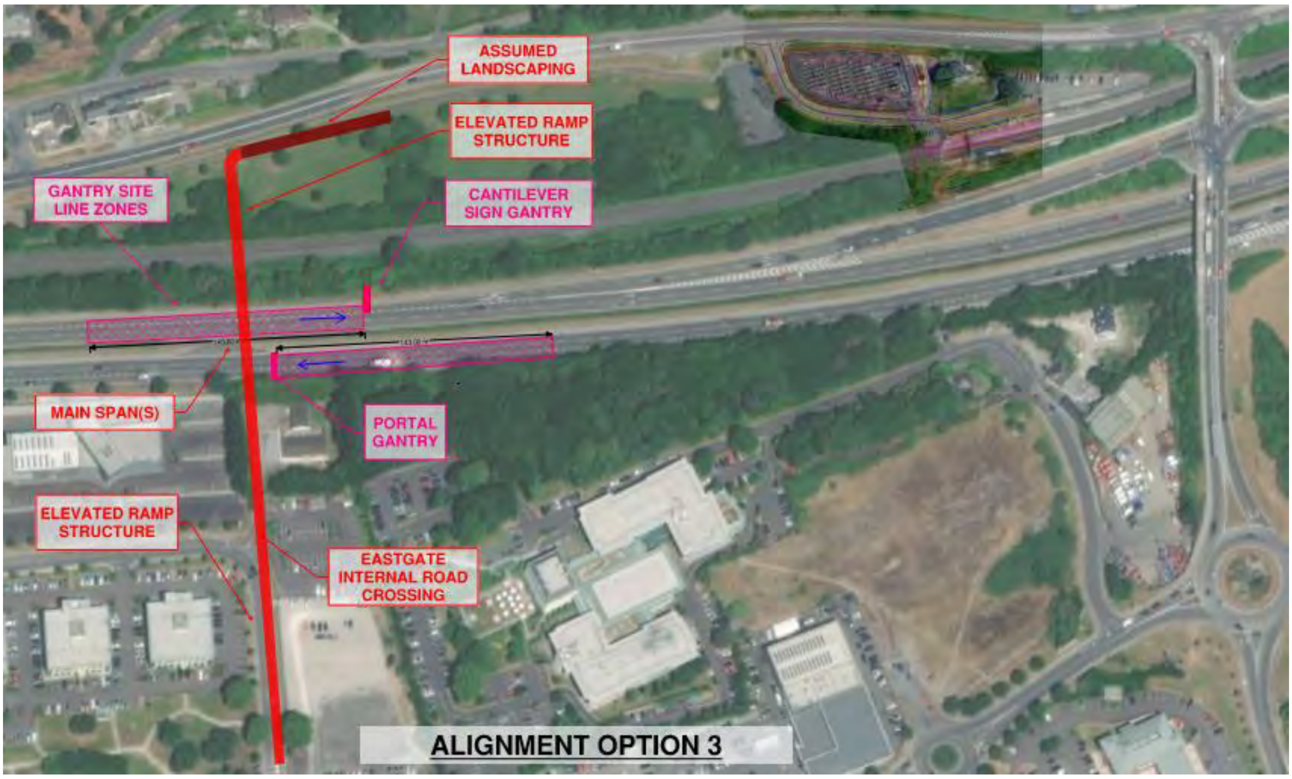


Figure 2.10: Bridge Alignment Option 3

Alignment option 3 is the furthest west of the options from the Little Island train station however, the landing point of the bridge is towards the hub of the east gate business park. Key considerations of this option are outlined below.

The overall structure length is approximately 390m, subject to review of ground levels when topographical survey is available.

Advantages:

- Minimises tree felling and potential habitat disturbance.
- Access for construction will be easier.
- Lower structure relative to option 1 over N25 as avoids rising section of N25 off ramp.

Disadvantages:

- Long straight southern ramp due to internal road crossing. Large amount of Eastgate land taken up along existing internal road, footway and cycle tracks which would require additional CPO;
- Landing points connect Eastgate business park to Little Island train station however base of northern ramp is approx. 170 m from the station car park. This leads to poorer connectivity.
- Located within gantry sight lines, will likely need to relocate the cantilever gantry.
- Northern abutment and ramp close to existing Bord Gais gas line. May need to provide utility diversion.
- Bridge elevation obscured on east approach by portal gantry, will affect aesthetics of the bridge regardless of bridge structural form.
- Southern ramp crossing Irish water premises which is currently in operation.
- Straight ramps sections encourage faster cycling speeds.

2.7 Alignment Options Evaluation

A multi-criterion assessment is carried out to establish a preferred alignment. The criteria have been assessed based on a scoring hierarchy from 1 to 5. An untenable solution, one which is unfeasible or detrimental to the progression of the project, scores a 1. While a characteristic which aligns with the core criteria of the brief and has a highly beneficial impact on the project receives a scoring of 5. An equal weighting has been given to all criteria.

Table 2.1: Preferred bridge alignment assessment

Criteria	Alignment options			Comment
	Option 1	Option 2	Option 3	
Economy	3	4	2	The longer structural length of Alignment Option 3, additional CPO and realigning of internal roads in Eastgate is expected to result in a higher cost in comparison to Alignment Option 2.
Integration/ Desire Lines	1	5	4	The distance between the Little Island Train station and Alignment Option 3 is seen as less desirable than that of Alignment Option 2. Option 2 can tie into a high-quality travel interchange at Little Island Train station. Alignment Option 2 ties provides a route into Eastgate with less diversions for some users from the Northern part of the park.
Statutory Requirements	–	–	–	Both Alignment Options will require an EIAR and it is likely both options will require a Natura Impact Statement. Therefore both options are neutral.
Third Party Engagement. Landowners	–	–	–	It is likely that both options will require significant third-party engagement and therefore, no option is preferred here.
Impact on existing development	2	4	3	Option 2 will take up land of existing landowners however this land is currently car parks and vegetated areas. Option 3 would interfere with the currently planned LISTI improvements in
Impact on services and utilities	3	4	2	Alignment Option 3 will require the relocation of the cantilever gantry on the N25. Additionally, Alignment Option 3 is closer to existing services on the northern approach.
User Safety	2	4	2	The straight ramp on Alignment Option 3 could increase the number of accidents/incidents on the bridge as cyclist are potentially encouraged to travel at higher speeds in comparison to the curved ramps of Alignment Option 2.
Total	11	21	13	

2.8 Recommendation

Based on the evaluation above of alignment options presented in this technical note, we recommend **Alignment Option 2** be taken forward as the preferred alignment option.

3. Bridge Width and Segregation

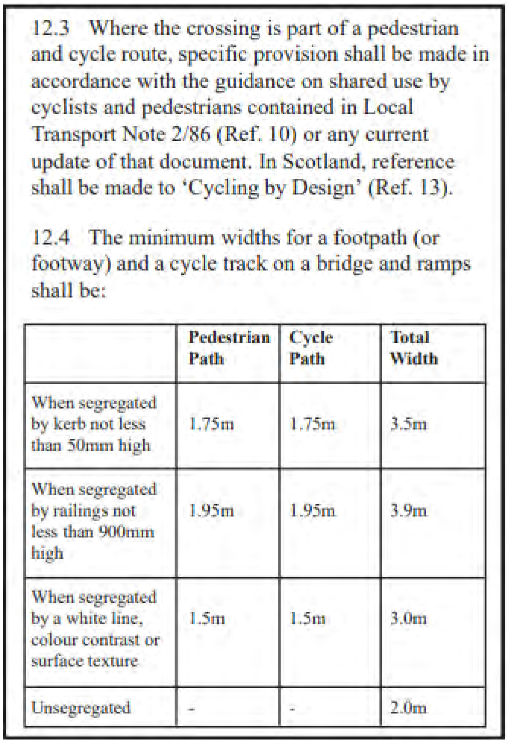
3.1 Bridge width

3.1.1 Overview

The usable deck width of the bridge should comply with all relevant Irish codes and standards and is informed by current international best practice. Given the design life of this type of structure at 120 years, the width should also be sufficient for future use and potential growth in user numbers. The bridge width is defined as the internal usable space between parapets in this note and does not look at overall bridge width.

3.1.2 Transport Infrastructure Ireland Standards

Transport Infrastructure Ireland (TII) DN-STR-03005 Design Criteria for Footbridges is largely based on the UK Design Manuel for Roads and Bridges (DMRB) BD29/04. Clause 12.3 defines the minimum bridge width for pedestrian and cycle bridges to be between 2m and 3.9m dependent on the level of segregation, which can be seen to be outdated. BD29/04 has been withdrawn and updated. TII DN-STR-03005 requires the current update of the UK Local Transport Note 2/86 be considered.



12.3 Where the crossing is part of a pedestrian and cycle route, specific provision shall be made in accordance with the guidance on shared use by cyclists and pedestrians contained in Local Transport Note 2/86 (Ref. 10) or any current update of that document. In Scotland, reference shall be made to 'Cycling by Design' (Ref. 13).

12.4 The minimum widths for a footpath (or footway) and a cycle track on a bridge and ramps shall be:

	Pedestrian Path	**Cycle Path**	**Total Width**
When segregated by kerb not less than 50mm high	1.75m	1.75m	3.5m
When segregated by railings not less than 900mm high	1.95m	1.95m	3.9m
When segregated by a white line, colour contrast or surface texture	1.5m	1.5m	3.0m
Unsegregated	-	-	2.0m

Figure 3.1: TII DN-STR-03005 Minimum Width Requirements

3.1.3 UK Local Transport Notes

The Local Transport Note 2/86 as referred to in TII DN-STR-03005 has been replaced with LTN 1/20: Cycle Infrastructure Design. LTN 1/20 gives guidance on cycle lane width requirements and directs the user to the 'Inclusive Mobility' document for footway width.

See excerpt from LTN 1/20 below with 2-way cycle track width requirements, Figure 3.2. Absolute minimum and desirable widths are defined based on peak hour cycle flow. Widths should be considered as effective widths with additional widths required dependant on the edge constraint type to maintain effective width, Figure 3.3. The Cork Cycle Network Plan 2017 section 4.5 presents a cycling proposed cycling mode share for AM trips in Little Island of 5% by 2025. Whilst modelling for future cycle numbers over a proposed crossing has not taken place, we recommend it would be prudent to allow for the absolute minimum effective cycle width for 300-1000 users per hour of 2.5m.

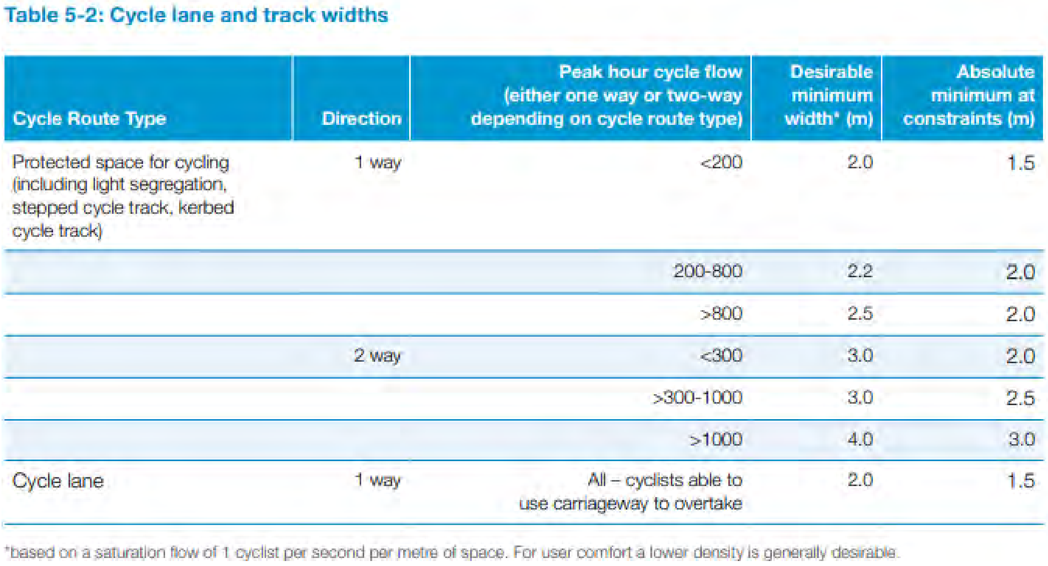


Table 5-2: Cycle lane and track widths

Cycle Route Type	Direction	Peak hour cycle flow (either one way or two-way depending on cycle route type)	Desirable minimum width* (m)	Absolute minimum at constraints (m)
Protected space for cycling (including light segregation, stepped cycle track, kerbed cycle track)	1 way	<200	2.0	1.5
		200-800	2.2	2.0
		>800	2.5	2.0
	2 way	<300	3.0	2.0
		>300-1000	3.0	2.5
		>1000	4.0	3.0
Cycle lane	1 way	All – cyclists able to use carriageway to overtake	2.0	1.5

*based on a saturation flow of 1 cyclist per second per metre of space. For user comfort a lower density is generally desirable.

Figure 3.2: LTN 1/20 Cycle Lane effective width requirements

Additional width for edge constraints will be required depending on the method of segregation. Additional 0.5m width should be provided adjacent to the cycle parapet and varying additional width of between 0m and 0.25m dependant on the method of segregation. Minimum cycle track width should be between 3m and 3.25m dependant on method of segregation.

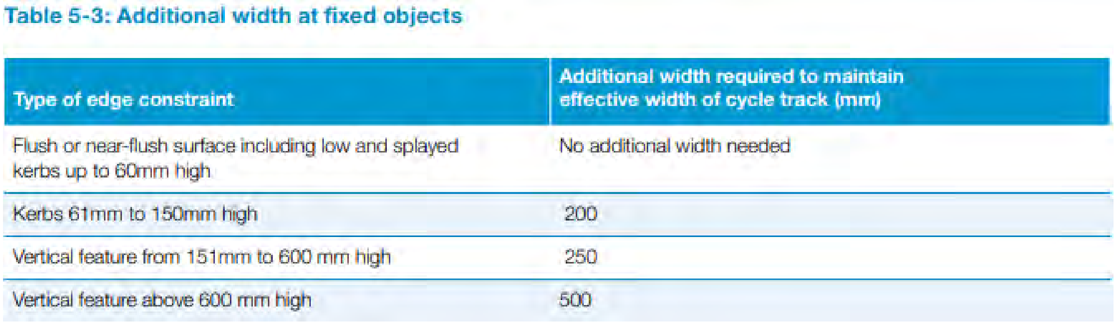


Table 5-3: Additional width at fixed objects

Type of edge constraint	Additional width required to maintain effective width of cycle track (mm)
Flush or near-flush surface including low and splayed kerbs up to 60mm high	No additional width needed
Kerbs 61mm to 150mm high	200
Vertical feature from 151mm to 600 mm high	250
Vertical feature above 600 mm high	500

Figure 3.3: LTN 1/20 Cycle additional width requirements for edge constraint.

The UK Inclusive Mobility document section 3.1 recommends a minimum clear width of **2m** for footways which allows two wheelchairs to pass each other comfortably. As per the guidance of LTN 1/20 and 'Inclusive Mobility' a total bridge usable minimum bridge width of between **5m and 5.25m** is recommended to be adopted depending on method of segregation.

3.1.4 National Cycle Manuel

The Irish Cycling Manual section 1.5.2 gives guidance on required cycleway width. The Width Calculator figure is reproduced below. From this figure the width requirements applicable for this crossing would be

A=0m (no kerb to footway, just painted line)
B=1.75m (minimum for basic 2 way)
C=0.5m (Outside edge parapet allowance)
D=0.25m+0.25m=0.5m (Additional allowance for uphill cycling + sharp bends)
A+B+C+D = 2.75m min.

This requirement is less onerous than the requirement for 3m cycleway width given by LTN 1/20.

A Inside Edge	B Cycling Regime	C Outside Edge	D Additional Features
Kerb 0.25m	Single File 0.75m	30kph, 3.0m wide lane 0.50m	Uphill 0.25m Sharp bends 0.25m
Channel Gully 0.25m	Single File + Overtaking, Partially using next lane 1.25m	50kph, 3.0m wide lane 0.75m	Cyclist stacking, Stopping and starting 0.50m
Wall, Fence or Crash Barrier 0.65m	Basic Two-Way 1.75m	Raised kerb, dropped Kerb or physical barrier 0.50m	Around primary schools, Interchanges, or for larger tourist bikes 0.25m
Poles or Bollards 0.50m	Single File + Overtaking, Partially using next lane 2.00m	Kerb to vegetation etc. (ie. cycleway) 0.25m	Taxi ranks, loading, line of parked cars 1.00m (min 0.8m)
	2 Abreast + overtaking (tracks and cycleways) 2.50m		Turning pocket cyclists 0.50m

Example:
To determine required cycle width, select the appropriate Inisde Edge, Cycling Regime, Outside Edge and any Additional Features

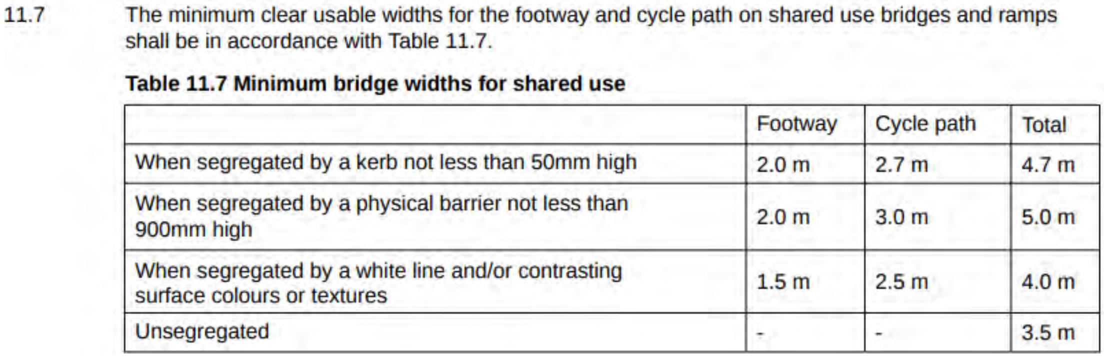
Channel Gully 0.25m	Single File + Overtaking, Partially using next lane 1.25m	50kph, 3.0m wide lane 0.75m	Around primary schools, Interchanges, or for larger tourist bikes 0.25m

0.25m
+ 1.25m
+ 0.75m
+ 0.25m
Required width = 2.50m Note: This is the maximum width for an on road cycle lane. Cycle tracks can be wider.

Figure 3.4: National Cycle Manual Width Calculator

3.1.5 UK DMRB Standards

TD29/04 has been superseded in the UK by DMRB CD 353 Design Criteria for Footbridges, this document gives minimum widths for shared bridges. The minimum usable bridge width for shared cycle and pedestrian use are given below. LTN documents are no longer referenced in CD353.



11.7 The minimum clear usable widths for the footway and cycle path on shared use bridges and ramps shall be in accordance with Table 11.7.

Table 11.7 Minimum bridge widths for shared use

	Footway	Cycle path	Total
When segregated by a kerb not less than 50mm high	2.0 m	2.7 m	4.7 m
When segregated by a physical barrier not less than 900mm high	2.0 m	3.0 m	5.0 m
When segregated by a white line and/or contrasting surface colours or textures	1.5 m	2.5 m	4.0 m
Unsegregated	-	-	3.5 m

Figure 3.5: DMRB CD 353 Bridge minimum width requirements

3.1.6 Dutch Standards

Although not strictly relevant in Ireland, Dutch standards have been considered as an example of available best practice.

The 'Dutch Design Manual for Bicycle and Pedestrian Bridges' gives minimum footway and cycleway widths. The minimum allowable width for a 2-way footway is 1.8m while the minimum allowable width for a two way cycleway is 2.575m (inclusive of safety margins, 1 vertical barrier and 1 side painted strip). This would give an overall bridge width of 4.375m.

3.2 Segregation

3.2.1 Overview

This bridge is intended to be used by pedestrians, cyclists, and other non-motorised users. The decision on whether to segregate bridge users will influence safe cycle speeds and the promotion of cycle use. Relevant codes and standards as well as international best practice will be considered in the recommendation of segregation type, if any.

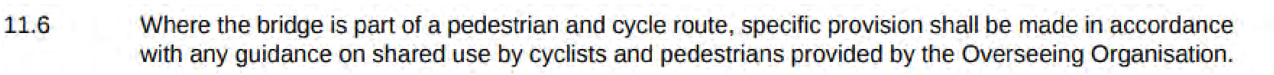
3.2.2 Relevant standards

TII

TII DN-STR-03005 does not give any guidance on segregation on the bridge structure but instead states that segregation should be determined locally.

UK DRMB

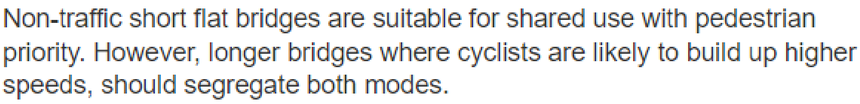
UK DMRB CD353 Design Criteria for footbridges states that *segregation shall be consistent over the full length of the footbridge and its approaches,* however it does not provide guidance on the decision to segregate or not segregate. Instead, clause 11.6 states the following.



11.6 Where the bridge is part of a pedestrian and cycle route, specific provision shall be made in accordance with any guidance on shared use by cyclists and pedestrians provided by the Overseeing Organisation.

National Cycle Manual

Section 1.9.4 of the National Cycle Manual deals with requirements on how whether to provide segregation between cyclists and pedestrians. It states that on longer bridges where cyclists are likely to build up higher speed's segregation is recommended. See excerpt below. The proposed crossing can be deemed a long bridge and therefore segregation is appropriate in accordance with the National Cycle Manual.



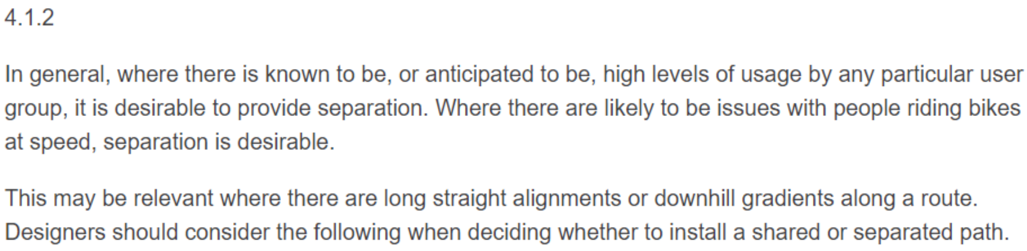
Non-traffic short flat bridges are suitable for shared use with pedestrian priority. However, longer bridges where cyclists are likely to build up higher speeds, should segregate both modes.

Dutch Standards

The Dutch Design Manual for Bicycle and Pedestrian Bridges recommends the use of separation in high density traffic flow situations stating *"it is advisable to separate footpath and cycleway in such cases by creating a physical or visual separation"*

SUSTRANS

SUSTRANs section 4.1 provides an in-depth discussion on the requirements for separation and allows for it to be considered on an individual project level. Section 4.1.2 states the following, however.



4.1.2

In general, where there is known to be, or anticipated to be, high levels of usage by any particular user group, it is desirable to provide separation. Where there are likely to be issues with people riding bikes at speed, separation is desirable.

This may be relevant where there are long straight alignments or downhill gradients along a route. Designers should consider the following when deciding whether to install a shared or separated path.

This would indicate that separation would likely be advisable for the proposed structure.

Inclusive Mobility UK

UK Inclusive Mobility document section 3.1 states "*Where a cycle track runs alongside a footway or a footpath best practice is to physically…".*

Ultimately there is no explicit guidance currently in Ireland on the requirement for segregation and the decision sits with the overseeing authority. Recent sub-urban bridges completed in Ireland have however included visual segregation, such as the new Garry castle Footbridge crossing the N6 in Athlone.

3.2.3 Buildability and complexity

Design of a bridging structure including a physical segregation in the form of a raised kerb or vertical central barrier has the potential to increase structural complexity and potentially add load due to non-structural makeup due of the level difference. Physical segregation with attachments to the structure may also add to the maintenance liability of the structure and could potentially add to the construction and ongoing maintenance cost.

Judgement of the potential benefits of physical segregation should be balanced against this. Visual segregation by comparison would not require any additional structure or physical barriers but can instead be achieved with differing surfacing colours and/or textures.

3.2.4 Conclusion

It is recommended that the cycle traffic be segregated from pedestrian/wheelchair traffic on the proposed bridge. As a minimum we would recommend that this segregation is in the form of painted lines and different surface textures/colours. Physical segregation would necessitate a larger and more complex structure and at this time is not recommended unless deemed necessary by CCC.

3.3 Recommendation

In summary, we would recommend that a bridge with a usable width of 5m be taken forward in the development of structural options. Usable width comprises a 3m 2-way cycleway and a 2m footway segregated via a painted strip or differing surface textures and colours.

4. Conclusions

The purpose of this note is to determine the recommended bridge alignment option along with the recommended internal bridge width requirements.

Three bridge alignment options were considered in this technical note. Bridge Alignment Option 1 was discounted as it did not satisfy the basic requirements of the project. Whilst it is a feasible option, it is located off the desire line for users and is considered to fail in enhancing connectivity between the little island train station and the east gate business park.

A multi-criterion assessment was carried out to determine the preferred bridge alignment between Option 2 and Option 3. From this assessment, bridge Alignment Option 2 has emerged as the preferred option.

In addition to this, the required internal usable bridge width was assessed using both Irish and International design standards. Based on this assessment a footway width of 2m and a cycleway of 3m, totalling an overall internal bridge width of 5m is recommended for this project.

A segregated footway/cycleway is also recommended using visual segregation in the form of a painted strip and/or different surface colours and textures.

Appendix B

Comparative Cost Estimate

Project: N25 Little Island Pedestrian and Cycle Bridge
Titile: Options Selection Report/Structural Options Report - Comparative Cost Estimate
Created by: Timothy O Sullivan Glynn
Checked by: John O Riordon
Date: 15/09/2022

1.1 Structural option 1: N25 and Irish Rail spans	Length [m]	Width [m]	Area [m2]	Rate [€/m2]	Deck total [€]	No. foundations	Rate [€/foundation]	Foundation total [€]	Overall total [€]
Irish rail span + N25 combined span	82	6	492	€ 3,800.00	€ 1,869,600.00	2	€ 160,000.00	€ 320,000.00	€ 2,189,600.00

1.2 Structural option 2: N25 and Irish Rail spans	Length [m]	Width [m]	Area [m2]	Rate [€/m2]	Deck total [€]	No. foundations	Rate [€/foundation]	Foundation total [€]	Overall total [€]
Irish rail span	32	6	192	€ 3,000.00	€ 576,000.00	1	€ 130,000.00	€ 130,000.00	€ 706,000.00
N25 span	50	6	300	€ 2,700.00	€ 810,000.00	2	€ 130,000.00	€ 260,000.00	€ 1,070,000.00

1.3 Structural option 3: N25 and Irish Rail spans	Length [m]	Width [m]	Area [m2]	Rate [€/m2]	Deck total [€]	No. foundations	Rate [€/foundation]	Foundation total [€]	Overall total [€]
Irish rail span	32	6	192	€ 2,600.00	€ 499,200.00	2	€ 50,000.00	€ 100,000.00	€ 599,200.00
N25 span	50	6	300	€ 5,300.00	€ 1,590,000.00	2	€ 130,000.00	€ 260,000.00	€ 1,850,000.00

1.4 Steel elevated ramp structures	Length [m]	Width [m]	Area [m2]	Rate [€/m2]	Deck total [€]	No. foundations	Rate [€/foundation]	Foundation total [€]	Overall total [€]
North elevated ramp	82	6	492	€ 3,500.00	€ 1,722,000.00	4	€ 50,000.00	€ 200,000.00	€ 1,922,000.00
South elevated ramp	110	6	660	€ 2,500.00	€ 1,650,000.00	5	€ 50,000.00	€ 250,000.00	€ 1,900,000.00

1.5 Reinforced concrete elevated ramp structures (all options)	Length [m]	Width [m]	Area [m2]	Rate [€/m2]	Deck total [€]	No. foundations	Rate [€/foundation]	Foundation total [€]	Overall total [€]
North elevated ramp	82	6	492	€ 3,500.00	€ 1,722,000.00	4	€ 50,000.00	€ 200,000.00	€ 1,922,000.00
South elevated ramp	110	6	660	€ 2,500.00	€ 1,650,000.00	5	€ 50,000.00	€ 250,000.00	€ 1,900,000.00

1.6 Northern embankments	Length [m]	Top width [m]	Average height [m]	Average base width [r	Volume [m3]	Rate [€/m3]	Embankment total [€]
North embankment	78	5	1.2	9.8	693	€ 55.00	€ 38,095.20

1.7 Southern retaining walls	Length [m]	Top width [m]	Average height [m]	Volume [m3]	Rate [€/m2]	Retaining wall total [€]
Southern retaining wall ramp	22	0.5	5	55	€ 200.00	€ 22,000.00

1.8 Walkway/cycleway (at grade and on embankments)	Length [m]	Width [m]	Area [m2]	Rate [€/m2]	Walkway total [€]
North (to elevated structure)	78	5	390	€ 140.00	€ 54,600.00
South (to elevated structure)	161	5	805	€ 190.00	€ 152,950.00
					€ 207,550.00

1.9 Other (prelims included seperately in section 2)	Length of structure [m	Rate [€/m]	Total	
Lighting (Public lighting to embankments, retaining wall and at grade walkway)	239	€ 280.00	€ 66,920.00	
Lighting (Bridge & elevated ramp structures - LED strip lighting type)	274	€ 900.00	€ 246,600.00	
General Site Clearance (Incl Tree removal up to girth of 300mm @1.5m above G.L.)	4	€ 10,000.00	€ 40,000.00	*Unit In hectares*
Bins - City of Cork black litter bin	10	€ 1,666.25	€ 16,662.50	
Benches	6	€ 1,666.25	€ 9,997.50	
Bike Storage - Cork City Council bicycle parking stands - type B stainless steel	6	€ 322.06	€ 1,932.36	
Bollards	20	€ 300.00	€ 6,000.00	
CCTV Cameras	3	€ 953.53	€ 2,860.58	
Allowance for Road markings/signs etc	1	€ 30,000.00	€ 30,000.00	
		Total	**€ 420,972.93**	

2.1 Summary tables - breakdown of componants

	Irish Rail span(s)	N25 span	North elevated ramps	South elevated ramps	North embankment	South retaining wall	Walkway/cycleway paving	Other	Prelims @12%
Structural option 1	*Combined span*	€ 2,189,600.00	€ 1,922,000.00	€ 1,900,000.00	€ 38,095.20	€ 22,000.00	€ 207,550.00	€ 420,972.93	€ 804,026.18
Structural option 2	€ 706,000.00	€ 1,070,000.00	€ 1,922,000.00	€ 1,900,000.00	€ 38,095.20	€ 22,000.00	€ 207,550.00	€ 420,972.93	€ 669,674.18
Structural option 3	€ 599,200.00	€ 1,850,000.00	€ 1,922,000.00	€ 1,900,000.00	€ 38,095.20	€ 22,000.00	€ 207,550.00	€ 420,972.93	€ 763,274.18

2.1 Summary tables - totals

	Total	Total -30%	Total +30%
Structural option 1	€ 7,504,244	€ 5,252,971	€ 9,755,518
Structural option 2	€ 6,956,292	€ 4,869,405	€ 9,043,180
Structural option 3	€ 7,723,092	€ 5,406,165	€ 10,040,020

Exclusions:

The following items are specifcally excluded from the cost estimate

Legal costs

Site surveys, scans and investigations

Operating costs (Planned and preventative maintenance)

VAT

Finance Costs

Design team fees

All other costs not specifically mentioned above

Landscaping and upgrades to the Northern park have not been allowed for at this point

Landscaping and upgrades to station area have not been allowed for at this point

N25 Little Island Pedestrian and Cyclist Bridge
Environmental Impact Assessment Report

Chapter 05

Construction Strategy

N25 Little Island Pedestrian and Cyclist Bridge
Environmental Impact Assessment Report

Appendix 5.1

Construction Environmental Management Plan

Contents

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Images

1. Introduction

1.1 Overview

This Construction Environmental Management Plan (CEMP) has been prepared to support Cork County Council's (CCC) application for consent for the proposed pedestrian and cyclist bridge located in Little Island, County Cork (i.e., the Proposed Development).

CCC will have a construction management team which will oversee aspects of the Construction Phase of the Proposed Development.

The contractor (and any subcontractors) appointed by the construction management team will be required to comply with all of the performance requirements set out in the tender documentation including the conditions attached to statutory consents which may be granted by relevant statutory consent authorities.

This document presents an outline construction sequence, supported by possible construction methodologies and techniques that may be adopted during the construction of the Proposed Development. This plan seeks to demonstrate how such works can be delivered in a logical, sensible, and safe sequence, with the incorporation of specific measures to mitigate the potential impact on people, property and the environment.

Nothing stated in this document shall supersede or be taken to replace the items of the Contract, the detailed design description issued with the Contract tender or the conditions of planning.

This CEMP sets out the duties and responsibilities which will be imposed on the contractor in the construction contract. CCC's construction management team will be responsible for ensuring that the contractor complies with all the requirements of this CEMP.

1.2 Purpose

The purpose of this CEMP is to provide a framework for managing and where practicable, minimising negative environmental effects during the construction of the Proposed Development. Construction is considered to include all site preparation, enabling works, materials delivery, materials and waste removal, construction activities and associated engineering works.

This CEMP identifies the minimum requirements with regard to the appropriate mitigation, monitoring, inspection and reporting mechanisms that need to be implemented throughout construction. The appointed contractor will need to comply with all relevant environmental legislation and take account of published standards, accepted industry practice, national guidelines and codes of best practice appropriate to the Proposed Development

This CEMP has been produced as part of the application for consent to ensure compliance with legislative requirements and the EIAR and associated ecological reports that have been prepared for the Proposed Development.

1.3 Approach

This CEMP provides a framework to:

- Describe the programme for environmental management during construction;
- Implement those monitoring and mitigation measures identified in the EIAR and associated ecological reports;
- Outline the principles and minimum standards required during the development of the CEMP (and associated method statements) and throughout construction;
- Identify the relevant roles and responsibilities for developing, implementing, maintaining and monitoring environmental management; and
- Outline the procedures for communicating and reporting on environmental aspects of the Proposed Development throughout construction.

It is intended that this CEMP would be expanded and updated prior to the commencement of any construction activities on site. The CEMP is a dynamic document and will remain up to date for the duration of the Construction Phase. The CEMP may need to be altered during the lifecycle of the Construction Phase to take account of monitoring results, legislative changes, outcomes of third-party consultations etc.

Following appointment, the contractor will be required to develop more specific method statements that are cognisant of the proposed construction activities, equipment and plant usage, and environmental monitoring plan for the Proposed Development. This CEMP should not be considered a detailed Construction Method Statement as it would be the responsibility of the contractor appointed to undertake the individual works to implement appropriate procedures and progress this documentation prior to commencement of construction.

This CEMP outlines the range of potential types of construction methods, plant and equipment which may be used by any contractor appointed to enable their effects to be assessed for the purposes of the planning authority's environmental impact assessment and appropriate assessment prior to determining whether to grant planning permission.

1.4 Structure

This CEMP is structured as follows:

- **Section 1** introduces the Proposed Development and outlines the purpose of the CEMP;
- **Section 2** describes in detail the Proposed Development;
- **Sections 3** describes the construction strategy for the Proposed Development;
- **Section 4** describes construction traffic management for the Proposed Development;
- **Sections 5** describes in detail the measures to be implemented to minimise likely significant negative effects, as far as practicable, during the construction of the Proposed Development.
- **Section 6** sets out the framework and mechanisms through which environmental requirements would be managed; and
- **Section 7** outlines the procedures to be employed during construction to manage environmental aspects.

1.5 Updates to the CEMP

The detailed CEMP is considered a 'live document' that will be reviewed and revised regularly as construction progresses. The process for update, review and approval of the CEMP must be documented in the detailed CEMP to ensure that all revisions can be easily understood, applied and updated.

The contractor is required to update the CEMP to ensure that it:

- Is in accordance with the mitigation measures specified in the EIAR and associated ecological reports and this CEMP;
- Is in accordance with any conditions that may be prescribed as part of the consent(s) for the Proposed Development;
- Aligns with those design and construction details described in the EIAR and associated ecological reports and ensures there is no material change in terms of significant effects on the environment;
- Where practicable, the contractor should seek to identify opportunities for further reducing significant negative environmental effects and to implement best practice in as far as reasonably practicable, i.e., take every reasonable effort to reduce and prevent negative effects, while enhancing benefits; and
- Will have regard to the guidance contained in the handbook 'Environmental Good Practice on Site' published by Construction Industry Research and Information Association (CIRIA, 2015a).

Further, the following plans, and any others considered relevant, will be incorporated into the CEMP by the contractor:

- Construction Traffic Management Plan;
- Noise and Vibration Management Plan;
- Surface Water Management Plan;
- Dust Management Plan; and
- Emergency Incident Response Plan.

It is expected that amendments to the CEMP may be necessary to reflect, inter alia, changes in the project scope, contract scheduling, contractor appointments, environmental management policies, practices or regulations and developments on the site. These reviews and updates are necessary to ensure that environmental performance is subject to continual improvement and that best practice is implemented throughout construction.

2. The Proposed Development

2.1 Site location

The site of the Proposed Development is located in Little Island, Co. Cork, approximately 10km to the east of Cork City. The Proposed Development is a pedestrian and cyclist bridge that will function as an active travel link for pedestrian and cyclists to travel from the Little Island Train station and surrounds to the Eastgate Business Park and further surrounds of Little Island.

Refer to **Image 1** for a site location map.

Image 1: Approximate site location. Not to scale. Source: OpenStreetMap

2.2 Proposed Development description

The Proposed Development will include the construction of a new pedestrian and cyclist bridge and associated ramps over the existing N25. The Proposed Development will be located approximately 10km to the east of Cork City and will cross over the N25 and the Cork City to Midleton / Cobh railway line, connecting the Little Island train station, the L3004 Glounthaune Road, the Dunkettle to Carrigtwohill pedestrian and cycle route and Eastgate Business Park in Little Island, Cork. The Proposed Development site is bounded by the L3004 Glounthuane Road to the north and the Eastgate Business Park to the south. When operational, it will function as an active travel link for pedestrians and cyclists to travel from the Little Island Train station and surrounds to the Eastgate Business Park and further surrounds of Little Island.

The Proposed Development will consist of a new pedestrian and cyclist bridge that encompasses a segregated footway and cycleway that will be 5m wide. The proposed crossing will be approximately 460m long and will consist of a combination of different structural forms as follows:

- Northern approach ramp: combination of earthen embankment and elevated ramp structure;
- Irish Rail span: concrete portal frame structures;
- N25 span: steel network arch structure; and
- Southern approach ramp: combination of elevated ramp structure, at grade sections and earthen embankment.

The construction footprint of the Proposed Development, including the construction compounds and bridge assembly area, is approximately 1.7 hectares. The construction footprint of the final works (excluding planting and minor tie in footpaths in the northern park area) is approximately 0.3 hectares.

An extract of the site layout for the Proposed Development is presented in **Image 2**.

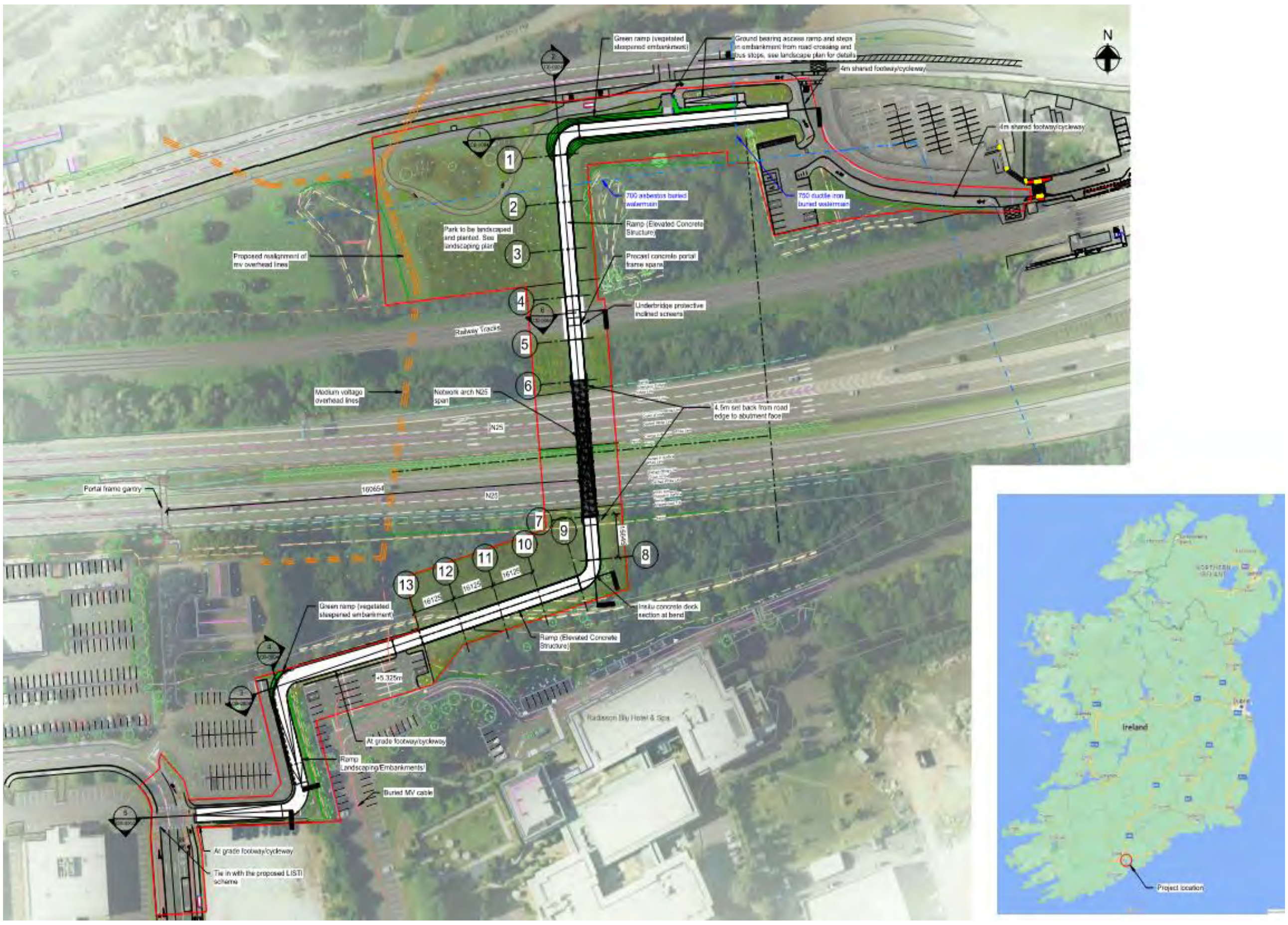

Image 2: Site layout map. Not to scale. Extract from site layout plan drawing – refer to Drawing No. LIPB-ARUP-ZZ-XX-DR-CB-0003 in Volume 3 of this EIAR.

2.3 Key interfaces and elements

The Proposed Development will cross the following areas from north to south:

- Northern park amenity area;
- Cork City to Midleton / Cobh Irish Rail line;
- N25 national road dual carriageway;
- Wooded area, south of the N25; and
- Radisson Blu Hotel and Eastgate Business Park car parks.

The site is bounded by the L3004 Glounthaune Road to the north. Levels at the tie in to the Little Island train station area are approximately +2.5mOD, while levels at the at tie in to the Radisson Blu Hotel car park are approximately 5.2mOD. On the southwest of the site, there is a 1.1m drop in elevation between the Radisson Blu Hotel car park and the adjacent Eastgate Business Park car park (5.5mOD to 4.4mOD).

The proposed crossing main spans (N25 & Irish Rail) consist of a single span steel network arch structure over the N25 and a 2-span precast concrete segmental portal frame structure over the Irish Rail track and adjacent land to the south. The spans of these structures will be approximately 49m (N25) and 2x15m (Irish Rail).

Access ramps to main spans will consist of a combination of reinforced concrete elevated structures, embankments, landscaping and some at grade sections with minor cut or fill. For the northern approach ramp, the lower ramp section will be a steepened slope green embankment transitioning into a reinforced concrete elevated ramp structure for higher sections in a north / south direction. The southern access ramp section between the Radisson Blu Hotel car park and the N25 bridge tie in is proposed to be an elevated reinforced concrete structure due to the sharp fall off in level to the north and east of the Radisson Blu Hotel car park. A retained embankment is proposed on the west side tie-in to the Radisson Blu Hotel car park from the lower Eastgate Business Park car park.

For the northern elevated ramp, a bespoke architectural concrete structure with single circular piers is proposed as the public will have access below the structure. For the southern elevated ramp, a more economical precast prestressed bridge beam structure with two column piers and crossheads is proposed.

2.4 Access strategy

Construction access to the L3004 Glounthaune Road construction compound (north) and Radisson Blu Hotel construction compound (south) will be from the local road network. Access to the local access roads to the construction compounds will be via the N25 dual carriageway using Little Island junction 2 to avoid excessive traffic on the surrounding local road network. It is anticipated construction traffic will use the following routes to access the site from the N25 Little Island junction:

- North construction compound: N25 junction 2, R623 north, L3004 Glounthaune Road west;
- South construction compound: N25 junction 2, R623 south, Eastgate Way, Radisson Blu Hotel local access road; and
- Southwest tie in area: N25 junction 2, R623 south, Eastgate Way, Eastgate Road north.

3. General Construction Strategy

3.1 Duration and phasing

The commencement of construction works for the Proposed Development is subject to obtaining statutory consent, funding and the relevant permits and licences.

Construction is expected to commence in 2025, with the development becoming operational in 2026.

The approach outlined in **Table 1** represents an indicative reasonable scenario as to how the Proposed Development may be constructed, with regards to the terms of sequencing and duration. Whilst the general requirements detailed in this section will be followed, the contractor, when appointed, will ultimately be responsible for the sequencing and implementation of the works in a safe and secure manner and in accordance with all statutory requirements.

It should be noted that trees and vegetation will not be removed between 1st March and 31st August to avoid direct impacts on nesting birds. Tree removal will be carried out in accordance with the Arboricultural Impact Assessment report (refer to **Appendix 8.1** in **Volume 4** of this EIAR).

Table 1: Indicative construction phasing for key activities

Activities	M 1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18
Tender award	🟧																	
Bridge fabrication planning and approval		🟥	🟥															
Site access, clearance and tree removal. Set up of construction compounds and construction surfacing.		🟩	🟩															
Utility diversion		🟩	🟩	🟩														
Bridge superstructure fabrication and precast concrete element casting (offsite)				🟥	🟥	🟥	🟥	🟥	🟥	🟥								
Northern approach ramp embankment construction				🟦	🟦													
Northern approach elevated ramp foundation construction (piling and substructure)				🟦	🟦													
Irish Rail structures construction						🟦												
Northern approach ramp elevated section deck construction						🟦	🟦	🟦										
Southern approach ramp foundation construction (piling and substructure)						🟦	🟦											
Southern approach ramp elevated section deck construction							🟦	🟦	🟦									
N25 bridge foundation and abutment construction										🟦	🟦							
N25 span assembly (offline)											🟥	🟥	🟥					
N25 span erection														🟦				
Ramp and bridge deck finishing (installation of lights, parapets, handrails, surfacing etc.)															🟦	🟦	🟦	
Construction of southern embankment ramp																	🟩	
Tie in footway / cycleway construction and final landscaping / tree planting																	🟩	🟩

Note: M1, M2 etc. = Month 1, Month 2, etc.

3.2 Site clearance

Site clearance, including vegetation clearance, will be undertaken within the Proposed Development boundary. Trees and vegetation will not be removed between 1st March and 31st August to avoid direct impacts on nesting birds. Tree removal will be carried out in accordance with the Arboricultural Impact Assessment report (refer to **Appendix 8.1** in **Volume 4** of this EIAR). Trees to be retained will be identified and protected to avoid accidental damage during the construction works.

Site drainage will be provided to collect surface water runoff, which will be directed into a site water treatment facility before being discharged to the local drainage network. Drainage ponds, silt traps and interceptor ditches will be constructed in advance of the main earthworks to collect, treat and discharge all surface water run off during construction. Specific controls / mitigation measures will be put in place to manage runoff and minimise pollution to receiving waterbodies during the Construction Phase. These will be outlined in a Surface Water Management Plan (SWMP) that will be prepared and implemented by the contractor as part as part of the CEMP in advance of the commencement of the construction works.

Two construction compounds and one bridge assembly area will be required for the Proposed Development. Hoarding or fencing (2.4 metres in height as a minimum), which will remain in-situ for the duration of the works, will be erected around the compounds. Site offices and welfare facilities will be installed within the construction compounds.

3.3 Surveys and utilities

Only minor service diversions are required during the Construction Phase. Surface and sub-surface infrastructure services and utilities which may be temporarily affected during the construction works are as follows:

- Surface water drainage;
- Electricity; and
- Water mains.

Any area to be excavated will be subject to utilities surveys, ground penetrating radar (GPR) surveys and cable avoidance tool (CAT) scanning. Service diversions are only anticipated to be require in the northern park amenity area.

Following identification of services with the relevant utility providers including Uisce Eireann, Eir, GNI, BT Ireland, Enet and ESB Networks, the proposed utility diversions / protection measures are as follows:

- The Uisce Eireann 750 diameter ductile iron water main is proposed to be protected via an in situ concrete structure where it passes under the proposed north embankment ramp. Refer to **Image 3**.

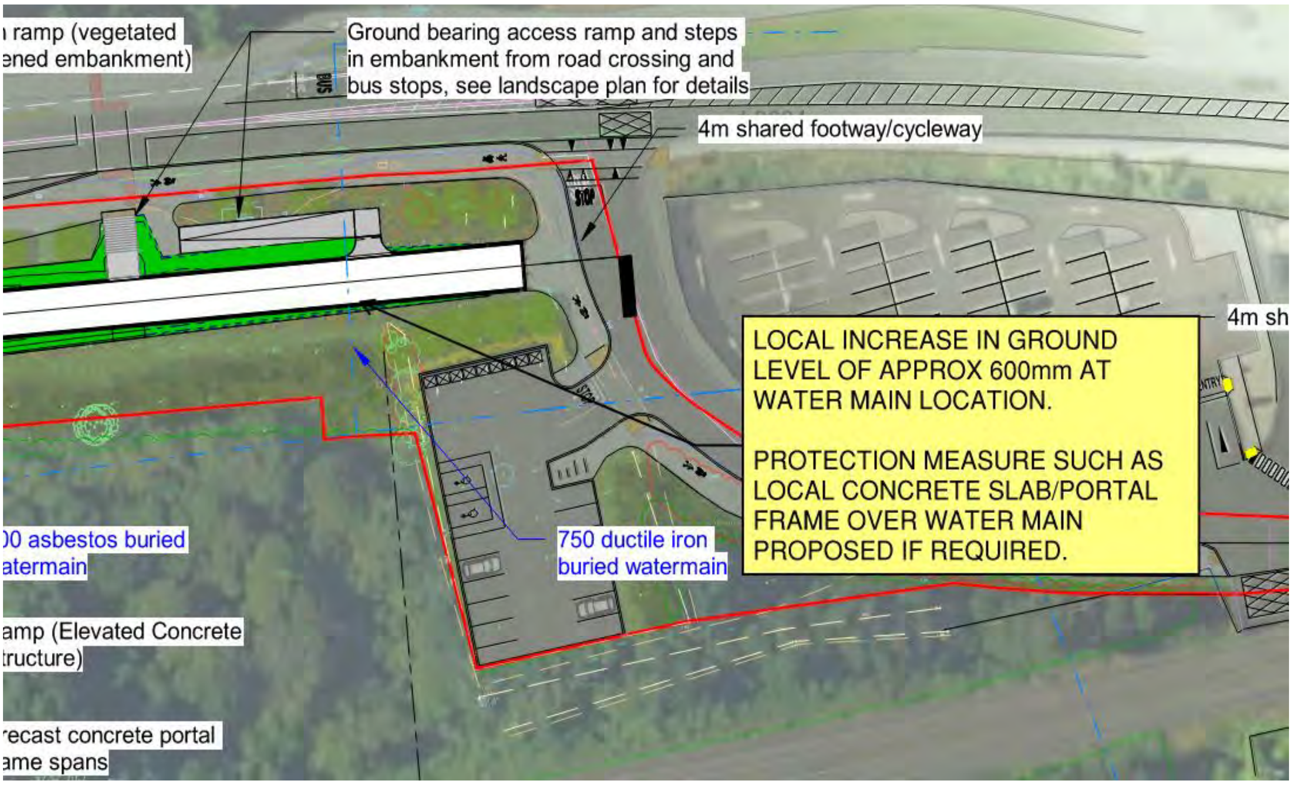

Image 3: Proposed protection measure to water main under north embankment

- Subject to discussions with Uisce Eireann, it is proposed that the 700mm diameter asbestos water main will remain in place with suitable protection measures and easements to allow piling works and bridge assembly / protection works. Refer to **Image 4**.

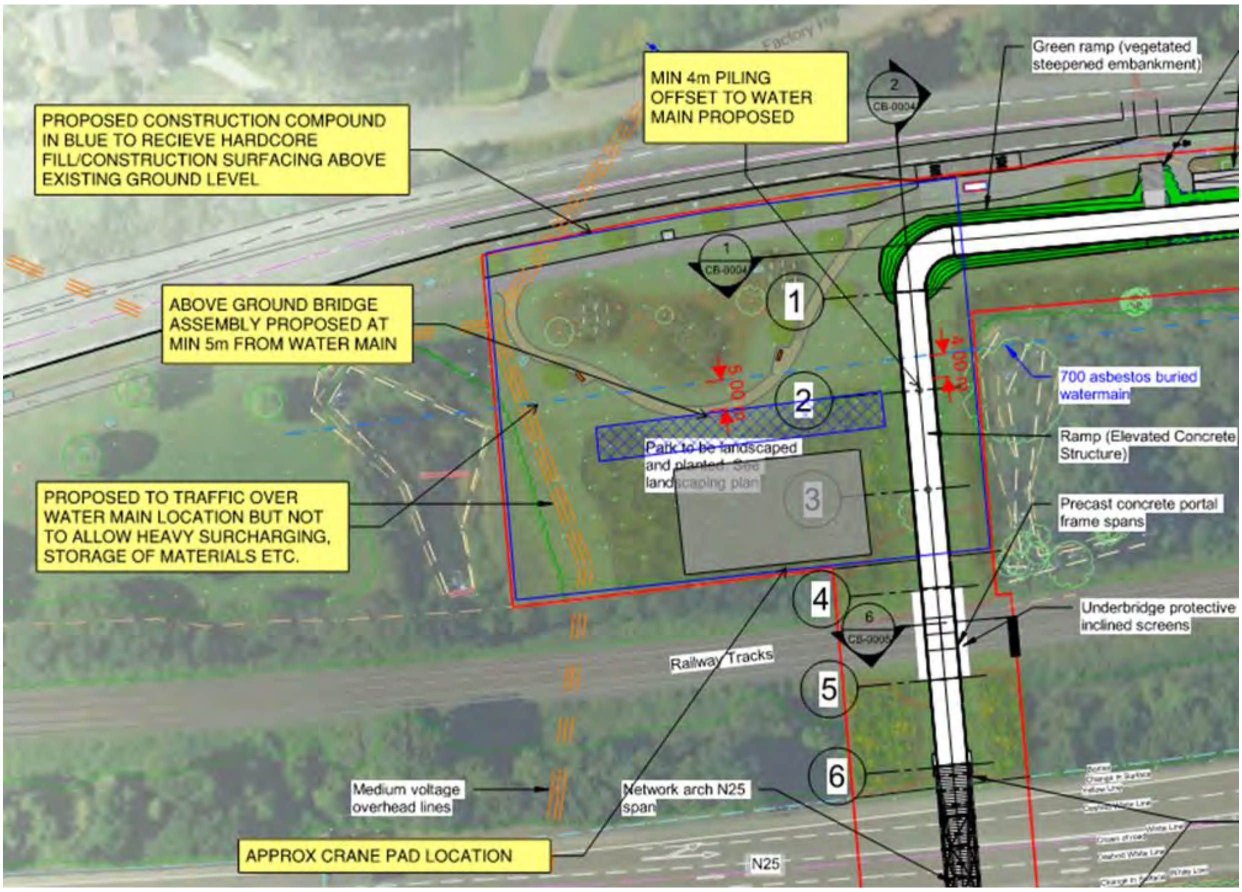

Image 4: Proposed easement to underground water main running through bridge assembly area

- Subject to discussions with ESB, it is proposed that the existing medium voltage overhead lines traversing through the northern amenity park area in a north / south direction be slightly rerouted by moving a single electricity pole and moving connecting overhead lines. This will allow for bridge assembly and erection to take place from the bridge assembly area, with suitable protection measures in place. Refer to **Image 5**.

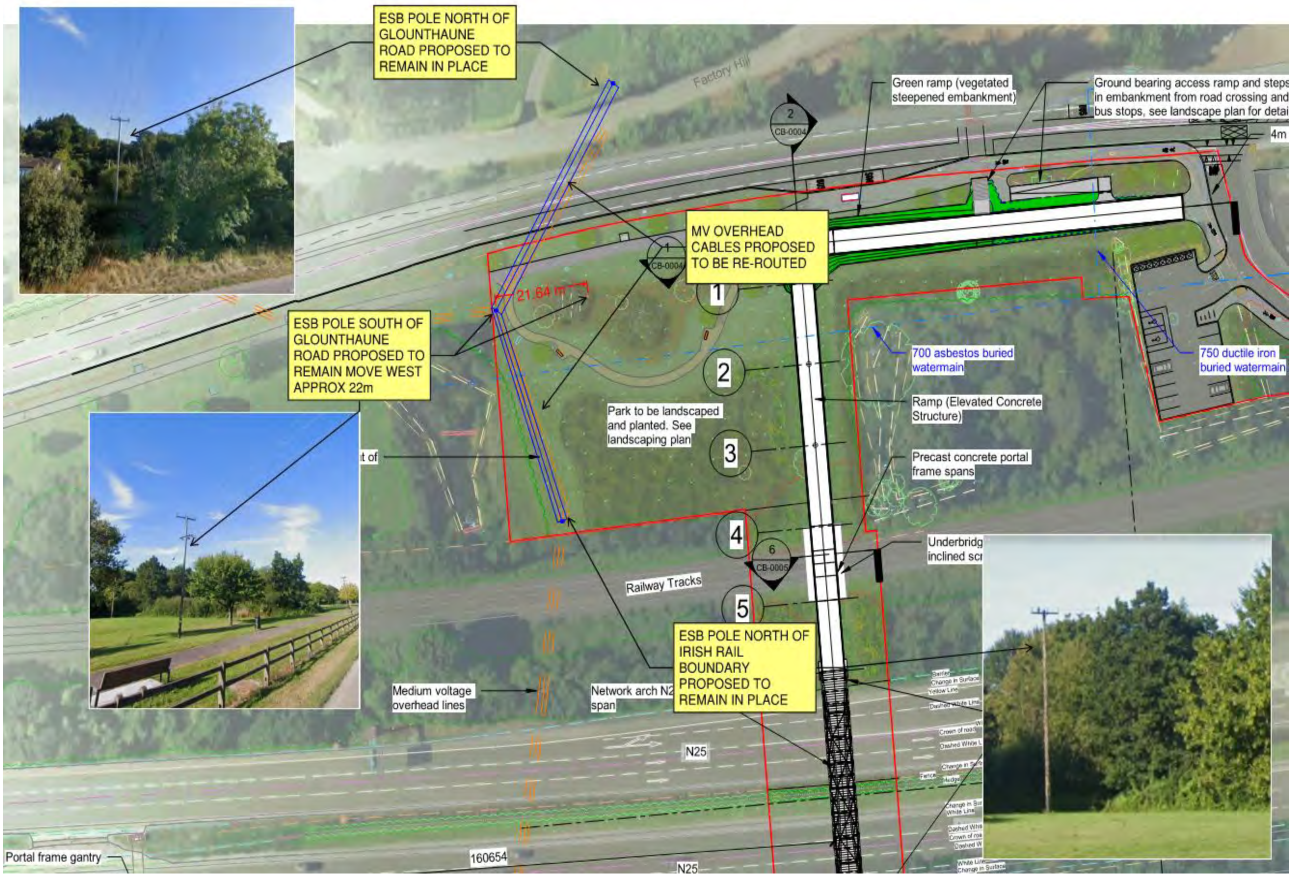

Image 5: Proposed re-routing of ESB MV overhead lines

3.4 Earthworks

It is estimated that approximately 415 tonnes of cleared vegetation will be generated as a result of the Proposed Development.

Excavated material generated as part of the construction works will generally consist of:

- Made ground;
- Topsoil and subsoil; and
- Spoil from piling.

In total, it is estimated that the construction of the Proposed Development will require the excavation of approximately 5,950 tonnes (bulk weight) of material.

It is estimated that approximately 300mm will need to be excavated under the proposed embankments and tie ins at grade footways / cycleways to allow for competent formation layers to be placed. The total amount of material estimated to be generated from these works will be approximately 2,260 tonnes (bulk weight).

Where practicable and subject to the material being suitable for re-use, excavated topsoil will be stored in an appropriately designated area in the bridge assembly area on site for use in the landscaping works. Refer to **Chapter 15**, *Resources and Waste* in **Volume 2** of this EIAR for further details.

In addition to the excavated topsoil, it is estimated that approximately 1,950 tonnes (bulk weight) of piling spoil material and approximately 1,740 tonnes (bulk weight) of excavated material for the pile caps will be generated. This material will be removed from site.

Following the completion of the construction works, it is estimated that approximately 32,400 tonnes of construction surfacing material will be removed from site.

Surplus excavation material will be removed off site by a waste collection permit holder and delivered to an authorised waste facility (i.e., a facility which holds a Certificate of Registration, Waste Facility Permit or Waste Licence). Where feasible and subject to testing, this material is likely to be used as a by-product in construction, provided the material itself and its proposed end use complies with the provisions of Article 27 of the European Communities (Waste Directive) Regulations, 2011. A review will be undertaken by the contractor for suitable construction projects for reuse of this material in accordance with Article 27, e.g., projects requiring materials specified in Transport Infrastructure Ireland Series 600 Specification for Earthworks.

In the event that an Article 27 declaration is not feasible for all or part of the surplus excavation material, it will be delivered for recovery or disposal to a facility authorised in accordance with the Waste Management Act, 1996.

Should excavated material containing hazardous substances be discovered as part of the Proposed Development, this will be delivered to a facility authorised to accept hazardous wastes in accordance with the terms of an Industrial Emissions Licence or Waste Licence or exported from Ireland for treatment, recovery or disposal in accordance with current industry practice and the provisions of the Waste Management (Shipments of Waste) Regulations, 2007 S.I. No. 419 of 2007.

The contractor will further develop and implement the mitigation measures as outlined in the Construction Resource and Waste Management Plan (CRWMP) which is included as **Appendix 15.3** in **Volume 4** of this EIAR.

3.5 Foundations

Foundations for all structures, except for the embankments, are proposed to be bored reinforced concrete piles. Piling methods such as Cased Auger Piles or Continuas Flight Auger piles proposed.

The foundations for the Proposed Development will consist of:

- Northern steepened slope reinforced earth embankment ramp, with green vegetated finish;
- North elevated ramp structure: 3 no. piers / pile groups (shares one support with portal frame structure);
- Precast portal frame structures: 2 no. piers / pile groups (shares one support with N25 northern abutment). Piles and abutments adjacent to the rail track are to be set back a minimum of 4.5m from the nearest running rail in accordance with the Irish Rail Standard 'Requirements for Track and Structures Clearances I-PWY-1101' (Irish Rail, 2010);
- 25 main span: 2 no. piled abutments, Piles and abutments adjacent the highway are to be set back a minimum of 4.5m from the road edge as per TII requirements;
- South elevated ramp structure: 6 no. piers / pile groups (shares one support with N25 southern abutment); and
- Northern steepened slope reinforced earth embankment ramp, with green vegetated finish.

3.6 Landscaping Works

Landscaping is described in more detail in **Chapter 8**, *Landscape and Visual*. Landscaping will generally comprise the following:

- Reinstatement of the northern park amenity area with additional compensatory tree and vegetation planning;

- Provision of additional amenity footpaths; and
- Reinstatement of wooded area below and surrounding Irish rail spans, and the southern wooded area, including compensatory planting of new trees and vegetation surrounding the structure.

4. Construction Traffic Management

4.1 Site access

All construction works will be undertaken in a clearly delineated site area which will have specific entry and exit points for construction related traffic onto the public road network. All access points will be temporary and used solely during the Construction Phase.

Where works are to be undertaken adjacent to the existing roads, temporary traffic barriers will be erected to separate the construction works from the public, to create a safe working space for the contractor and to clearly define the areas within which construction will be undertaken.

All site access routes will be connected to the existing local road network. Minor road works may occur such as the removal of existing kerbs, paving and a small amount of excavation prior to the replacement of paving and realigned kerbs within the Eastgate Business Park, the Little Island train station area and the L3004 Glounthaune Road.

Site access to the northern construction compound will be via the existing car park entrance off the Little Island train station access road.

Site access to the northern bridge assembly area will be via a temporary access directly off the L3004 Glounthaune Road.

Site access to the southern construction compound will be via the western end of the Radisson Blu Hotel car park, which is accessibly from Eastgate Way and the Radisson Blu Hotel local access road. The southern construction compound will be located in a dedicated area of the car park, with parking restrictions and management measures implemented within the car park as necessary to ensure that the functioning of the car park is maintained and to avoid any site parking overspill issues (refer to Section 4.3.1).

4.2 Closures

Traffic management and temporary lane / carriageway closures are expected to be required during the Construction Phase. The below temporary management measures and closures are expected. These will be confirmed during the Construction Phase subject to the contractors proposed construction methodology:

- Site clearance: overnight traffic management on N25 junction 2 eastbound off ramp slip lane to allow site clearance;
- N25 span north abutment construction: temporary lane closure of localised section of the eastbound hard shoulder and off ramp slip lane, and surrounding traffic management to allow access and exit from the construction area, and to enable the construction of the N25 span north abutment. This is expected to be in place for 6 – 10 weeks;
- Irish Rail south portal frame span construction: overnight lane closures and traffic management on N25 junction 2 eastbound off ramp slip lanes and adjacent traffic lanes to facilitate erection of south span of the precast concrete portal frame structure over Irish Rail land. It is expected that a single eastbound lane can remain open;
- N25 span steelwork erection: weekend closure of the N25 to allow for steelwork erection of the N25 span; and
- Irish Rail portal frame structures: weekend closure of Irish Rail track in agreement with Irish Rail to allow for construction of the precast concrete portal frame structures.

4.3 Construction Traffic Mitigation

4.3.1 Construction Phase

Construction traffic will be limited to certain routes and times of day, with the aim of keeping disruption to existing traffic and residents to a minimum. To minimise disruption to the local areas, construction traffic volumes will be managed through the following measures:

- During peak hours, ancillary, maintenance, and other site vehicular movements will be discouraged;
- Daily construction programmes will be planned to minimise the number of disruptions to surrounding streets, nearby residents to the north of the Proposed Development, train passengers and nearby businesses such as the Radisson Blu Hotel to the south of the Proposed Development, by staggering HGV deliveries to site;
- HGV routes to and from the site will be developed in agreement with CCC and with the objective of minimising the impact in the local area for residents, train users and businesses;
- Parking restrictions and management measures at the Radisson Blu Hotel and Eastgate Business Park car parks will be reviewed and implemented as necessary in agreement with the local businesses and CCC to ensure that the functioning of the car parks is maintained and to avoid any site parking overspill issues; and
- The contractor will be required to promote travel by sustainable modes of transport – refer to **Section 4.3.4**.

4.3.2 Working hours

The timing of construction activities, core working hours and the rate of progress of construction works are a balance between efficiency of construction and minimising nuisance and significant effects.

The core construction working hours for the Proposed Development will be:

- 7am – 7pm: Monday to Friday; and
- 8am – 2pm: Saturday.

Similarly, deliveries of materials to site will generally be between the hours of 7am to 7pm, Monday to Friday, and 8am to 2pm on Saturdays.

The construction shift times will ensure construction traffic will have limited impact on the peak periods of 7.30am to 8.30am and 5.15pm to 6.15pm as it is envisaged most construction staff will arrive to work before 7am and leave after 7pm.

Due to the specific nature of some construction activities, or to mitigate disruption to the local environment, there may be a requirement for working outside these hours. Should this be required, it will be agreed in advance with CCC and scheduling of such works will have regard to nearby sensitive receptors.

4.3.3 Construction Traffic Management Plan

A Construction Traffic Management Plan (CTMP) will be developed by the contractor when updating this CEMP and presented to CCC for approval prior to commencement of the construction works. The CTMP will contain detailed temporary traffic management drawings for each construction stage and will include the mitigation measures described in this section.

4.3.4 Mobility management

In accordance with the Cork County Development Plan 2022-2028 (CCC, 2022) a Mobility Management Plan (MMP) will be prepared by the contractor for its workforce to encourage access to the site by means other than by private car. The following section identifies some of the measures the contractor is likely to provide as part of the Mobility Management Plan. The MMP will form part of the CTMP in the updated CEMP and will be agreed with CCC prior to works beginning on site.

Walking: The pedestrian environment surrounding the site is considered to be good with footpaths provided on the L3004 Glounthaune Road and within the Eastgate Business Park, adjacent to the construction works areas.

Cycling: Cycle parking spaces will be provided on the site for construction staff. The Dunkettle to Carrigtwohill cycle route is also located adjacent to the Proposed Development.

Car Sharing: Car sharing among construction staff should be encouraged, especially from areas where construction staff may be clustered. The contractor will aim to organise shifts in accordance with staff origins, hence enabling higher levels of car sharing. Such a measure offers a significant opportunity to reduce the proportion of construction staff driving to the site and will minimise the potential traffic impact on the surrounding road network.

Public Transport: The site is reasonably well served by public transport. The closest bus stops are located directly adjacent to the proposed site on the L3004 Glounthaune Road, approximately 40m from the site. The closest railway station is Little Island, approximately 100m from the proposed site. The contractor will issue an information leaflet to all staff as part of their induction on site highlighting the location of the various public transport services in the vicinity of the construction site, including bus and rail routes that operate in the vicinity of the site.

5. Site Management

5.1 Health and Safety

The primary aim of planning for safety on the site is ensuring the safety of people involved in and affected by the development. This includes pedestrians, road users, neighbours, site staff and visitors to site.

The following are examples of some site-specific issues that will have to be addressed during the construction of the Proposed Development:

- Working at height for construction of all elevated structures;
- Managing crane movements to limit lifting over live roadways;
- Working on potentially unstable and steep ground in wooded areas surrounding Irish Rail tracks and south of the N25;
- Work on or adjacent to Irish Rail track and N25 dual carriageway requiring vehicular and pedestrian traffic management and potential track / road closures;
- Managing site clearance and excavation works and the materials generated;
- Identifying, storing and handling of hazardous and contaminated materials;
- Protecting existing roadways against damage in areas where excavations are proposed adjacent to roadways;
- Identifying, diverting, maintaining and connecting to existing live services; and
- Maintaining existing public and operational access routes.

The contractor will be required to ensure all health and safety and security requirements are provided for in co-ordination with CCC. A CTMP will be prepared and implemented by the contractor with the objective of protecting the public in the vicinity of the working areas during the Construction Phase of the works.

All construction staff and operatives will be inducted into the security, health and safety and logistic requirements on site prior to commencing work.

Contractors will be required to progress their works with reasonable skill, care and diligence, and to proactively manage the works in a manner most likely to ensure the safety, health and welfare of those carrying out construction works, all other persons in the vicinity of the working areas and interacting stakeholders.

Contractors will also have to ensure that, as a minimum, all aspects of their works and project facilities comply with legislation, good industry practice and all necessary consents.

The requirements of the Safety, Health and Welfare at Work Act 2005 (Government of Ireland, 2005), the Safety, Health and Welfare at Work (Construction) Regulations, 2013 (Government of Ireland, 2013), as amended, (the "Regulations") and other relevant Irish and EU safety legislation will be complied with at all times.

As required by the Regulations, a Health and Safety Plan will be formulated which will address health and safety issues from the design stages through to completion of the construction and maintenance phases. This plan will be reviewed and updated as required, as the development progresses.

In accordance with the Regulations, a 'Project Supervisor Design Process' has been appointed and a 'Project Supervisor Construction Stage' will be appointed for the construction stage by CCC.

The Project Supervisor Construction Stage will assemble the Safety File as the project progresses.

5.2 Working Hours

As outlined in Section 4.3.2, construction operations on site are proposed to be between the hours of 7am to 7pm, Monday to Friday, and 8am to 2pm on Saturdays. Similarly, deliveries of materials to site will generally be between the hours of 7am to 7pm, Monday to Friday, and 8am to 2pm on Saturdays.

It may be necessary to undertake certain activities outside of the core construction working hours such as the installation of the main span over the N25, which is anticipated to take place during an overnight or a weekend road closure.

Any construction works outside of the core construction working hours will be agreed in advance with CCC and scheduling of such works will have regard to nearby sensitive receptors.

5.3 Public Relations

The site is located near a number of residences and local businesses. The contractor will be required to ensure that all agents, sub-contractors and suppliers act in a manner to minimise disruption to the surrounding locality.

Keeping people informed of site operations will help create and maintain good relationships, fostering a co-operative atmosphere. A Liaison Manager will be appointed by the contractor, whose responsibility would include:

- Regular briefings with CCC, local neighbour and business representatives on progress and issues;
- Liaison with CCC and emergency services as appropriate;
- Liaison with A Garda Síochána, particularly in relation to traffic movements and permits; and
- Preparation of reports for the site meetings on neighbourhood issues.

5.4 Hoarding and Fencing

Following possession of the site, the contractor will erect suitably robust hoarding and / or Heras fencing around the perimeter of the site. This will provide separation of the construction works from the adjacent roadways, footpaths and buildings. Hoarding and / or fencing in the vicinity of the railway line will be erected in agreement with Irish Rail.

The plan alignment of the hoarding and / or fencing may not remain constant for the entire works and is likely to change to meet the requirements and constraints of construction sequence.

If it is required to remove an existing secure site boundary it shall be replaced with hoarding. The hoarding will typically take the form of standard plywood hoarding to a height of 2.4m, as illustrated in **Image 6**.

IBEX and / or Heras fencing, or alternate hoarding / fencing and the existing boundary may also be used in places. Controlled access points to the site, in the form of gates or doors, will be kept locked in any time that these areas are not monitored (e.g., outside working hours). The hoarding will be painted, well maintained and may contain graphics portraying project information.

Image 6: Example of suitable hoarding

5.5 Site Security

The contractor will be responsible for the security of the site for the duration of the works. All reasonable precautions will be taken to prevent unauthorised access to the site, the works and adjoining property. Adequate safeguards will be put in place to protect the site, the works, products / materials and plant from damage, theft and trespass.

As part of their site security responsibilities, the contractor will be required to:

- Install and maintain adequate site hoarding to the site boundary with adequate controlled access and egress points;
- Always maintain site security;
- Ensure restricted access is maintained to the works; and
- Monitor and record all deliveries to site and materials / waste taken off site.

All staff will be made fully aware of their individual responsibilities regarding safety and security and will undertake their work in accordance with such guidelines. All staff and operatives will be fully inducted into the security, health and safety and logistic requirements on site.

5.6 Construction Compound and Material Storage

Construction compounds will be the primary locations for the storage of materials, as well as plant and equipment. No stockpiling will be permitted in any other areas, aside from the bridge assembly area. Surplus excavation material will be removed off site by an authorised waste contractor to an appropriately licensed / permitted waste facility.

The proposed extent of the construction compounds and the bridge assembly area is outlined in **Image 7**.

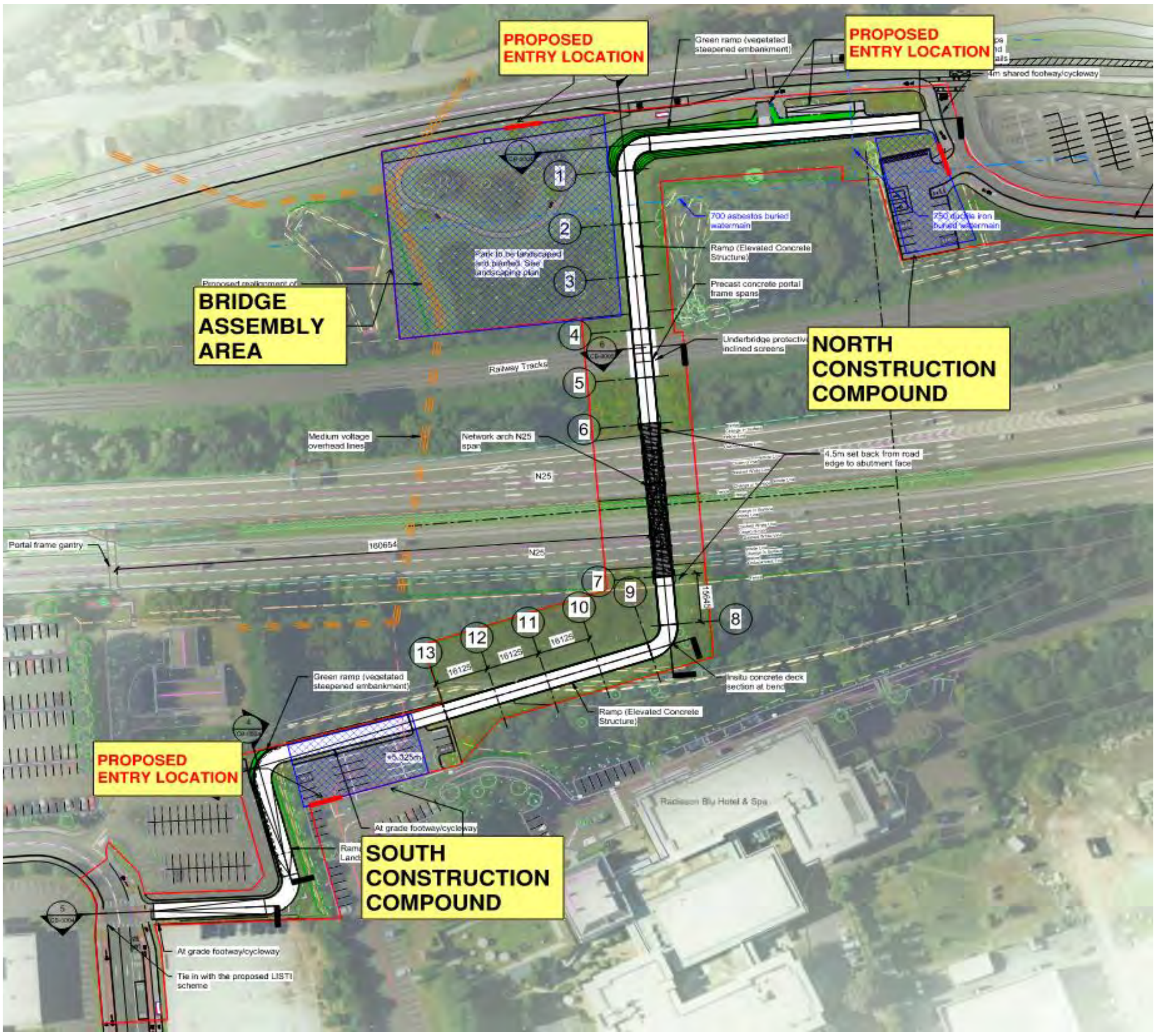

Image 7: Proposed construction compounds and bridge assembly area

For the site clearance and earthworks, the contractor will require the use of the construction compounds for the storage and segregation of hazardous and non-hazardous excavated material. For the bridge assembly works, the contractor will again require the use of the construction compounds for material storage.

The following construction management measures will be implemented at the two construction compounds and the bridge assembly area:

- Any containers of potential polluting materials such as fuels and oils will be stored in appropriately bunded containment areas designed to retain spillages;
- All bulk fuel storage will be integrally bunded or kept within a bunded area; and
- A designated bunded refuelling area on an impermeable surface will be provided.

Spill kits and hydrocarbon absorbent packs will be stored at the two construction compounds and the bridge assembly area, as well as in the cabin of each vehicle. All operators will be fully trained in the use of this equipment.

The contractor is responsible for obtaining all necessary permissions from relevant statutory bodies, including local authorities, for the disposal of water off site. Standing water should be cleared as soon as is practicable or treated with an approved product at least once a week.

The contractor is to ensure that there is no hazardous build-up of water and is to provide for temporary disposal of rainwater from the site during the works. Any water that is potentially contaminated is to be treated on site by way of sediment / filtration tanks and comply with a waste disposal licence obtained by the contractor from the local authority.

5.7 Cranage

The construction works will require the use of several mobile cranes on site. The cranes will be required for the moving of building materials on site such as formwork for concrete, reinforcement, precast concrete, steelwork, plant and general construction materials. The contractor will develop a crane management plan to limit lifting operations over live roadways and the rail line. Proposed details of crane set up locations to achieve maximum coverage of the site are presented below.

For the northern elevated ramp sections, the spans can be lifted into place using mobile cranes sited at a close distance to the structure. Due to the open nature of the amenity park area, this is possible and will reduce the need for major crane pads. A suitable crane for the lifting of the northern spans is expected to be a Liebherr LTM 1750-6.1 800 tonne mobile crane, or similar. Refer to **Image 8** for further details.

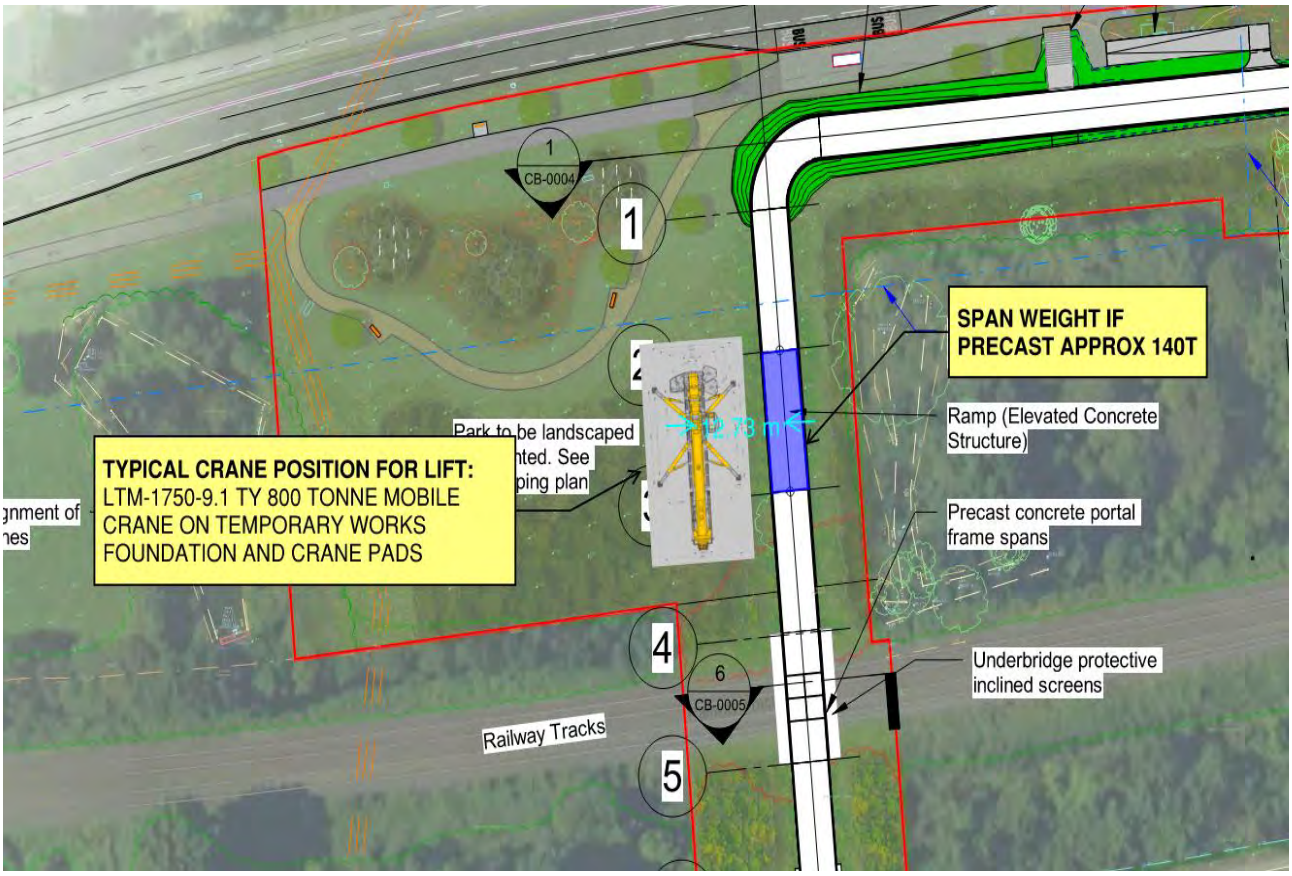

Image 8: Proposed methodology for erection of north elevated ramp superstructure for precast deck option

Due to the uneven nature of the terrain surrounding the southern elevated ramp, a rough terrain crane is anticipated to be used for lifting of the bridge beams into position. Crane pads or a build-up of hardcore is expected to be required at the craning positions. A suitable crane is the Liebherr LTR 1100-2.1 100 tonne rough terrain crane or similar which is available from Irish suppliers. Refer to **Image 9** for an indication of the lift radia and crane pad positions.

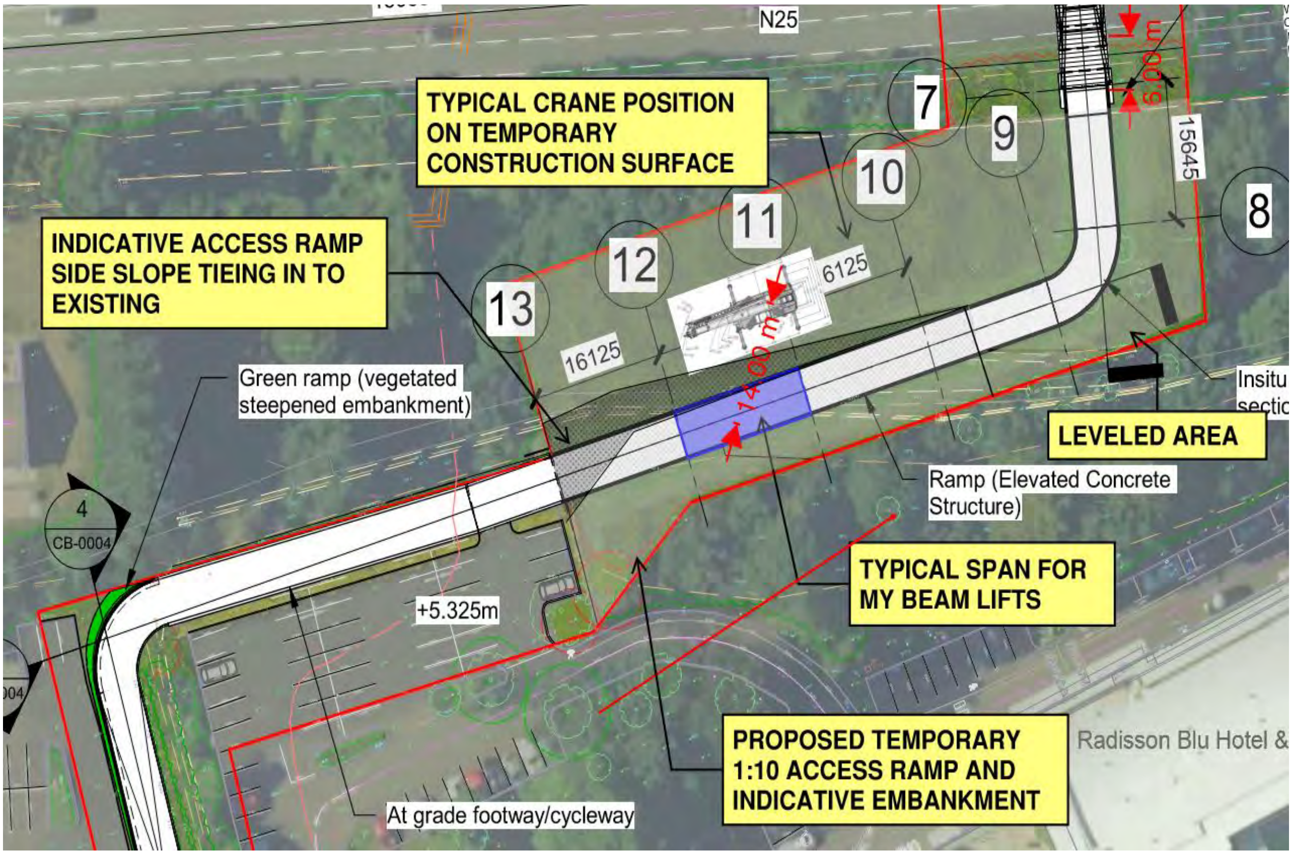

Image 9: Proposed methodology for erection of southern elevated ramp precast concrete bridge beams

The portal frame will be assembled in its final position during a temporary track closure in agreement with Irish Rail. Sections will be joined together via in-situ concrete stitches as per the supplier details. Components are designed to be lifted into place by mobile cranes. The crane size to be used will be confirmed by the contractor. However, it is anticipated to be placed on the same temporary works crane pad as that used for the first lift of the N25 bridge. For the roof sections of the south portal frame span, it is expected that the crane will be located on the N25 northern carriageway. This will require an overnight partial closure of the N25 eastbound carriageway. It is expected that it will be possible for a single lane to remain open with suitable traffic management measures in place.

As such, it is expected that the crane required will be the same crane as that required for the N25 bridge lift. A suitable crane is the Liebherr LTM 1750-9.1 800 tonne mobile crane TY variant. This crane is available from local suppliers. It is proposed that the erection of the Irish Rail spanning portal frames be completed prior to the erection of the N25 steel bridge to allow for these spans to be used as an intermediate support position for the N25 span during the craning operation. Refer to **Image 10** for further details.

Following assembly of the N25 steel network arch bridge structure on temporary supports and following construction of the northern ramp and portal frame structures (without parapets fitted), it is proposed that a large mobile crane (LTN 1750-9.1 TY 800 tonne crane or similar) is set up on a temporary works crane pad adjacent to the Irish Rail boundary in the bridge assembly area. This crane is proposed to lift the bridge structure onto a temporary seating position on the northern elevated ramp and portal frame structures.

Following the initial lift, the crane is proposed to be repositioned to the northern edge of the N25 carriageway during an overnight closure of the N25 at this location. A second lift will then take place to lift the structure into its final position. The proposed crane is available from local suppliers. The two-stage lift of the N25 structure and crane pad positions is illustrated in **Image 11**.

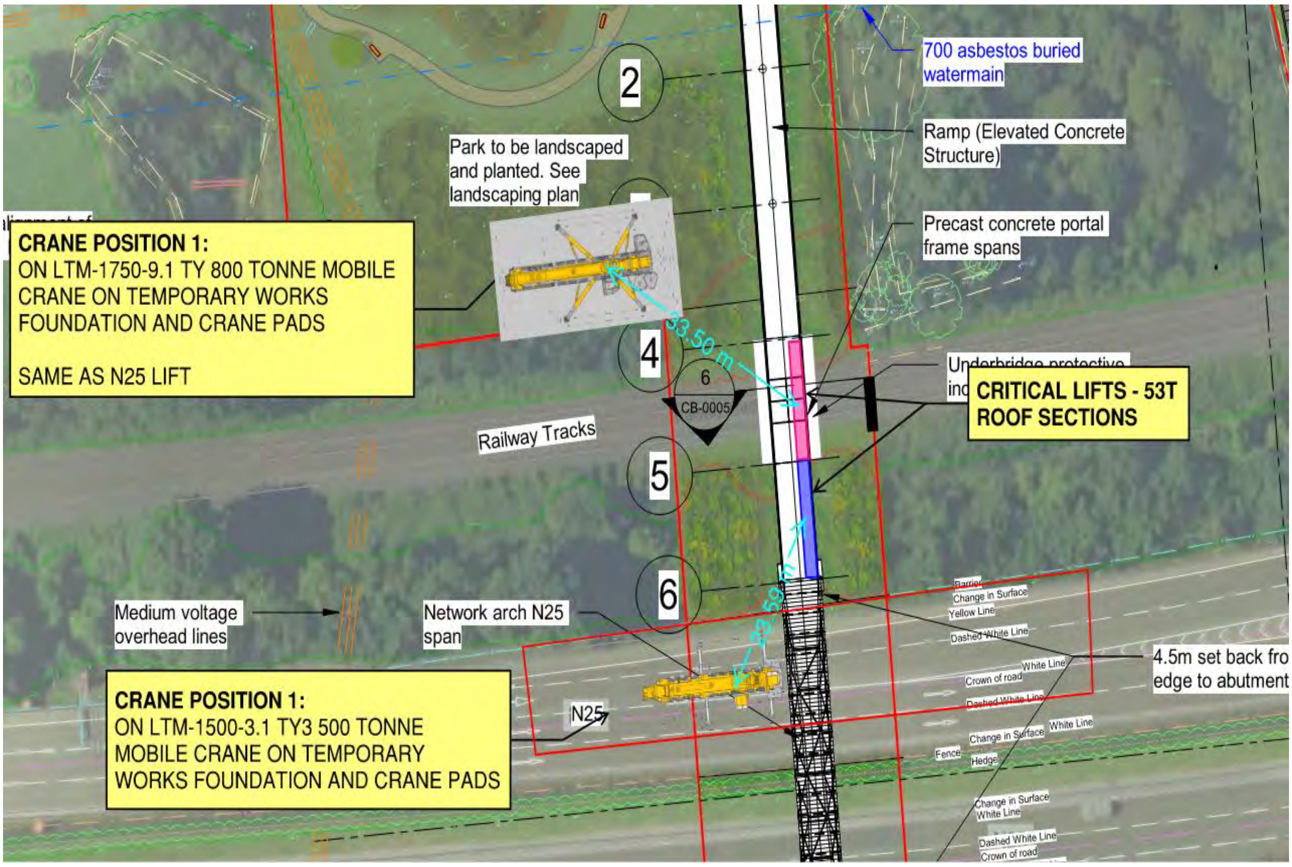

Image 10: Proposed methodology for erection of precast portal frame elements of railway spans

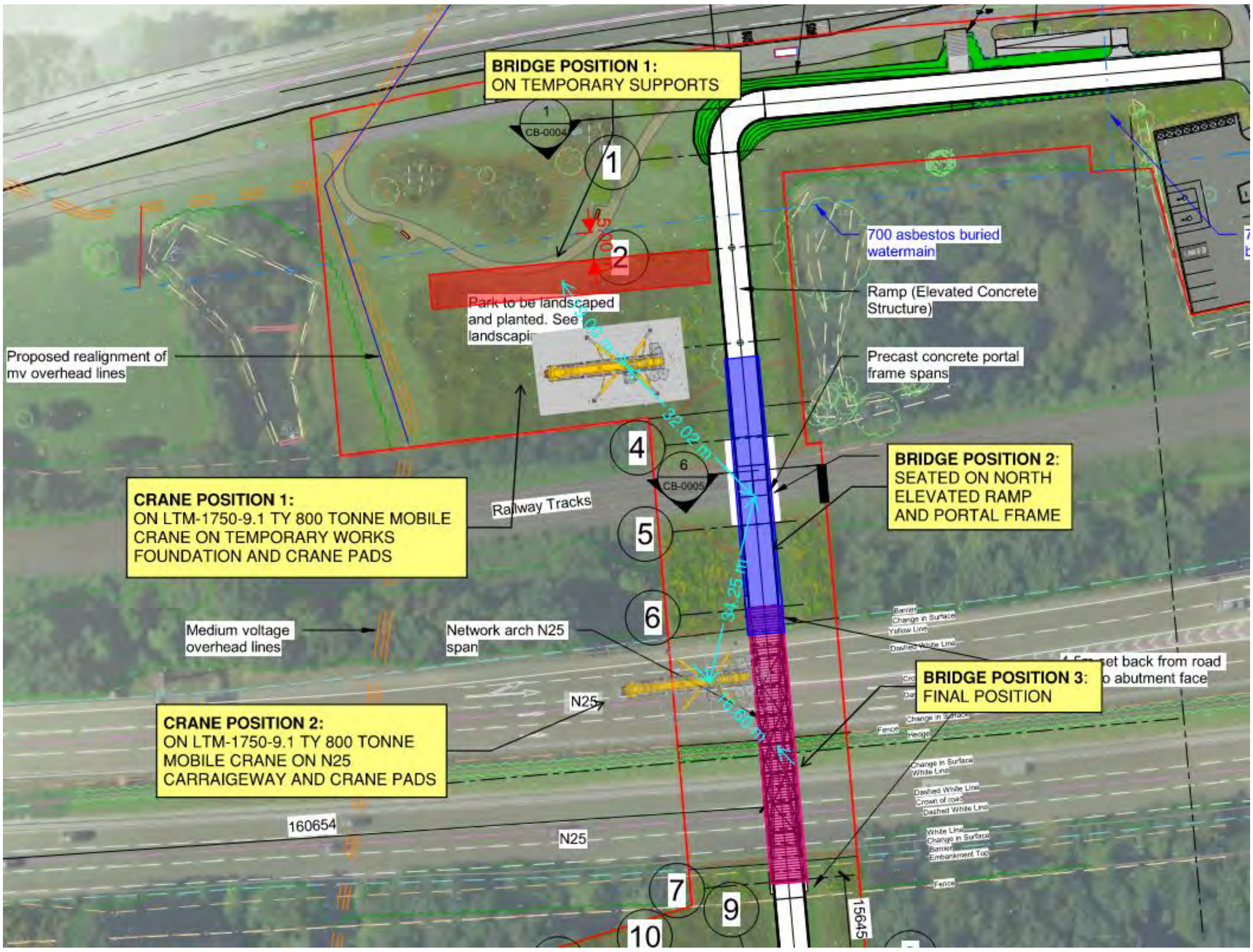

Image 11: Proposed methodology for bridge lift 1 using LTN1750-9.1 TY

5.8 Dust

A dust minimisation plan will be prepared and implemented by the contractor for the Construction Phase.

The adoption of mitigation measures will vary throughout the construction works depending on the type of activities being undertaken and the prevailing weather conditions at the time. For instance, additional mitigation such as damping down of earth mounds on site would be undertaken if the prevailing weather conditions are dry and windy.

The key aspects of controlling dust are listed below. In summary, the measures which will be implemented will include:

- During very dry periods when dust generation is likely, construction areas will be sprayed with water;
- Exhaust emissions from vehicles operating within the site, including trucks, excavators, diesel generators and other plant equipment, will be controlled by the contractor through regular servicing of machinery;
- Vehicle speeds will be limited in the construction site;
- Wheel-wash facilities may be provided, if required. Wheel-wash facilities will have rumble grids to remove excess mud from wheels. These facilities will be located at the exit from the construction compounds and away from sensitive receptors, where possible;
- Surrounding roads used by trucks to access to and egress from the site will be cleaned regularly using an approved mechanical road sweeper. Roads will be cleaned on a daily basis, or more regularly, as required;
- Areas where materials will be handled and stockpiled will be designed to minimise their exposure to wind – all temporary stockpiles shall be kept to the minimum practicable height with gentle slopes;
- Material drop heights from plant to plant or from plant to stockpile will be minimised; and
- Where practicable, truck loads will be covered when carrying material likely to generate dust.

The following measures shall also be implemented to minimise off-site dust impacts:

- Provision of hoarding around the site;
- Covering of all trucks exiting the site with tarpaulin;
- Locating plant likely to generate emissions away from sensitive receptors; and
- Any stockpiled material will be covered / dampened during periods of dry weather to prevent the spreading of dust.

At all times, these procedures will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movements of materials likely to raise dust would be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.

Staff training and the management of operations will ensure that all dust suppression methods are implemented and continuously inspected.

5.9 Wheelwashing / Road Sweeping

Wheel-wash facilities may be provided, if required. Should these facilities be provided, the contractor shall ensure, where appropriate:

- Enough wheel wash facilities are provided at each egress point from the site;
- The wheel wash must be kept in place and used throughout the critical dirt generating activities of the construction works; and
- Water supplies servicing the wheel wash will be from recycled sources, where possible. All waters shall be drained through appropriate filter material prior to discharge.

Should wheel-wash facilities not be provided, it will be ensured that surrounding roads used by trucks to access to and egress from the site will be cleaned regularly using an approved mechanical road sweeper. Roads will be cleaned on a daily basis, or more regularly, as required.

The contractor will also endeavour to mitigate the risk of blockage of local gullies and drains due to construction materials and will carry out drain clearing as required.

5.10 Noise and Vibration

A Noise and Vibration Management Plan (NVMP) will be prepared for the Construction Phase of the Proposed Development. The contractor is required to follow and implement where required, the procedures set out in the NVMP. The contractor will have responsibility for managing construction noise and vibration in accordance with the procedures outlined in the NVMP. Where required, appropriate mitigation measures shall be implemented to minimise significant impacts at receptor locations.

A noise and vibration monitoring programme will be implemented for the duration of the construction works. Noise and vibration monitors shall be maintained and operated as per the methods set out in the NVMP.

Construction noise should not exceed the threshold values outlined in **Table 2** at nearby noise sensitive receptors, or further limits if imposed by the local authority or specified in the NVMP.

Table 2: Construction noise threshold for significant effect at noise sensitive receptors (BS5228-1+A1:2014)

Time period	Day and times	Threshold value ($L_{Aeq,T}$) dB
Day	Weekdays 07:00 – 19:00 Saturday 07:00 – 13:00	65
Evening	Weekday 19:00 – 23:00 Saturday 13:00 – 23:00 Sunday 07:00 – 23:00	55
Night	All days 23:00 – 07:00	45

For residential receptors and other medium sensitivity receptors, a negative vibration effect has been defined as a peak particle velocity (PPV) of 0.3 mm/s or higher during the daytime. The onset of a significant negative vibration effect has been defined as a PPV of 1.0 mm/s or higher in the daytime. It is likely that residential receptors are more sensitive to vibration at night and therefore a significant negative vibration effect is likely to occur at a PPV of 0.3 mm/s or higher during the night time periods.

In addition to human annoyance, building structures may be damaged by high levels of vibration. The levels of vibration that may cause building damage are far in excess of those that may cause annoyance. Consequently, if vibration levels are controlled to those specified for human annoyance (i.e., 1.0 mm/s) then it is highly unlikely that buildings will be damaged by construction vibration.

The contractor shall be required to assess and monitor vibration levels during critical work activities to identify any risks of vibration impacts at nearby sensitive receptors in accordance with the procedures outlined in the NVMP.

5.11 Road and Footpath Maintenance

In addition to the waste management measures listed above, the following measures will be taken to ensure that the site and surrounding roads and footpaths are kept clear, tidy and well maintained:

- A regular programme of site tidying will be established to ensure a safe and orderly site; and
- In the event of any fugitive solid waste escaping the site, it will be collected and removed to storage on site, and subsequently disposed of in the appropriate manner.

If the existing roads or footpaths around the site are damaged as a result of the construction works, the contractor will carry out repairs to same.

5.12 Services and Lighting

5.12.1 Services and utilities

During the construction works, the working areas will be powered from the existing electrical network in the area or diesel generators where an electrical supply is not available.

5.12.2 Lighting

Site lighting will typically be provided by tower mounted 1000W metal halide floodlights. The floodlights will be cowled and angled downwards to minimise spillage to surrounding properties. The following measures will be applied in relation to site lighting:

- Lighting will be provided with the minimum luminosity sufficient for safety and security purposes. Where practicable, precautions will be taken to avoid shadows cast by the site hoarding on surrounding footpaths, roads and amenity areas;
- Motion sensor lighting and low energy consumption fittings is recommended to be installed to reduce usage and energy consumption; and
- Lighting will be positioned and directed as not to unnecessarily intrude on adjacent buildings, ecological receptors and structures used by protected species, nor to cause distraction or confusion to passing motorists.

5.13 Welfare Facilities

Welfare facilities will be provided, as appropriate, for construction staff and site personnel such as toilets, site offices etc. The construction compounds will be used as the location for worker welfare facilities. The contractor will be required to ensure that the sanitary facilities for site personnel are maintained and effluent storage is regularly emptied and disposed of appropriately.

5.14 Reinstatement of Works Areas on Completion

All working areas and access routes will be reinstated as work proceeds during construction. All plant, equipment, materials, temporary infrastructure and vehicles will be removed at the earliest opportunity.

6. Environmental Management Framework

6.1 Overview

As part of the environmental management framework, contractors will be required to comply with all relevant environmental legislation and take account of published standards, accepted industry practice, national guidelines and codes of practice appropriate to the Proposed Development. Due regard should be given to the guidance and advice given by ISO14001 standard (ISO, 2015) and CIRIA guidance (CIRIA, 2002; 2015a; 2015b).

The contractor will be required to develop and implement an Environmental Management System (EMS) that follows the principles of ISO14001. Further, the contractor's EMS should include an environmental policy, operational, monitoring and auditing procedures to ensure compliance with all environmental requirements and to monitor compliance with environmental legislation and the environmental management provisions outlined in the relevant documentation.

6.2 Responsibilities

6.2.1 Employer / employer's representative

Procurement of the appointed contractor(s) by the CCC (the employer for the construction works), will involve the determination that the appointed contractor is competent to carry out the works, including the effective implementation of the mitigation measures.

The appointed contractor will be required to plan and construct the Proposed Development construction works in accordance with the employer's requirements, and CCC will employ an employer's representative team with appropriate competence to administer and monitor the construction contract for compliance with the employer's requirements.

6.2.2 The contractor

The contractor(s) appointed will be responsible for the organisation, direction and execution of environmental related activities during the detailed design and construction of the Proposed Development. The contractor is required to undertake all activities in accordance with the relevant environmental requirements including the consent documentation and other regulatory and contractual requirements.

6.2.3 Site manager

A site manager will be appointed by the contractor to oversee the day-to-day management of working areas within the site and ensure that effective, safe, planned construction activities are delivered on an ongoing basis to the highest standards. The site manager will be a suitably qualified, competent and experienced professional that will oversee site logistics, communicate regularly with construction staff, accommodate project-specific inductions for staff on site and ensure that all work is compliant with the relevant design standards and health and safety legislation.

6.2.4 Environmental manager

An environmental manager will be appointed by the contractor to ensure that the CEMP is effectively implemented. The environmental manager will be a suitably qualified, competent and experienced professional that would perform the necessary tasks, review environmental procedures and consult with the members of the construction team and stakeholders as requited. The environmental manager will be responsible for:

- Updating, maintaining and implementing the CEMP;
- Establishing, implementing, and maintaining the EMS in line with ISO 14001;
- Conducting regular weekly environmental inspections as specified in the contract and checking adherence to the CEMP;
- Ensuring that construction occurs in accordance with the relevant environmental requirements and that such compliance is adequately recorded and documented;
- Completing a site inspection and compiling an environmental compliance list as agreed and specified in the CEMP;
- Attending site and stakeholder meetings as required;
- Keeping up-to-date with relevant environmental best practice and legislative changes;
- Liaising with the relevant staff to prepare method statements and relevant plans for all activities where there is a risk of environmental damage;
- Having a detailed level of knowledge on all aspects of environmental information associated with the Proposed Development;
- Ensuring all personnel have undertaken adequate environmental inductions, awareness briefings and training (including sub-contractors);

- Dealing with environmental complaints; and
- Managing and responding to environmental incidents and ensuring that all incidents are recorded and reported in an appropriate manner.

6.2.5 Liaison manager

A Liaison Manager will be appointed by the contractor and will be responsible for managing such tasks as the following:

- Briefing residents / neighbours on progress and issues, as necessary;
- Liaison with CCC and emergency services, as appropriate;
- Liaison with An Garda Síochána, particularly in relation to traffic movements and permits, where necessary.

6.2.6 Environmental specialists engaged by the contractor

To fulfil its obligations under the CEMP and to support its environmental manager, the contractor will be responsible for engaging suitably qualified and experienced professionals including, where necessary, the following (i.e., depending on the scope of the contract) competent experts:

- Project archaeologist;
- Project ecologist;
- Noise and vibration specialist;
- Land, soils and contamination specialist(s); and
- Water specialist.

6.3 Communication Process

6.3.1 Community and stakeholder engagement

The contractor will take all reasonable steps to engage with stakeholders in the local community, focusing on those who may be affected by the construction works including residents, businesses, community resources and specific vulnerable groups.

Communication with the local community and other relevant stakeholders shall be undertaken at an appropriate level and frequency throughout construction. Where communications are related to environmental issues, the environmental manager will be informed and engaged with, as appropriate.

6.3.1.1 Community liaison

CCC recognises the importance of effective community liaison to reduce nuisance to residents, to ensure public safety and welfare and to help ensure the smooth running of construction activities. Important issues in ensuring good relations are:

- Providing information for the public during the Construction Phase (particularly nearby sensitive receptors);
- Providing the correct points of contact and being responsive; and
- Ensuring good housekeeping in all aspects of the operations.

A ‘good neighbour’ policy will be implemented, as far as possible. Key aspects of this policy include:

- Early implementation of the policy, i.e., from the commencement of construction;
- Reduction of nuisance factors;

- Maintaining access to neighbouring premises and businesses;
- Clear and concise information; and
- Undertaking timely liaison with stakeholders.

6.3.2 Advance notice of works

The contractor will ensure that residents, businesses, occupiers, general users of the area and stakeholders are informed in advance of construction activities that may affect them. Relevant obligations and procedures in relation to advance notice of works will be identified in the updated CEMP.

All notifications will detail the nature, estimated duration and working hours. All notifications will include a project-specific contact number to which any enquires can be directed. The contractor will be responsible for preparing and issuing the notifications subject to the relevant approval and consents.

The contractor in consultation with CCC and statutory stakeholders will decide whether to arrange any further targeted consultation with the public or relevant stakeholders in advance of specific construction activities on a local basis.

6.3.3 Emergency contacts

As outlined in Section 7.4.2.1, an emergency contact list will be established and made available to all construction staff employed. The contact list shall be displayed prominently on site as well as at suitable locations where construction activity is being carried out around working areas. The contact list will include key environmental representatives that may need to be contacted in the event of an incident.

6.3.4 Enquiries and complaints

The contractor will establish a process for handling all enquiries including complaints. All enquiries will be recorded and a log will be maintained to include details of the response and action taken. This will be available upon request for inspection to CCC. All enquiries, whether a query or a complaint, will be dealt with in a timely manner.

The environmental manager will be immediately informed of any environmental-related issues that have been raised. Where appropriate, the environmental manager would be responsible for informing CCC, relevant stakeholders and statutory bodies.

7. Environmental Management Procedures

7.1 Training, Awareness and Competence

The contractor (and their subcontractors) will be selected with due consideration of relevant qualifications and experience. The contractor will be required to employ construction staff with appropriate skills, qualifications and experience appropriate to the needs of the works to be carried out during construction. A site induction will be provided to all construction staff before they commence work on site. Where appropriate, the contractor will identify specific training needs for the construction workforce and will ensure that appropriate training requirements are fulfilled.

The contractor will establish an environmental training and awareness programme and ensure that all personnel receive adequate training prior to the commencement of construction activities. A baseline level of environmental awareness will be established through the site induction programme. Key environmental considerations and objectives will be incorporated into this induction. Specifically, site inductions will cover the following as a minimum:

- Introduction to the environmental manager;
- Description of the CEMP and consequences of non-compliance;

- The requirements of due diligence and duty of care;
- Overview of conditions of consents, permits and licences;
- Requirements associated with community engagement and stakeholder consultation;
- Identification of environmental constraints and notable features within the site; and
- Procedures associated with incident notification and reporting including procedures for dealing with damage to the environment.

Nobody will work on site without first receiving environmental induction. Signed records of environmental training will be established, maintained and made available to the employer's representative.

Site briefings and talks would be carried out on a regular basis to ensure that construction staff have an adequate level of knowledge on environmental topics and community relations and can effectively follow environmental control procedures throughout construction.

7.2 Meetings

CCC and / or the employer's representative will arrange regular monthly meetings to discuss environmental matters and ensure effective coordination to be attended by:

- CCC;
- The employer's representative;
- Contractor (including site manager);
- Environmental manager; and
- Environmental Specialists – engaged by either CCC and / or the contractor.

The environmental manager will be responsible for arranging and holding monthly meetings and site walk overs with the employer's representative. The environmental manager will develop and distribute minutes of the monthly meetings and distribute them accordingly.

7.3 Monitoring, Inspections and Audits

For the duration of the contract(s), the environmental performance of the contractor will be monitored through site inspections and audits. Monitoring, inspections and audits shall be specified in the contract and are likely to be a combination of internal inspections and independent external audits that may be either random or routine.

Records of all inspections carried out will be recorded on standard forms and all actions should be closed out in a reasonable time. The updated CEMP will include further details of inspection procedures.

7.3.1 Monitoring

Mitigation and monitoring will be carried out in accordance with the relevant environmental requirements so that construction activities are undertaken in a manner that does not give rise to significant negative effects. Suitable monitoring programmes will need to be developed, implemented, documented and assessed.

The results of all environmental monitoring activities would be reviewed by the environmental manager on an ongoing basis to enable trends or exceedance of criteria to be identified and corrective actions to be implemented as necessary. The contractor will be required to inform the employer's representative of any exceedances of criteria.

7.3.2 Inspections

Regular weekly inspections of construction activities will be carried out by the environmental manager to ensure all necessary environmental measures relevant to the construction activities are being effectively implemented by construction staff, ensuring legal and contractual conformity.

The weekly inspections would be appropriately documented by the environmental manager and copies of these records and any action required to be undertaken should be made available to the employer's representative.

Each month, one of the weekly inspections will include a review of environmental documentation and records. The monthly inspection will be recorded on a standard form and reported to the employer's representative within five days of the inspection taking place. This standard form will address the following as a minimum:

- Summary of compliance / non-compliance with the CEMP;
- Results and interpretation of the monitoring programme;
- Key issues noted in inspections and / or audits;
- Summary record of non-conformities, incidents and corrective actions;
- Summary of environmental complaints and queries received in relation to environmental matters; and
- Summary record of environmental training undertaken by staff.

Inspection and review documentation will be amended to the monthly environmental compliance report that will be submitted to the employer's representative by the contractor – refer to Section 7.5.1.

7.3.3 Audits

CCC will arrange for independent environmental audits to be carried out by a third-party during construction. External audits provide the opportunity for an independent auditor to advise on compliance with applicable environmental regulatory requirements, the efficacy of the environmental management approaches used, and recommendations for reducing identified environmental risks (if considered appropriate).

Further, regulatory and statutory bodies may undertake site visits to monitor compliance with legislative and regulatory requirements. These site visits may occur randomly throughout the construction period. The contractor will facilitate these visits and the environmental manager will be available to provide information as required and deal with any issues that may arise during, or because of, these visits.

Planned and documented audits aimed at evaluating the conformance of the EMS would also be carried out by the environmental manager. The environmental manager will establish a schedule for internal audits and this inspection calendar will be made available to the employer's representative. These environmental audits will be scheduled at least once every three months.

Standard forms for reporting and audit items will be prepared and will include but not be limited to the following activities:

- Review of environmental documentation to establish if relevant requirements are being achieved and if continual improvement is occurring;
- Site inspection and interviews with onsite personnel; and
- Reporting with recommendations.

For any environmental nonconformities found, the auditor will prepare a corrective actions report to describe and record the findings of the non-conformance. The verification of previous corrective actions reports should be also recorded.

Upon completion of an audit, the auditor will review all corrective actions reports and prepares an audit report to summarise:

- Corrective action requests raised;
- Previous corrective action requests closed; and
- Observations made during the audit.

The environmental manager will be entitled to participate in all audits. Notwithstanding this, the employer's representative shall produce and provide the contractor with a copy of each audit report within five working days of the audit. Each audit report will detail the findings from the auditor, specify non-conformances identified and outline the proposed corrective action.

7.4 Incident Response

7.4.1 Corrective actions

7.4.1.1 Overview

Corrective actions are measures to be implemented to rectify any non-conformances (i.e., exceedance of criteria or targets) identified during monitoring, inspections and / or audits.

In the first instance, an investigation should be undertaken by the environmental manager to identify the cause of any non-conformances. Remedial measures shall be identified by the environmental manager, in agreement with the employer's representative, and implemented as soon as practicable to prevent further exceedances. If necessary, the appropriate statutory authority and stakeholders will be notified.

Where new or amended measures are proposed, the relevant CEMP will be updated accordingly by the environmental manager and the employer's representative should be informed at the earliest opportunity.

7.4.1.2 Corrective action reports

As previously mentioned, a corrective actions report is prepared on foot of any non-conformances identified during environmental monitoring, inspections and / or audits on site. The corrective actions report will describe in detail the cause and effect of a non-conformance on site and describe the recommended corrective action that is required to remedy it.

An appropriate timeline for closing out the corrective actions will be identified by the contractor as well as arrangements for the environmental manager verifying the corrective actions report and informing appropriate authorities and stakeholders in a timely manner.

7.4.2 Emergency incidents

7.4.2.1 Overview

Emergency incidents are those occurrences that give rise to significant negative environmental effects including but not limited to the following:

- Any malfunction of any mitigation measure and / or environmental protection system;
- Any emission that does not comply with the requirements of the contract;
- Any circumstance with the potential for environmental pollution; or
- Any emergency that may give rise to environmental effects (e.g., significant spillages or fire outbreak).

An emergency contact list will be established and made available to all construction staff employed. The contact list shall be displayed prominently on site as well as at suitable locations where construction activity is being carried out around working areas. The contact list will include key environmental representatives that may need to be contacted in the event of an incident.

7.4.2.2 Spill control measures

Every effort will be made to prevent pollution incidents associated with spills during the construction of the Proposed Development. The risk of oil / fuel spillages will exist on the site and any such incidents will require an emergency response procedure.

The following steps provide the procedure to be followed in the event of an oil / fuel spill occurring on site:

- Identify and stop the source of the spill and alert people working in the vicinity;

- Notify the environmental manager immediately giving information on the location, type and extent of the spill so that they can take appropriate action;
- If applicable, eliminate any sources of ignition in the immediate vicinity of the incident;
- Contain the spill using the spill control materials, track mats or other material as required. Do not spread or flush away the spill;
- If possible, cover or bund off any vulnerable areas where appropriate such as drains, watercourses and/or sensitive habitats;
- If possible, clean up as much as possible using the spill control materials;
- Contain any used spill control material and dispose of used materials appropriately using a fully licensed waste contractor with the appropriate permits so that further contamination is limited;
- The environmental manager shall inspect the site as soon as practicable and ensure the necessary measures are in place to contain and clean up the spill and prevent further spillage from occurring; and
- The environmental manager will notify the appropriate stakeholders such as CCC, National Parks and Wildlife Service, Department of Environment Climate and Communications, and Department of Housing, Local Government and Heritage and / or the EPA.

Environmental incidents are not limited to just fuel spillages. Therefore, any environmental incident must be reported, recorded and investigated in accordance with the procedures described in Section 7.4.

7.4.2.3 Emergency incident response plan

A set of standardised emergency response procedures will govern the management of emergency incidents. The contractor will be required to detail emergency incident response procedures and to develop an Emergency Incident Response Plan.

The emergency incident response plan will contain emergency phone numbers and the method of notifying local authorities, statutory authorities and stakeholders. Contact numbers for key personnel will also be included therein. Contractors will be required to adhere to and implement these procedures and ensure that all staff and personnel on site are familiar with the emergency arrangements.

In the case of work required in an emergency, or which if not completed would be unsafe or harmful to workers, the public or local environment, CCC will be informed as soon as reasonably practicable of the reasons and likely duration. Examples may include where the ground needs stabilising if unexpected ground conditions are encountered, concrete pouring taking longer than anticipated due to delayed deliveries or equipment failure.

In the event of an emergency incident occurring, the contractor will be required to investigate and provide a report including the following, as a minimum:

- A description of the incident, including location, the type and quantity of contaminant and the likely receptor(s);
- Contributory causes;
- Negative effects;
- Measures implemented to mitigate adverse effects; and
- Any recommendations to reduce the risk of similar incidents occurring.

The contractor will consult with the relevant statutory authorities, stakeholders and relevant parties such as the Health and Safety Authority, the Fire Authority, the Ambulance Service, the EPA, utilities companies and CCC when preparing and developing response measures. Further, if any sensitive receptor is impacted, the appropriate environmental specialists will be informed and consulted with accordingly.

Any response measures will be incorporated into an updated emergency incident response plan that should be disseminated accordingly to construction staff, CCC and the employer's representative.

7.4.2.4 Emergency access

The contractor will be required to maintain emergency access routes throughout construction and identify site access points for each working area.

This should be developed in partnership with the emergency services and documented as part of the emergency incident response plan.

7.4.2.5 Extreme weather conditions

The contractor will consider the effects of extreme weather events and related conditions during construction. The contractor will use a short to medium range weather forecasting service from Met Eireann or other approved meteorological data and weather forecast provider to inform short to medium term programme management, environmental control and mitigation measures.

All measures deemed necessary and appropriate to manage extreme weather events will be considered and will specifically cover training of personnel and prevention and monitoring arrangements for staff. As appropriate, method statements will also consider extreme weather events where risks have been identified, e.g., construction works adjacent to public roads and business premises.

7.4.3 Unexpected discoveries

Appropriate procedures will be put in place in the event of encountering unexpected archaeological or cultural heritage assets or subsurface contamination during intrusive ground works. Appropriate procedures will be developed as part of the CEMP and the environmental manager will ensure that specialists (e.g., archaeologist) are facilitated to ensure management in accordance with industry best practice and effective compliance with the relevant legislation. All unexpected discoveries will be reported to the appropriate authorities and documented in an appropriate manner.

7.5 Reporting

7.5.1 Environmental compliance report

The contractor will be required to submit a monthly report to the employer’s representative for review and approval. The report shall address the following as a minimum:

- Summary of compliance with the CEMP including identification of any non-conformances;
- Interpretation of the results of ongoing monitoring;
- Detailed description of any issues and / or non-conformances identified during inspections and / or audits;
- Record of incidents and corrective actions (including corrective actions reports, as appropriate);
- Synopsis of environmental complaints received / queries raised by stakeholders; and
- Records of environmental training undertaken (as appropriate).

7.5.2 Incident investigation reports

The contractor will inform the employer’s representative of all emergency incidents immediately and prepare an initial report within 24 hours setting out the details of the incident and cause(s) if known. The contractor will be required to complete the environmental incident report and any further documentation requested by the employer’s representative in relation to the incident within 7 days of the incident occurring. The contractor will respond to all comments made by the employer’s representative on any incident.

The environmental incident report will contain details of the incident including the location, known and suspected causes and weather conditions. It will define the scale and effects (short, medium, long term, temporary / permanent), as well as required corrective actions and mitigation / remediation / compensation measures (as appropriate).

7.5.3 Environmental records

Records of all environmental documentation will be maintained including monitoring, test results, method statements and plans. All records will be kept up to date and be made available for audits, inspections and periodical reporting. The contractor will maintain the following environmental records (as a minimum) that will be made available for inspection to the employer's representative and the relevant authorities, if required:

- Management plans;
- Records of environmental incidents;
- Monthly environmental reports;
- Records of environmental training;
- Register of environmental complaints;
- Corrective action reports;
- Environmental inspection and audit reports;
- All monitoring data;
- Waste and chemical inventories; and
- Health and safety records.

7.6 Construction Phase Mitigation and Monitoring

7.6.1 Traffic and Transportation

The following mitigation measures are proposed:

- Overnight traffic management on N25 junction 2 eastbound off ramp slip lane to allow site clearance;
- Blocking a small area of only one lane on the eastbound off ramp for access for construction of the N25 span northern abutment for 6-10 weeks;
- Overnight lane closures and traffic management on N25 junction 2 eastbound off ramp slip lanes and adjacent traffic lanes to facilitate erection of south span of the precast concrete portal frame structure over Irish Rail land. It is expected that a single eastbound lane can remain open;
- Overnight / weekend closure of the N25 to allow for steelwork erection of the N25 span;
- Weekend closure of Irish Rail track in agreement with Irish Rail to allow for construction of precast concrete portal frame structures;
- Provision of a temporary bus service covering the same route and stops, in order to reduce the impact of the closure of the Irish Rail track on a weekend, in consultation with Irish Rail and Bus Eireann.
- A temporary road widening and right turn pocket will be provided along the L3004 Glounthaune Road for right turning construction traffic to / from construction compound 1;
- Overnight partial closure of N25 for maintenance repainting of bridge soffit in a sequential fashion for 6-10 nights;
- Provision of adequate parking spaces in the construction compounds during the Construction Phase should be ensured; and
- Parking restrictions and management measures at the Radisson Blu Hotel and Eastgate Business Park car parks will be reviewed and implemented as necessary in agreement with the local businesses and Cork County Council (CCC) to ensure that the functioning of the car parks is maintained and to avoid any site parking overspill issues.

A CTMP will be developed by the contractor when updating this CEMP and presented to CCC for approval prior to commencement of the construction works. Refer to Section 4.3.3.

The effectiveness of the CTMP will be continually monitored to ensure that impacts on traffic flows and road users on the surrounding public road network are minimised and additional mitigation measures are introduced, as required. The monitoring regime will consider all modes of traffic, including pedestrians, cyclists and public transport.

A Mobility Management Plan will be prepared by the contractor for its workforce to encourage access to the site by means other than by private car. Refer to Section 4.3.4.

7.6.2 Landscape and Visual

The following mitigation measures are proposed:

- Temporary site hoarding will be erected around areas that adjoin public or private land that may be impacted by the works. This includes the:
    - North, east and western site boundary with the L3004, access road to Little Island Railway Station and public green space respectively; and
    - Boundaries with the existing public car park at East Gate Road and The Radisson Blu Hotel car park.
- Additional protective fencing will be erected at the boundary of proposed works areas to protect retained landscape, planting, features etc. The remaining trees along the railway line embankments, N25 road corridor and the woodland block between the N25 and Radisson Blu Hotel will be protected with fencing in accordance with BS5837:2012: Trees in relation to Design, Demolition and Construction (BSI, 2012) and TII's Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes (TII, 2006). Refer to the Arboricultural Impact Assessment with accompanying tree clearance and tree constraints plans by Heritage Tree Care Ltd., for details of existing trees and tree groups to be removed, retained and the specification of protection measures (see **Appendix 8.2** in **Volume 4** of this EIAR). All necessary measures will be taken to avoid non-native, invasive species establishing in the area;
- Site machinery will only operate within the Proposed Development area;
- Storage of materials and temporary stockpiling will only be permitted at the bridge assembly area and construction compounds located at the north and southern ends of the Proposed Development site;
- Construction works will use the optimum number and arrangement of pile foundations, support columns and bridge abutments to minimise the impact of Construction and Operational Phase impacts on the landscape, particularly existing trees and woodland blocks;
- Locating, arranging and designing construction and assembly zones so that they use existing hard standing areas and / or minimise construction within existing landscape areas which will require removal and subsequently reinstatement as landscape; and
- Design and construction that minimises the requirement for future access under the structure and within woodland / landscape areas, thereby minimising potential disturbance to reinstated landscape areas.

The works will be monitored continuously to ensure the adequate protection of trees, built heritage features, amenity and public realm areas.

Any construction works within close proximity to the retained trees are advised to be undertaken in accordance with approved method statements prepared by the construction contractor under the direct supervision of a qualified consultant Arboriculturist. Therefore, during the construction works, a professionally qualified Arboriculturist is recommended to be retained by the principal contractor or site manager to monitor and advise on any works within the root protection area (RPA) of retained trees to ensure successful retention and planning compliance.

Copies of the Tree Clearance and Tree Constraints / Plans included with the Arboricultural Impact Assessment prepared by Heritage Tree Care Ltd. (refer to **Appendix 8.1** in **Volume 4** of this EIAR) and

BS5837:2012: Trees in relation to Design, Demolition and Construction (BSI, 2012), should be kept available on-site during development. All works are to be carried out in accordance with these documents.

On the completion of the construction works, all trees and vegetation retained are to be reviewed by the project Arboriculturist and any necessary remedial tree surgery works required to promote health and safety are to be implemented.

7.6.3 Biodiversity

7.6.3.1 General

All construction staff, including all sub-contracted workers, will be notified of the sensitive nature of onsite habitats, the Kilcoolishal Stream and nearby designated sites, and will also be made aware that no construction waste of any kind (rubble, soil, etc.) is to be deposited in these protected areas and that care must be taken with liquids or other materials to avoid spillage.

All personnel involved with the Proposed Development will receive an onsite induction relating to construction and operations and the environmentally sensitive nature of habitats on and adjacent to the Proposed Development site and to re-emphasise the precautions that are required as well as the precautionary measures to be implemented. Site managers, foremen and workforce, including all subcontractors, will be suitably trained in pollution risks and preventative measures.

All staff and subcontractors have the responsibility to:

- Understand the importance of mitigating pollution onsite, including noise and dust, and how to respond in the event of an incident to avoid or limit environmental impact;
- Respond in the event of an incident to avoid or limit environmental impact;
- Report all incidents immediately to the project manager;
- Monitor the workplace for potential environmental risks and alert the site manager if any are observed; and
- Co-operate as required, with site inspections.

7.6.3.2 Water quality

Details of water quality mitigation measures are outlined in Section 7.6.9.

7.6.3.3 Noise

Details on noise and vibration mitigation measures are outlined in Section 7.6.4.

7.6.3.4 Lighting

Lighting associated with the site works could cause disturbance / displacement of fauna. If of sufficient intensity and duration, there could be impacts on reproductive success.

During construction, lighting mitigation measures will follow *Bats & Lighting Guidance Notes for: Planners, engineers, architects and developers* (Bat Conservation Ireland, 2010).

Site lighting will typically be provided by tower mounted temporary portable construction floodlights. The floodlights will be cowled and angled downwards to minimise spillage to surrounding properties. The following measures will be applied in relation to site lighting:

- Lighting will be provided with the minimum luminosity sufficient for safety and security purposes. Where practicable, precautions will be taken to avoid shadows cast by the site hoarding on surrounding footpaths, roads and amenity areas;
- Where possible, construction lights will be switched off when not in use; and
- Lighting will be positioned and directed so that it does not to unnecessarily intrude on adjacent ecological receptors and structures used by protected species. The primary area of concern is the

potential impact on woodland on the southern and northern boundary of the N25. There will be no directional lighting focused on these sensitive habitats and cowling and focusing lights downwards will minimise light spillage.

Core construction works will take place during hours of daylight to minimise disturbance to any nocturnal mammal species.

7.6.3.5 Protection of habitats

The Wildlife Act 1976, as amended, provides that it is an offence to cut, grub, burn or destroy any vegetation on uncultivated land or such growing in any hedge or ditch from the 1st March to the 31st August. Exemptions include the clearance of vegetation in the course of road or other construction works or in the development or preparation of sites on which any building or other structure is intended to be provided. Site clearance including vegetation clearance will be undertaken within the Proposed Development. Trees and vegetation will not be removed between 1st March and 31stAugust, to avoid direct impacts on nesting birds. Tree removal will be carried out in accordance with the Arboricultural Impact Assessment (refer to **Appendix 8.1** in **Volume 4** of this EIAR). Trees to be retained will be identified and protected to avoid accidental damage during the Construction Phase.

Site drainage will be provided at the construction compounds to collect surface water runoff, which will be directed into the existing local drainage network. Surface water or contaminants within the site compounds will not be released from the site to any waters or the bed and banks of any waters (including ground water).

To prevent incidental damage by machinery or by the deposition of spoil during site works, woodland, hedgerow, tree and scrub vegetation which are located in close proximity to working areas will be clearly marked and fenced off to avoid accidental damage during excavations and site preparation. Tree protection measures are included in Arboricultural Impact Assessment (refer to **Appendix 8.1** in **Volume 4** of this EIAR). The project ecologist will specify appropriate protective fencing where required.

The streambed and banks of the Kilcoolishal Stream will be reprofiled / reinstated once the construction works are complete – refer to Section 7.6.9.

Habitats that are damaged and disturbed will be reinstated and landscaped once construction is complete.

7.6.3.6 Invasive species

Prior to the commencement of construction works an invasive species survey will be undertaken within the Proposed Development boundary by a competent expert to determine if invasive species listed under Part 1 of the Third Schedule of S.I No. 477 of 2011 have established in the area in the period between pre-planning and post consent. In the event that invasive species are identified within the works area, a site-specific Invasive Species Management Plan (ISMP) will be developed and implemented by a competent specialist on behalf of the contractor.

In addition, in order to comply with Regulations 49 and 50 of the European Communities (Birds and Natural Habitat) Regulations (2011), biosecurity measures will be implemented throughout the Construction Phase to ensure that the introduction and translocation of invasive species is prevented. The appointed project ecologist will carry out a toolbox talk which will identify invasive species and will also implement biosecurity measures such as the visual inspection of vehicles for evidence of attached plant or animal material prior to entering and leaving the works area. Stringent biosecurity measures will be implemented throughout the works. The best practice principles of Check-Clean-Dry guidance of the Non-Native Species Secretariat (NNSS, 2017), IFI biosecurity protocols (IFI, 2010) and Waterways Ireland Marine Notice No. 39/2017 shall be followed during these works to ensure that invasive non-native species are not introduced into the Proposed Development site.

Japanese Knotweed

Japanese Knotweed was recorded within the Proposed Development site. The following site hygiene and mitigation measures will be followed during construction to ensure that Japanese Knotweed is effectively removed from the site and is not spread outside of the site during construction works.

Site Hygiene at Contaminated Areas

- Understand the potential extent of the rhizome (root) system underground – up to seven metres horizontally and three metres vertically;
- Where possible, the contaminated area will be avoided and fenced off, or the extent of the rhizomes clearly marked;
- If possible, the use of machinery with tracks will avoid contaminated areas. Movement of machinery between contaminated and non-contaminated areas must be controlled and adequate power washing measures implemented;
- Areas where contaminated soil is to be stockpiled on site will be clearly identified and marked out;
- Designated entry and exit points will be identified for personnel on foot and for small mobile equipment. A delineated access track, to be maintained free of Japanese Knotweed, will be established through the site to minimise the spread of Knotweed species by permitted vehicles accessing the site;
- Vehicles, including footwear and tools, leaving the site will be inspected for any plant material and washed down (using a pressure washer) in a dedicated vehicular wheel wash down facility, which will drain into a contained area within the site. Particular care is required with tracked machines;
- Vehicles used in the transport of contaminated material will be visually checked and washed down into a contained area before being used for any other work, either in the same area or on a different site;
- Only vehicles required for essential works, including site investigation works, will be brought on site and the number of visits minimised as much as practicable;
- Material gathered in the dedicated wash down contained areas will be appropriately disposed of off-site;
- For any subsoil or topsoil entering the site, the supplier will be required to provide an assurance that it is free of Japanese Knotweed;
- All site personnel will be made aware of measures to be taken and will be informed of the requirements of the ISMP; and
- Site hygiene signage, in relation to the management of invasive species, will be erected.

Management options

In addition to the possible advance treatment works and pre-construction survey, when the works areas become available to the contractor for enabling works, areas identified as requiring specific invasive species treatment will be demarcated and the designated control measures implemented at the earliest possible stage to reduce the risk of spread within the Proposed Development site or beyond.

There are a number of management options that may be implemented to control and prevent the spread of invasive species. These are presented in the sections below.

Those involved in the application of herbicides / pesticides will be competent to do so and, consequently, will have sufficient training, experience and knowledge in the area of herbicides / pesticides application.

All staff involved in the application of herbicides / pesticides will have received appropriate training, which may include achieving competency certification in the safe use of herbicides / pesticides through a National Proficiency Tests Council registered assessment centre or achieving an appropriate FETAC award in this area. The following management options will be used i.e., chemical control and / or excavation and chemical treatment onsite:

Chemical treatment

The control of Japanese Knotweed will require the use of herbicides, which can pose a risk to human health, to non-target plants or to wildlife. To ensure the safety of herbicide applicators and of other public users of the site, it is essential that a competent and qualified person carries out the herbicide treatment. A qualified and experienced contractor will be employed to carry out all treatment work.

The contractor will follow the detailed recommendations of the following documents for the control of invasive species and noxious weeds:

- Chapter 7 and Appendix 3 of the TII Publication: The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads (NRA, 2010);
- Best Practice Management Guidelines for Japanese Knotweed (Invasive Species Ireland, 2015); and
- Circular Letter NPWS 2/08 Use of Herbicide Spray on Vegetated Road Verges (National Parks and Wildlife Service, 2008).

These documents include measures to aid the identification of relevant species, with details for the timing, chemicals and methodology for chemical control, and for measures to avoid environmental damage during the use of herbicides.

Chemical treatment involves the application of an herbicide to invasive species plant such as Japanese Knotweed stands without any excavation or removal of the plant material. The preferred types of herbicides to be used in the treatment of Knotweed are Glyphosate and 2,4-D Amine.

If herbicide is applied as the treatment option, it may need to be reapplied for up to five years after the first application to ensure the plant control measures have been effective.

Glyphosate is non-persistent and can be used near water, but it is not selective (i.e., it is a broad spectrum chemical and will impact all plant species) whereas 2,4-D Amine can be persistent for up to one month, and can also be used near water but is more selective on certain plants. The selection of chemical by the contractor and supervising ecologist will depend on seasonal factors, site conditions, proximity to water, surrounding habitats etc.

The most effective time to apply Glyphosate is from July to September (or before cold weather causes leaves to discolour and fall). The majority of herbicides are not effective during the winter dormant stage because they require living foliage to take up the active ingredient.

Reapplication rates will depend on site specific considerations including the extent of the infestation, its location, and the time of year treatment commences. Details of the proposed chemical treatment plan will be included in the updated ISMP based on the proposed work programme.

Foliar treatment (spraying) is usually applied with a sprayer such as a knapsack sprayer or a larger spray system. It is important to use a treatment dye to identify clearly all areas treated. Foliar treatment is an efficient way to treat large monocultures of invasive plants, or to spot-treat individual plants that are difficult to remove mechanically such as Japanese Knotweed.

In the case of Japanese Knotweed, depending on weather and temperatures in the days following the initial treatment, and to ensure optimal uptake of herbicide into the rhizome system, a second similar treatment will be required usually within ten days, before the internal vascular system is no longer capable of translocating the herbicide to the root system.

While the upper surface of the leaves will be easier to treat, it is also important to treat the leaf under surface as Japanese Knotweed possesses many stomata openings on the leaf under surface. Dead stems can be cut, removed and burned on / off site in accordance with the relevant legislation.

The stem injection method is sometimes used for Japanese Knotweed control. This treatment requires a higher concentration of the active ingredient than is used in foliar applications. It involves the use of a specialist herbicide injection tool whereby the injection tool injects the herbicide directly into each of the canes approximately 20-30cms from the base of each cane (between the 1st and 2nd nodule).

Subsequently, approximately 10ml of herbicide mix is injected into each cane at a ratio of 5:1 through the use of a specialist stem injection tool. The application of glyphosate-based products by injection is most effective when applied in the early Autumn (mid to late Sept). Regrowth will occur in subsequent years, albeit much less vigorously, which will require follow up treatment at the appropriate time of year. Spot treatment will be required each year until no regrowth is observed.

To ensure that the use of herbicides does not contravene legislation, the contractor must comply with Circular Letter NPWS 2/08 *Use of Herbicide Spray on Vegetated Road Verges* (NPWS, 2008) on dealing with the application on to non-target areas.

Excavation and chemical treatment on-site

This option employs both physical and chemical methods of treatment. This method is employed in situations where treatment of invasive species, in particular Japanese Knotweed, is required to be completed in a relatively short timeframe. Generally, digging up the rhizomes and re-cultivating it stimulates plant growth and will result in more successful herbicide application and management.

In summary, this management method requires cutting and killing of the surface plant. The cut material must be left on top of plastic sheeting until dried out and subsequently monitored for any sign of regrowth. Storage of cut material should not take place within flood risk zone of a river. The cut material should not be placed in a green waste recycling bin. Once dried out, the material should be burned on site in accordance with the relevant legislation. The surface of the affected area should be raked with tines to remove crowns and surface material, and in order to break up the rhizomes, bringing them to the surface, which will stimulate leaf production. This will make the plant more vulnerable to herbicide treatment. The more rhizomes that are brought to the surface, the more growth will occur, allowing for a more successful treatment. An excavator can be used to scrape the surface crowns and rhizomes into a pile and then to cultivate the ground to stimulate rhizomes to produce a higher density of stems for treatment. Reapplication of herbicide may be required for up to five years after initially application, subject to the site-specific management plan.

Buddleia, Wild Clematis and Winter Heliotrope

It is noted that the amber list species Buddleia, Wild Clematis and Winter Heliotrope were also recorded at the Proposed Development site. There is no statutory obligation to remove these species. However, should it be concluded that they should be removed, the following treatment methods are recommended. These species are straightforward to control using a mixture of mechanical removal and herbicide treatment.

Buddleia

Buddleia favours disturbed sites, where physical grubbing of plants can provide ideal conditions for the germination of seeds. Therefore, care needs to be taken to ensure re-vegetation of controlled areas is undertaken swiftly. The branches of Buddleia are capable of rooting as cuttings, so care should also be taken to ensure material is disposed of in a manner to avoid this risk.

As mature plants occur within the proposed works area, the preferred method of treatment is cutting back to a basal stump or grubbing out followed by chemical treatment. Herbicide applications will consider sensitive receptors such as watercourses and locally important habitats such as woodland and must only be applied in line with manufacturers recommendations.

Recommended practice for the application of herbicides requires cutting back of plants to a basal stump during active growth (late spring to early summer) which is then treated (brushed on) immediately with a systemic weed killer mix (Starr *et al.*, 2003). Foliar application of triclopyr or glyphosate may be adequate for limited infestations of younger plants but should be followed up at 6 monthly intervals until the supervising ecologist can certify that the plant is no longer extant within the works area.

Best practice biosecurity measures should be implemented for works in proximity to the stream and drainage ditches. All wet gear or machinery which has previously come into contact with watercourses should be checked for any silt or mud, plant material or animals. It then should be cleaned and finally dried. Disinfectant or hot water (over 65ºC) should be used to clean all equipment followed by a 24 hour drying period. This should be adopted as standard practice in all freshwaters.

Wild Clematis

Wild Clematis is straightforward to control using a mixture of mechanical removal and herbicide treatment. Alternative methods of control are discussed below.

This species can be controlled by both mechanical control and herbicides, though typically its control relies on a combination of both i.e., cut-stump application.

Small seedlings can be readily pulled by hand. Larger stems have to be cut, the roots grubbed out and the material placed off the ground so it cannot take root again.

A number of chemicals have been used effectively against Wild Clematis in New Zealand, including glyphosate, though control invariably takes more than one year (New Zealand Department of Conservation 2005). Control should be undertaken during active growth. For mature plants, the vines should be cut back to ground level or waist height in winter or spring and the subsequent re- growth can be then foliar sprayed. This method will avoid impacting on the host plant the vine may be covering.

For larger specimens, the plant can be cut at the base with a straight horizontal cut. Herbicide is then applied immediately to the wound with a paint brush, eye dropper or small squeeze bottle. On larger stems it is only necessary to wipe herbicide around the outer rim of the cut. The plants should be left in situ until they are dead. Where plants are not killed in a single application, wait until re growth before re spraying.

Triclopyr can also be used as a foliar spray or as a spot treatment. This should be applied in summer during active growth before senescence, when it is not very hot or during drought. Following control, regular monitoring will be required with appropriate follow-up to deal with re-growth or new seedling germination over a period of 2–3 years.

Winter Heliotrope

Physical control

Due to the extensive rhizome network, physical removal of winter heliotrope is really only practical on a limited scale. Where mechanical means can be employed, it should be possible to deal with larger infestations but due to the potential for regeneration from fragments of roots, it may be best to tackle its control using a combination of excavation with follow-up treatment by herbicides. As with other plants with the potential to spread from small root fragments, disposal of material should be undertaken with due caution to prevent accidental spread of the plant. Other means of disposal include burial of material at a depth of at least 2m, incineration or disposal to licensed landfill. There is no evidence that the material would withstand composting though this approach would probably only be suitable for limited infestations.

Chemical control

An application of a glyphosate-based herbicide after flowering in February to March is recommended by Cornwall Nature Reserves (2008), though the Royal Horticultural Society (2008) recommends spraying in mid-summer or later but before the foliage begins to die back.

7.6.3.7 Bats

During the site works, general mitigation measures for bats will follow Marnell *et al.* (2022), Kelleher and Marnell (2006) and NRA (2005). These documents outline the requirements that will be met in the pre-construction (site clearance) stage to minimise negative effects on roosting bats or prevent avoidable effects resulting from significant alterations to the immediate landscape. All mitigation measures including detailed method statements will be agreed with the National Parks and Wildlife Service (NPWS) prior to commencement of works, which could affect any bat populations on site.

Mature and immature trees will be removed prior to construction. Although mature trees with the potential to be of significant value as bat roosts are absent from the site, the following precautionary measures will be implemented during the removal of semi-mature and mature trees:

- The project ecologist will work with the contractor to ensure that trees earmarked for retention are adequately protected;
- Tree-felling will ideally be undertaken in the period September to late October / early November. During this period, bats are capable of flight and may avoid the risks of tree-felling if proper measures are undertaken;
- Felled trees will not be mulched immediately. Such trees will be left lying several hours and preferably overnight before any further sawing or mulching. This will allow any bats within the tree to emerge and avoid accidental death. The bat specialist will be on-hand during felling operations to inspect felled trees

for bats. If bats are seen or heard in a tree that has been felled, work will cease and the local NPWS Conservation Ranger will be contacted;

- Tree will be retained where possible and no ‘tidying up’ of dead wood and spilt limbs on tree specimens will be undertaken unless necessary for health and safety;
- Treelines outside the Proposed Development area but adjacent to it and thus at risk, will be clearly marked by a bat specialist to avoid any inadvertent damage;
- During construction directional lighting will be employed to minimise light spill onto adjacent areas. Where practicable during night-time works, there will be no directional lighting focused on watercourses or boundary habitats and focusing lights downwards will be utilised to minimise light spillage; and
- If bats are recorded by the bat specialist within any trees no works will proceed without a relevant derogation licence from the NPWS.

Construction lighting mitigation measures will follow recommendations outlined in Bat Conservation Ireland (2010) and Bat Conservation Trust (2018).

7.6.3.8 Birds

Where practicable, vegetation will be removed outside of the breeding season and in particular, removal during the peak-breeding season (April-June inclusive) will be avoided. This will also minimise the potential disturbance of breeding birds outside of the Proposed Development site boundary. If works are carried out during the breeding season, a pre-construction survey will be carried out by the project ecologist and if birds are detected, appropriate mitigation measures will be implemented.

7.6.3.9 Common frog

As a precautionary measure, a visual search of the drainage ditches and the Kilcoolishal Stream will be carried out in the days prior to commencement of construction works and any frogs will be removed to alternative habitats elsewhere within the landholding. This will be carried out under licence from the NPWS and under supervision of the project ecologist.

7.6.4 Noise and Vibration

Good industry standards, guidance and practice procedures will be followed in order to minimise noise and vibration effects during construction. The following provisions, although not exhaustive, will be adhered to where practicable throughout the construction programme:

- Vehicles and mechanical plant used for the purpose of the works will be fitted with effective exhaust silencers, maintained in good and efficient working order and operated in such a manner as to minimise noise emissions. The contractor will ensure that all plant complies with the relevant statutory requirements;
- Machines in intermittent use will be idling or throttled down to a minimum when not in use;
- Compressors will be fitted with properly lined and sealed acoustic covers which will be kept closed whenever in use. Pneumatic percussive tools will be fitted with mufflers or silencers;
- Equipment which breaks concrete, brickwork, or masonry by bending, bursting, or “nibbling” will be used in preference to percussive tools. Where possible, the use of impact tools will be avoided where the site is close to occupied premises;
- Rotary drills and bursters activated by hydraulic, chemical, or electrical power will be used for excavating hard or extrusive material;
- Wherever possible, equipment powered by mains electricity will be used in preference to equipment powered by internal combustion engine or locally generated electricity;
- No part of the works nor any maintenance of plant will be carried out in such a manner as to cause unnecessary noise except in the case of an emergency when the work is absolutely necessary for the saving of life or property or the safety of the works;

- Plant will be maintained in good working order so that extraneous noise from mechanical vibration, creaking and squeaking is kept to a minimum;
- Noise emitting machinery which is required to run continuously will be housed in a suitable acoustically lined enclosure; and
- During the Construction Phase, the appointed contractor will carry out noise and vibration monitoring at representative noise and vibration sensitive receptors to evaluate and inform the requirement and / or implementation of noise and vibration management issues. Noise monitoring will be conducted in accordance with ISO 1996-1 (ISO, 2016) and ISO 1996-2 (ISO, 2017). The selection of monitoring locations will be based on the nearest representative noise and vibration sensitive receptors to the working area.

It is recommended that an acoustic barrier be installed as mitigation for all working areas, which will reduce noise levels overall by 10 dB.

7.6.5 Air Quality

Details of air quality mitigation measures are outlined in Section 5.8.

7.6.6 Climate

The following mitigation measures are proposed:

- The Proposed Development will use low carbon construction materials, such as recycled aggregate, where practicable;
- Where practicable, opportunities for materials reuse will be incorporated within the extent of the Proposed Development;
- Where practicable, materials will be sourced locally to reduce the embodied emissions associated with transport; and
- The Proposed Development will minimise wastage of materials due to poor timing or over ordering on site thus helping to minimise the embodied carbon footprint of the Proposed Development.

7.6.7 Archaeology, Architectural and Cultural Heritage

Licenced archaeological monitoring of all ground works will be undertaken during construction. If features of archaeological significance are identified, further mitigation will be required following consultation with the County Archaeologist and National Monuments Service. Such features will be fully resolved to professional standards of archaeological practice either by preservation *in situ* or preservation by record, as outlined in Policy and Guidelines on Archaeological Excavation (Department of Arts, Heritage, Gaeltacht and the Islands, 1999).

7.6.8 Resources and Waste

Waste generated during the Construction Phase will be carefully managed in accordance with the waste hierarchy which gives precedence to prevention, minimisation, reuse and recycling over energy recovery and finally disposal to landfill.

A Construction and Resource Waste Management Plan (CRWMP) is included in **Appendix 15.3** in **Volume 4** of this EIAR. This plan meets the requirements of the Best Practice Guidelines for the Preparation of Resource and Waste Management Plans for Construction and Demolition Projects (EPA, 2021). The contractor will be obliged to develop, implement and maintain the CRWMP during the Construction Phase.

The following measures will be implemented during construction, where practicable, by the appointed contractor, to ensure the maximum quantity of material is reused in the Proposed Development, to comply with the provisions of the Waste Management Acts, 1996, as amended, and to contribute to achieving the objectives set out in the Waste Action Plan for a Circular Economy (DECC, 2020):

- Where waste generation cannot be avoided, waste disposal will be minimised;

- Opportunities for reuse of materials, by-products and wastes will be sought throughout the Construction Phase of the Proposed Development;
- Possibilities for reuse of clean non-hazardous excavation material as fill on the site or in landscaping works will be considered following appropriate testing to ensure material is suitable for its proposed end use;
- Where non-hazardous excavation material cannot be reused within the Proposed Development works, material will be sent for recycling or recovery, where practicable;
- Excavations of made ground will be monitored by an appropriately qualified person to ensure that any hotspots of possible contamination are properly identified, with the contaminated material segregated and disposed of appropriately. Any potential contaminated material identified will be segregated and stored in an area where there is no possibility of runoff generation or infiltration to ground or surface water drainage. Care will be taken to ensure that the hotspot does not cross contaminate clean soils elsewhere throughout the site;
- If encountered, any potential asbestos during the Construction Phase will be managed using standard health and safety measures as outlined in 'Asbestos-containing Materials (ACMs) in Workplaces: Practical Guidelines on ACM Management and Abatement' (HSA, 2013). This document states that *"removal of asbestos from contaminated soil will require a specialist asbestos contractor for any friable asbestos to be removed"* and *"a risk assessment by an independent competent person should determine the most appropriate control measures and remediation strategies"* (HSA, 2013);
- Only a suitably experienced contractor shall be used to carry out the excavation works. During construction, they shall employ standard practices to manage risk from contaminated soils. These will be determined by the contractor depending on their construction practices but are likely to include the use of gloves, dust masks and potentially disposable overalls. These and other appropriate measures will minimise the exposure of site workers and members of the public;
- The site will be maintained to prevent litter and regular litter picking will take place throughout the site;
- 'Just-in-time' delivery will be used, where practicable, to minimise material wastage;
- Paints, sealants and hazardous chemicals will be stored in secure, bunded locations;
- All staff on-site will be trained on how to minimise waste (i.e., training, induction, inspections and meetings);
- Materials on-site will be correctly and securely stored;
- Where possible, recyclable material will be segregated and removed off site to a permitted / licensed facility for recycling. Waste stream colour coding and photographs will be used to facilitate segregation;
- On-site municipal waste arising swill be source separated at least into dry mixed recyclables, biodegradable and residual wastes;
- Waste bins, containers, skip containers and storage areas will be clearly labelled with waste types which they should contain, including photographs as appropriate;
- Segregated skips will be used within a designated waste segregation area to be located in the on-site construction compound (particularly for hazardous, inert waste and general waste);
- The appointed contractor will record the quantity in tonnes and types of waste and materials leaving the site during the Construction Phase. The name, address and authorisation details of all facilities and locations to which waste and materials are delivered will be recorded along with the quantity of waste in tonnes delivered to each facility. Records will show material which is recovered, which is recycled and which is disposed of;
- Waste generated on-site will be removed as soon as practicable following generation for delivery to an authorised waste facility;

- The appointed contractor will ensure that any off-site interim storage facilities for excavation material have the appropriate waste licences or waste facility permits in place;
- Where Article 27 notifications are required in relation to the Proposed Development, the appointed contractor will complete and submit these Article 27 notifications to the EPA for by-product reuse; and
- The relevant appropriate waste authorisation will be in place for all facilities that wastes are delivered to (i.e., EPA Licence, Waste Facility Permit or Certificate of Registration).

7.6.9 Water

The employment of good construction management practices will minimise the risk of adverse impacts on water quality, the hydrological regime and flood risk. All construction activities will be undertaken in accordance with the guidance 'Environmental Good Practice on Site' (CIRIA, 2015a) and 'The control of water pollution from construction sites' (CIRIA, 2001).

The following standard measures will be implemented during the construction of the Proposed Development:

- Earthworks operations will be carried out such that surfaces shall be designed with adequate falls, profiling and drainage to promote safe run-off and prevent ponding and flooding;
- Run-off will be controlled to minimise the water effects in outfall areas;
- All concrete mixing and batching activities will be in areas away from watercourses and drains;
- Collection systems will be used to prevent any contaminated drainage entering surface water drains, watercourses or groundwater, or draining onto the land;
- The use of cleaning chemicals will be minimised;
- Good housekeeping (site clean-ups, use of disposal bins, etc.) will be implemented on the site;
- Careful consideration will be given to the location of any fuel storage facilities. All vehicles and plant will be regularly inspected for fuel, oil and hydraulic fluid leaks. Suitable equipment to deal with spills will be maintained on site;
- Where dewatering may be required, it will be overseen and approved by a qualified hydrogeologist and treated appropriately in a site water treatment facility before being discharged to the local drainage network. No outfall will be permitted into the existing watercourse;
- Where possible, soil excavation will be completed during dry periods;
- No materials will be stored in floodplains or in areas which would impede flood flow paths (northern side); and
- To prevent the accidental release of hazardous materials (fuels, cleaning agents, etc.), all hazardous materials will be stored within secondary containment designed to retain at least 110% of the storage contents. Temporary bunds for oil / diesel storage tanks will be used on the site during the Construction Phase of the project. Safe materials handling of all potentially hazardous materials will be emphasised to all construction personnel employed during this phase of the Proposed Development.

The following addition measures will be implemented for the protection of the Kilcoolishal Stream:

- Works in the vicinity of the stream will be carried out in the summer months, when water levels and flows within the stream are minimal. In the eventually that the stream is not dry, construction works to the section of the Kilcoolishal stream crossing the construction boundary (approximately 28m) will be bunded on either side with earthen bunds and silt screens. Water would be over pumped in the flow direction. Environmental control measures will be implemented during construction in line with standard guidelines (i.e., 'The Control of Water Pollution from Construction Sites' (CIRIA, 2001) and "The Control of Water Pollution from Linear Construction Projects' (CIRIA, 2006)) for best practice measures for controlling water pollution. The Report for Screening for Appropriate Assessment submitted as part of the planning application concluded that the proposed project, in the absence of mitigation, and either alone or in - combination with other plans and / or projects, does not have the potential to significantly affect any European Site, in light of their conservation objectives. The environmental control measures which will be implemented relate to the minimisation of localised potential impacts;

- Apart from the area of the Kilcoolishal Stream directly affected by the bridge construction (i.e., Irish Rail portal frame), a buffer strip of 10m will be implemented around the stream with no works taking place in this area. Where this is not possible, in particular for the construction of the Irish Rail portal frame, the streambed and stream banks of the Kilcoolishal Stream in this location will be reprofiled and reinstated following construction and the bunds and silt traps removed;
- No plant or tools will be washed in the stream, should it contain water; and
- Spill kits will be permanently on hand and kept close to the works areas. Staff will be trained in how to use the spill kits correctly.

The following monitoring activities will be undertaken for the Construction Phase:

- Visual monitoring will be undertaken as part of the regular site audits during the construction of the Proposed Development to ensure that existing surface water runoff is draining from the site and is not exposed to any contaminants;
- The contractor will be required to ensure that the sanitary facilities for site personnel are and effluent storage is regularly emptied and disposed of appropriately;
- The contractor will be required to ensure that the water supply to the site is maintained and is free of contaminants; and
- The contractor will be required to monitor the weather forecast to inform the programming of earthworks and stockpiling of materials so as to minimise the risk of flooding.

7.6.10 Land, Soils, Geology and Hydrogeology

The Proposed Development will be constructed in accordance with the relevant design standards by means of good practice measures under appropriate engineering supervision.

7.6.10.1 Earthworks management

These mitigation measures relate to the following potential impacts:

- Loss of topsoil;
- Loss of solid geology;
- Earthworks haulage; and
- Effect on the surrounding ground.

Excavated topsoil will be stockpiled using appropriate methods to minimise the effects of weathering. Care will be taken in reworking this material to minimise dust generation, groundwater infiltration and generation of runoff. Any surplus suitable material excavated that is not required elsewhere for the Proposed Development, will be reused for other projects where possible, subject to appropriate approvals / notifications or removed off site to a suitable licensed facility.

In order to reduce the compaction and erosion of topsoil outside the areas of direct construction, haul routes will be along predetermined routes within the Proposed Development and deliveries will be along predetermined routes outside the Proposed Development. Where compaction occurs due to truck movements and other construction activities on unfinished surfaces, remediation works will be undertaken to reinstate the ground to its original condition. Where practical, compaction of any soil or subsoil which is not part of the works or to remain in-situ within the Proposed Development will be avoided.

The contractor will ensure that any topsoil or subsoil is assessed for re-use within the Proposed Development, ensuring the appropriate handling, processing and segregation of the material. Where practical, the removal of soil from the Proposed Development will be avoided. All earthworks will be undertaken in accordance with TII Specification for Road Works (SPW) Series 600 Earthworks (TII, 2013) and project specific earthworks specifications ensuring that all excavated material and imported material is classified using the same methodology so as to allow maximum opportunity for the reuse of materials on site.

7.6.10.2 Contaminated land management

These mitigation measures relate to the following potential impacts:

- Excavation of potentially contaminated land;
- Mobilisation of contamination into aquifers; and
- Mobilisation of contamination into environmentally sensitive sites.

Excavations in made ground will be monitored by an appropriately qualified person to ensure that any potential hotspots of encountered contamination are properly identified, segregated and disposed of appropriately. Any identified hotspots will be segregated and stored in an area where there is no possibility of runoff generation or infiltration to ground or surface water drainage. Care will be taken to ensure that the hotspot does not cross contaminate clean soils elsewhere throughout the site.

In areas with the potential to encounter asbestos containing materials the following measures will apply:

- During construction, the potential risk to site users and member of the public from contaminated dust will be managed using standard health and safety measures as outlined in the Health and Safety Authority (HSA) guidance document, Asbestos-containing Materials (ACMs) in Workplaces: Practical Guidelines on ACM Management and Abatement (HSA, 2013). This document states that *"Removal of asbestos from contaminated soil will require a specialist asbestos contractor for any friable asbestos to be removed"* and *"A risk assessment by an independent competent person should determine the most appropriate control measures and remediation strategies."*;
- Control measures for the Construction Phase will be devised based on a risk assessment carried out by the contractor prior to the commencement of the construction works and will be specific to the construction methods. Such methods could include the prompt removal of excavated soils to avoid stockpiling on site of material or dampening down of soil to prevent dust generation. In the rare instances where stockpiles are required, they will not be allowed in the areas which are identified as public interfaces; and
- Only suitably experienced contractors shall be used to carry out the excavation work. During construction, they shall employ standard practices to manage risk from contaminated soils. These will be designed by the contractor dependent on his construction practices and are likely to include the use of gloves, dust masks and potentially disposable overalls. These and other appropriate measures will minimise the exposure of the site workers and member of the public.

If a potential soil and water pollution are identified, this will be minimised by the implementation of good construction practices. Such practices will include adequate bunding for oil containers, wheel wash and dust suppression on site roads, and regular plant maintenance. CIRIA provides guidance on the control and management of water pollution from construction sites in their publication 'Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors' (CIRIA, 2001).

Any dewatering in areas of contaminated ground will be designed to minimise the mobilisation of contaminants into the surrounding environment. Where dewatering in such areas is unavoidable, the water will be adequately treated prior to discharge. Good construction management practices will be employed to minimise the risk of transmission of hazardous materials as well as pollution of adjacent watercourses and groundwater.

7.6.10.3 Spills from temporary storage of hazardous substances

These mitigation measures relate to the following potential impacts:

- Loss of topsoil;
- Excavation of potentially contaminated land;

- Mobilisation of contamination into aquifers; and
- Mobilisation of contamination into environmentally sensitive sites.

Good construction management practices, as outlined in the CIRIA guidance ‘Control of Water Pollution from Construction Sites – Guidance for consultants and contractors’ (CIRIA, 2001) will be employed by the appointed contractor to minimise the risk of transmission of hazardous materials as well as pollution of adjacent watercourses and groundwater. The construction management of the site will take account of these recommendations to minimise as far as possible the risk of soil, groundwater and surface water contamination.

Measures to be implemented to minimise the risk of spills and contamination of soils and waters include:

- Employing only a competent and experienced workforce, and site-specific training of site managers, foremen and workforce, including all subcontractors, in pollution risks and preventative measures;
- Ensure that all areas where liquids (including fuel) are stored, or cleaning is carried out, are designated impermeable areas that are isolated from the surrounding area and within a secondary containment system, e.g., by a roll-over bund, raised kerb, ramps or stepped access;
- The location of any fuel storage facilities shall be considered in the design of the construction compounds and bridge assembly area. These are to be designed in accordance with relevant guidelines and codes of best practice and will be fully bunded;
- Good housekeeping at the site (daily site clean-ups, use of disposal bins, etc.) during the entire Construction Phase;
- All concrete mixing and batching activities will be located in areas away from watercourses and drains;
- Potential pollutants to be adequately secured against vandalism;
- Provision of proper containment of potential pollutants according to codes of best practice;
- Thorough control during the entire Construction Phase to ensure that any spillage is identified at early stage and subsequently effectively contained and managed; and
- Spill kit to be provided and to be kept close to the storage areas. Staff to be trained on how to use spill kits correctly.

An emergency incident response plan will be implemented by the appointed contractor, which will identify the actions to be taken in the event of a pollution incident. Refer to Section 7.4.2.

7.6.10.4 Management of concrete during piling

These mitigation measures relate to the following potential impacts:

- Loss of topsoil;
- Effect on the surrounding ground;
- Mobilisation of contamination into aquifers; and
- Mobilisation of contamination into environmentally sensitive sites.

During the Construction Phase, concrete levels and volumes used will be monitored and compared against theoretical estimates to understand potential losses.

Before and during piling, it is proposed to monitor groundwater pH at the available groundwater monitoring points (trial wells and boreholes with standpipe installations). This will highlight any potential impacts on groundwater and surface water quality during piling. Where a change from baseline pH is identified, appropriate measures can then be adopted which may include an alternative grout / cement mix to limit migration or the use of temporary casing. The groundwater monitoring will utilise monitoring locations installed during the project specific ground investigation that are located outside the footprint of the

Proposed Development. These monitoring locations will be maintained during the Construction Phase of the Proposed Development.

Where ground bearing foundations are being constructed, the formation will be inspected for potential features that may result in concrete losses. Appropriate earthwork details, developed during detailed design phases, will be applied to limit losses.

7.6.10.5 Monitoring

Soil, groundwater and surface water verification testing shall be carried out by the contractor during the Construction Phase to confirm the findings of the risk assessment.

7.6.11 Material Assets

The contractor will be obliged to put measures in place to ensure that there are no interruptions to existing services and that all services and utilities are maintained, unless this has been agreed in advance with the relevant service provider and local authority. Where connections are required, the contractor will apply to the relevant utility company for a connection permit and adhere to their requirements.

All works near existing services and utilities will be carried out with ongoing consultation with the relevant utility company or local authority and will follow any requirements or guidelines they may have.

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N25 Little Island Pedestrian and Cyclist Bridge
Environmental Impact Assessment Report

Chapter 08

Landscape and Visual

N25 Little Island Pedestrian and Cyclist Bridge
Environmental Impact Assessment Report

Appendix 8.1

Arboricultural Impact Assessment

TABLE OF CONTENTS

DOCUMENT TRACKING & INFORMATION

Project Name	Arboricultural Impact Assessment (AIA)
Consulting Arborists	Daisy Todd- ISA Certified Arborist ®, Ben Mullen- City & Guilds Qualified Arborist & Michael Lawn ABC Level 3 Arborist.
Report Requested By:	Tim O'Sullivan Glynn, Senior Engineer, Bridges & Civil Structures, Ireland
Client	Cork County Council
Site Address	Little Island Train Station to Eastgate Business Park, crossing the N25 from OSI Centre Co-ordinates ITM: 51.907084N, -8.358132W to 51.906728N, -8.358068W.
Client Address	Arup, One Albert, Quay, Cork, T12 X8N6
Company Reference	*VT220083*
Arup Reference	*Job No. 285939-00*
Author	Daisy Todd
Reviewed by	Ben Mullen & Michael Lawn
Company Information	Name: Heritage Tree Care Ltd. Website: www.heritagetreesireland.com Phone: 0832060088 Mobile: 0830912073 (Daisy) Mobile: 0896039794 (Ben) Email: heritagetreesireland@gmail.com CRO: 711542

ABBREVIATIONS

DA	Development Application	RPA	Root Protection Area
DBH	Diameter at Breast Height	TMP	Tree Management Plan
CEZ	Construction Exclusion Zone	CMP	Construction Management Plan
ULE	Useful Life Expectancy	AA	Arboricultural Association
DRB	Diameter Root Base	BS	British Standard
PA	Planning Authority	ISA	International Society of Arboriculture
NTM	National Tree Map		

1.0 INTRODUCTION

I. Heritage Tree Care Ltd. were engaged by Tim O'Sullivan Glynn of Bridges & Civil Structures, Ireland, on behalf Cork County Council to complete a BS5837:2012 Tree Survey Schedule, Arboricultural Impact Assessment (AIA), Tree Clearance Plan and Tree Constraints Plan for eight hundred and fifty (850) trees located within the tree survey area *(see Fig.2)*, on 2 sites (A & B), spanning from Little Island Train Station to Eastgate Business Park, Co. Cork.

II. The report has been requested as part of a project for a proposed pedestrian and cycle bridge connecting Little Island Train Station to Eastgate Business park. The proposed development *(ARUP Job No. 285939-00)* will be built adjacent to the existing carparks, located to the West of Little Island Train Station. It will cross the Irish Rail line and N25 National Primary Road South towards the Radisson Blu Hotel & Spa, following the boundary line of the visitor carpark, and finally connecting to the North end of Eastgate Business Park.

III. The project scope is intended to identify trees to be removed; provide information on those trees to be retained; and assess and record the potential impact and conflicts which may occur between the subject trees and the proposed development.

IV. This AIA is accompanied by a Tree Clearance Plan (Appendix D) showing the location of individual trees and tree groups to be removed to facilitate the proposed development; and a Tree Constraints Plan (Appendix E) showing the location of the individual trees and tree groups to be retained. The Tree Constraints plan aids development and outlines encroachment areas where construction must be prohibited; and by doing so promotes the safety of the area's trees- before, during and after any construction activities take place.

V. Observations and recommendations provided within this report are based upon information provided by the client, certified arborist site visits and guidance provided within BS5837:2012 Trees in Relation to Design, Demolition and Construction; and BS3998:2010 Tree Work- Recommendations *(BSI, 2010 & 2012)*

VI. Where tree work is specified, all recommended tree work is to be carried out in accordance to the above-mentioned standards, by an appropriately trained arborist practitioner, with an up-to-date record of training and membership recognised by the Arboricultural Association (AA) and/or the International Society of Arboriculture (ISA).

2.0 METHODOLOGY

2.1 Data Collection

I. Heritage Tree Care Ltd. undertook the tree survey data collection and associated verification from the 21st to the 25th of November 2022. The trees that are the subject of this report were identified by reviewing the N25 Pedestrian & Cycle Bridge Tree Survey Plan *(ID: LIPB-ARUP-ZZ-XX-DR-SU-0002) (see Fig.1)* alongside the N25 LIPCB- Tree Survey Extent plan, both supplied by ARUP on the 11th November 2022.

II. This tree survey was not informed by a topographical survey, as such tree positions must be considered to be indicative only, and the relative distances of features must be measured out on the site.

III. Data collected on-site was analysed against the supplied development documentation by Daisy Todd (BA, MSc, ISA Certified Arborist and Lantra Awarded Professional Tree Inspector) and Ben Mullen (City & Guilds Qualified & Lantra Certified Arborist) of Heritage Tree Care Ltd. Following which relevant recommendations were formulated and collated into a report format.

IV. The subject trees were inspected from ground level. No foliage, soil or tissue sampling was conducted. No aerial or internal investigations were undertaken. Tree assessment and Qualitative Visual Tree Analysis has been carried out in accordance with The International Society of Arboriculture (ISA) TRAQ guidelines *(Smiley et al. 2017)* and the requirements of BS5837:2012 *(BSI, 2012).*

V. Tree height and canopy width were assessed using long-range binoculars and measured using a Laser Tree Height Meter and have been provided to the nearest whole centimetre. Main stems were 'sounded' using a nylon hammer. Trees were numbered with aluminium identification tags, attached with aluminium nails at a 2m height from ground level. Trunk diameter at breast height (DBH) was measured with a 50m diameter tape and provided to the nearest millimetre. The RPA of each tree *(see section 4.3)* and RPA areas were calculated in accordance to BS5837:2012, and have been provided to the nearest ten centimetres *(BSI, 2012).* The ages of the trees were calculated via circumferential measurement, with reference to species-dependent maturity rates. This information has been recorded in the BS5837 Tree Survey Schedule *(see Appendix C).*

VI. The plan of the proposed development *(Sketch Title: N25 LIPCB- Tree Survey Extents)* was provided to Heritage Tree Care Ltd. in November 2022 *(see Fig.1).* A National Tree Map (NTM) was purchased from Bluesky Ireland, customarily used by Heritage Tree Care Ltd. with PT Mapper Pro. However, the NTM proved inaccurate; as such Heritage Tree Care Ltd. mapped the locations of the individual trees and tree groups, within the tree survey area, using Google Map's labelling system, with increased location accuracy aided by a PocketGIS Geographical Information System. The trees to be retained and trees to be removed have been clearly mapped in the accompanying Tree Clearance and Tree Constraints plans *(see Appendices D & E).*

VII. Trees of similar condition, species, location and/or size have been formed into tree groups. There are forty one (41) groups within the tree survey area, all of which are clearly delineated in the Tree Constraints and Tree Clearance Plans *(see Appendices D & E).* As per standard procedure, only 1 tree out of each group has been numbered with an aluminium tree tag. However in groups G36, G38 and G39, all individual trees have been tagged, due to their close proximity to the proposed pedestrian and cycle bridge. It is intended that the individual tagging of these trees will facilitate the future monitoring procedures recommended in the BS5837 Tree Survey Schedule *(see Appendix C).*

VIII. One (1) individual tree and eleven (11) tree groups were not tagged due to restricted/limited access to the subject trees; either from water-logged conditions or high fence lines.

IX. Tree retention values have been determined based upon the trees' health, structure, dimensions, age class, life expectancy, location and environmental amenity/ significance in accordance with BS5837:2012 *(BSI, 2012).* These attributes have been reviewed collectively and used to categorise a tree value in a development context *(see Section 3.6).*

3.0 OBSERVATIONS

3.1 The Proposed Development

I. The proposed development is a pedestrian and cycle bridge connecting Little Island train station to Eastgate business park. The Northern end of the bridge will adjoin to Island Corporate Park road, to the West of Little Island train station carpark. From this entrance, the bridge runs parallel to the N25 road and Irish rail line, before crossing them from point (ITM 51.907084N, -8.358132W) to point (ITM 51.906728N, -8.358068W). The bridge then turns South East at a negative angle over a stream and around the boundaries of Radisson Blu Hotel & Spa visitor carpark, then finally into Eastgate Business Park, adjoining the Eastgate road *(see Fig.1)*.

II. The proposed development has been reviewed in the context of the Planning and Development Acts 2000-2020 *(eISB 2000)*; The National Planning Framework for Project Ireland 2040 *(The Department of Housing Planning and Local Government, 2018)* and the Cork County Development Plan 2022-2028 (Vols.1-6) *(CCC, 2015)*.

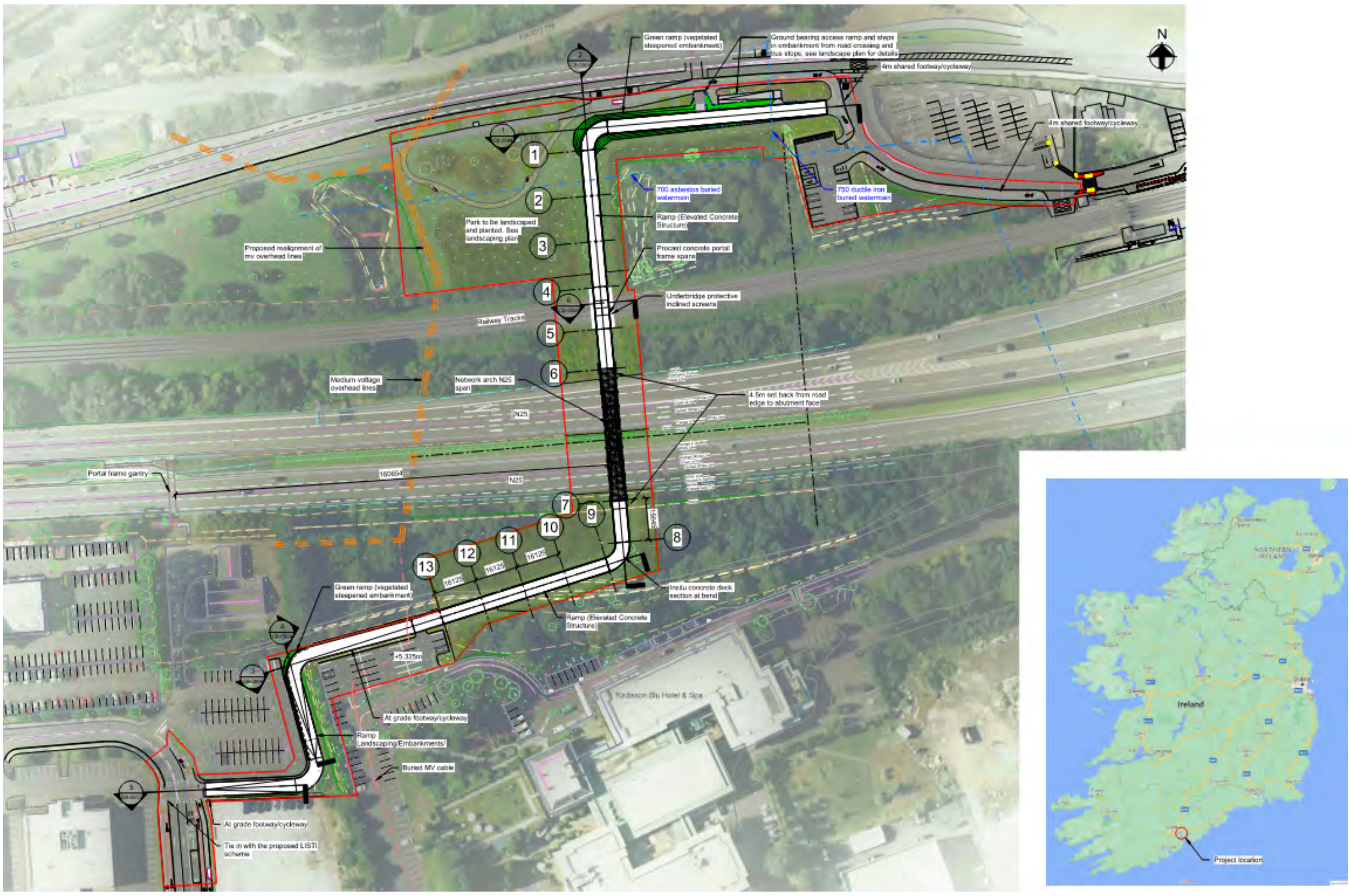

Fig. 1 Aerial image showing the RLB of the construction zone for the proposed pedestrian and cycle bridge connecting Little Island Train Station to Eastgate Business Park. All trees within these boundary lines are required to be removed to facilitate the development (ARUP Sketch Title: N25 LIPCB- Tree Survey Area Extents)

III. The provision of better pedestrian and cycling facilities will improve sustainable transport services and mobility around Cork City by providing safe access to transport links. This sustainable initiative is in-line with sustainable development goals (SDGs), outlined in the Johannesburg Plan of Implementation (JPOI) from the United Nation's 2002 World Summit, the 2012 United Nations Conference on Sustainable Development (Rio +20) and the 2016 High Level Advisory Group on Sustainable Transport (HLAG-ST) report *(UN, 2022).*

IV. Information in regards to the specifications for the proposed development are limited. The proposed bridge will be 496.5m long, with a width of 6m, with an unknown elevation over the low-lying riverine ground, the N25 and the Irish rail line. No proposed underground service locations have been reviewed in the preparation of this report.

3.2 Site Details

I. To facilitate the easy comprehension of this report, the Site was been divided into 2 areas: The area to the North of the N25 road, shall hereafter be referred to as 'Site A' and the area to the South of the N25 road, shall hereafter be referred to 'Site B'.

3.2.1 Site A: Site Details

I. The Northern tree survey Site, Site A, is located to the West of Little Island Train Station, around Island Corporate Park. The perimeter measurement of the tree survey area of Site A is ~716m, with an area of ~4.09 acres *(see Fig. 2).*

II. Site A consists of thirteen (13) individual parkland trees and twenty nine (29) tree groups.

III. Existing features on Site A include a large park green *(see Fig.1)* with concreted walking path and scattered park benches, two (2) protruding wetland areas, and a carpark for Island Corporate Park with a perimeter measurement of ~120m and an area of ~0.18 acres. Within the carpark are recycling bins, pedestrians and vehicles.

3.2.2 Site B: Site Details

I. The Southern tree survey Site, Site B, spans from the woodlands adjacent to the N25 road, South towards the Radisson Blu Hotel & Spa, following the boundary line of its carpark towards Eastgate Business park. The perimeter measurement of the tree survey area is ~491m, with an area of ~1.62 acres. The tree survey area measures 10-20m around the proposed development *(see Fig.2).*

II. Site B consists of two (2) woodlands, eleven (11) decurrent parkland trees and one (1) hedgerow.

III. Existing features on Site B include a deep stream running West to East through the tree survey area. The stream's course follows the horizontal boundary lines between the two (2) woodlands *(see Fig.2).* At higher elevation to the South of the stream, there is a carpark for the Radisson Blu Hotel & Spa, with a perimeter measurement within the tree survey area of ~229m and an area of ~0.47 acres. Within the carpark are pedestrians and vehicles.

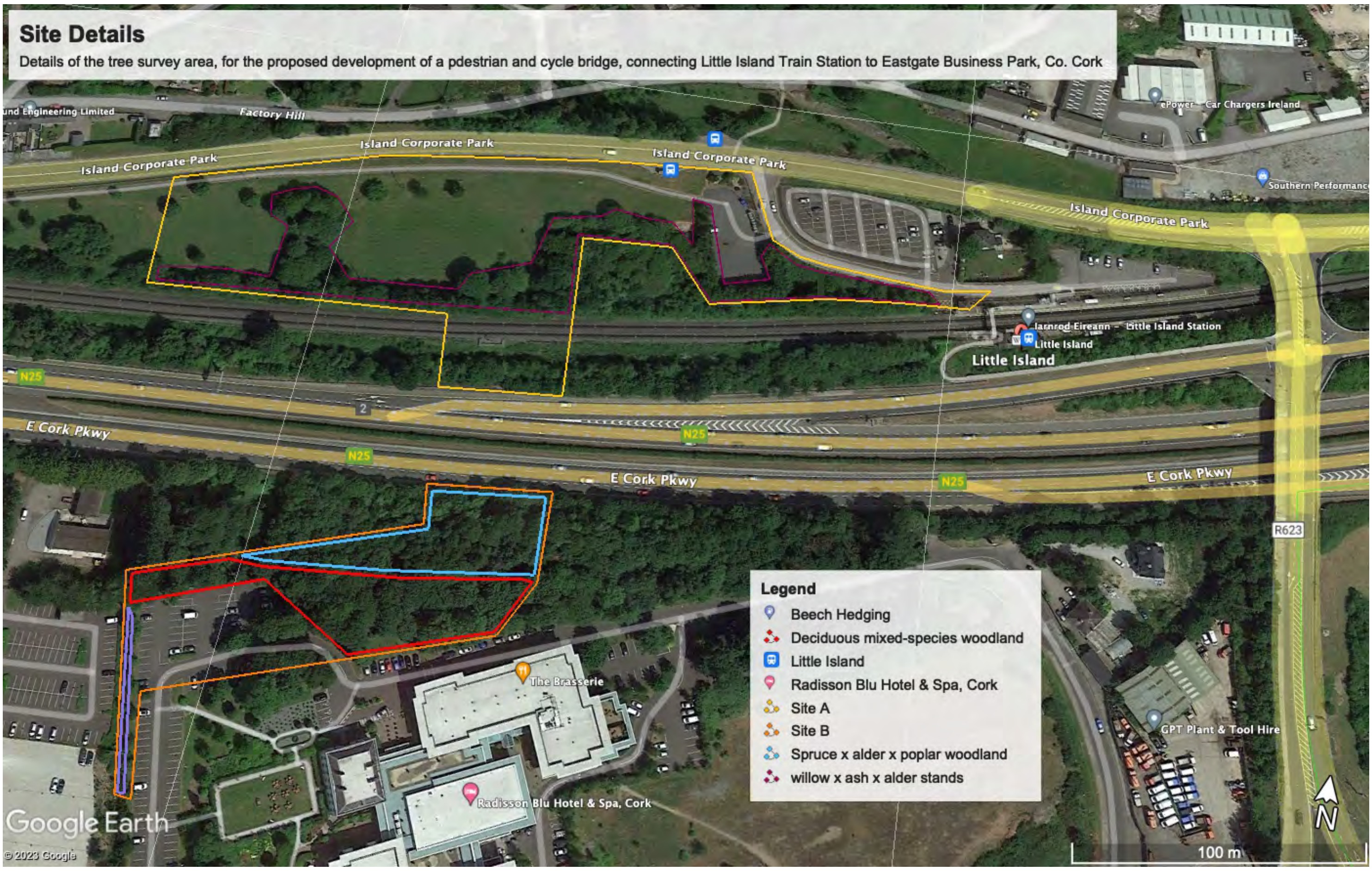

Fig. 2 Aerial image showing the tree survey area. Yellow lines delineate the boundaries of Site A; orange lines delineate the boundaries of Site B; the dark pink lines delineate the willow x ash x alder stands; the red lines delineate the area of the deciduous mixed-species woodland; the blue lines delineate the spruce x alder x poplar woodland; and the purple lines delineate the beech hedging (Google Earth Pro, 2022).

3.3 Statutory and Non-Statutory Designations

I. Heritage Tree Care Ltd. contacted Cork County Council in relation to statutory designations affecting the subject trees. There are no Tree Preservation Orders (TPO's) identified on the Site *(TCOI, 2011)* and the Site is not within an area designated by a Special Amenity Area Order *(CCC, 2015)*.

II. One veteran tree was identified during this survey, a sycamore opposite the Radisson Blu Hotel & Spa (numbered T578). Veteran trees are trees that are 'over-mature', trees that have surpassed maturity and are now 'veteran'. They are often of interest biologically and aesthetically. They are recognised by their impressive, unrestricted crown architecture, main stem girth, total size, and common presence of trunk hollows and/or cavities. Veteran trees are excellent examples of their species, and each requires a unique, specifically formulated care programme. *See Appendix C* for T578's recommended management strategy *(see fig.11)*.

III. Heritage Tree Care Ltd. reviewed the National Survey of Native Woodlands 2003-2008 *(Perrin et al. 2008)*, and The Ancient and Long-established Woodland Inventory *(Perrin & Daly 2010)*. The Sites are not classified as Ancient Woodlands, as they have not had a continuous history of cover since before the period when planting and afforestation became common practice (~1600's). As such the Sites have limited cultural and conservation value *(Pryor et al. 2002).*

3.4 Tree Works

I. Tree owners/managers, developers and contractors have responsibilities for health and safety as a result of their actions. They have a moral and legal 'duty of care' to prevent foreseeable harm. If remedial action is not carried out on trees, which are in an unstable/ hazardous condition, with obvious defects, those responsible could be subject to prosecution along with potential for further civil claims for damages.

II. It is advised that the tree maintenance annotated in the BS5837 Tree Survey Schedule is carried out, not only for planning purposes, but to ensure the prolonged health and continued longevity of the subject trees to be retained *(see Appendix C).*

III. In general the optimum period for significant pruning works is between November and February, and July to August, when trees are dormant or outside periods of high-functional activity. This reduces the overall impact on energy available to the tree for growth and processes, as the tree is better placed to respond to wounding and a reduction in leaf surface area *(Lilly, 2010)*.

IV. Tree work should, if possible, be carried out outside the typical bird nesting season of March to September. This report should be viewed alongside an ecology report, carried out by a qualified ecologist. Full consideration must be given to the presence of species protected under the Wildlife Act *(ISB 1976, as amended)* and other relevant legislation protecting wildlife and habitats, with special focus on the County Cork Protected Sites and Species document, the EC Natural Habitats Regulations *(EC, 1997)* and the Habitats Directive *(European Commission, 1992)*.

V. Any person who injures protected bird or animal species, of conservation concern and special conservation significance, or wilfully interferes with their breeding or resting places is guilty of an offence under Section 23 of the Wildlife Act *(ISB 1976).*

VI. Any tree surgery recommendations contained in this report are to be undertaken in accordance with BS3998:2010 *(BSI, 2010)* by suitably qualified and insured contractors.

VII. It is important to note that where trees which predate existing structures are to be removed, resultant soil-heave can occur as they are re-wet. To avoid potential future damage, any foundations that could be influenced by trees must be installed following the recommendations of the National Building Council Standards Chapter 4.2: Building Near Trees *(NHBC, 2021)*. Further guidance is available from the National Tree Safety Group *(NTSG 2011).*

Table. 1 Summary of the subject trees, in the tree survey area on Sites A & B.

Species	**Botanical Name**	**Native**	**Total No. trees on the Site**	**No. Trees to be removed to facilitate development**	**Category A**	**Category B**	**Category C**	**Category U**
Norway maple	*Acer platanoides*	N	3	1	1	2	0	0
English oak	*Quercus robur*	Y	4	2	3	0	1	0
Ash	*Fraxinus excelsior*	Y	118	38	98	11	4	5
Silver birch	*Betula pendular*	Y	3	3	3	0	0	0
European beech	*Fagus sylvatica*	N	98	8	92	3	1	2
Sycamore	*Acer pseudoplatanus*	N	44	18	9	16	15	4
Common lime	*Tilia x europaea*	N	14	3	10	1	1	2
Hawthorn	*Crataegus*	Y	44	36	0	25	16	3
Alder	*Alnus*	Y	256	87	185	55	13	3
Grey willow	*Salix cinerea*	Y	177	24	33	131	9	4
Goat willow	*Salix caprea*	Y	15	11	0	2	6	7
European yew	*Taxus bachata*	Y	1		0	0	0	1
Scots Pine	*Pinus sylvestnis*	Y	1	1	0	1	0	0
Chilean myrtle	*Luma apiculata*	N	2	2	2	0	0	0
Field maple	*Acer campestre*	Y	1		1	0	0	0
Sitka Spruce	*Picea sitchensis*	N	34	22	0	19	5	10
Grey poplar	*Populous x canescens*	N	4	3	0	3	1	0
Hazel	*Corylus*	Y	14	14	0	14	0	0
Hornbeam	*Carpinus betulus*	N	1		0	1	0	0
Horse chestnut	*Aesculus hippocastanum*	N	2	1	0	1	1	0
European holly	*Ilex aquifolium*	Y	1		0	1	0	0
Wild cherry	*Prunus avium*	Y	10		0	0	10	0
Wych elm	*Ulmus glabra*	Y	2	1	0	0	0	2
Chinese Elm	*Ulmus parvifolia*	N	1	1	0	1	0	0
Holly	*Ilex aquifolium*	Y	1	1	0	1	0	0
		Total	**850**	**277**	**437**	**287**	**83**	**43**

3.5 The Subject Trees

I. Eight hundred and fifty (850) trees were inspected and are the subject of this report. These have been sub-divided into two hundred and four (204) individual trees and forty one (41) tree groups. Complete attributes for trees to be retained can be found in Appendix C of this report.

II. There are twenty five (25) species of tree within in the tree survey area; 60% are native and 40% are non-native/introduced species *(see Table. 1).*

III. All significant trees, located in the tree survey area, on Sites A and B, have been included in this report. Pursuant with BS5837-2012 *(BSI, 2012)* all trees within this area, with a stem diameter of over 75mm have been assessed. Small trees/shrubs within the Sites may have been omitted from the report based on their species, current size and/or potential future size and contribution to local amenity.

IV. All trees on Sites A & B are considered to have been planted. This assumption is based on the trees' species type (not all native, many do not easily self-seed), current size, life stage/ age class (most are of similar height to their neighbouring trees, and are well-established and semi/mature), and location within the Sites (the trees are relatively evenly dispersed with semi-formulaic planting patterns).

3.5.1 Site A: Subject Trees

I. The open parkland area of Site A consists of 13 well-spaced decurrent deciduous trees *(see fig.3),* planted at equidistance from each other around the park/green, providing good visual diversity and amenity for pedestrians in Island Corporate Park. The seven (7) different species of trees, range in age from juvenile to mature and have moderately low maturing height (between 8-12m).

II. These trees have suffered damage characteristic to trees located in public parks; including strimmer/ mower damage above the root collar and soil compaction. These trees have predominantly Moderate to High retention values (87%), with life expectancies of over 40 years.

III. Along the Southern fence-line of Site A between the park, the Irish Rail line, the N25 and around the carpark, are native groups of three (3) excurrent high canopy tree species with high maturing heights (>12m) *(see fig.4).* These alder *(Alnus)* x grey willow *(Salix cinerea)* x ash *(Fraxinus excelsior)* stands consist of around 398 trees, categorised in this report into 21 groups. In addition there are 6 groups of understory scrub species, including hazel *(Corylus)* and hawthorn *(Crataegus) (Perrin et al. 2008).*

IV. The stands are all of similar age and height. They are well-suited to, and tolerate readily the water-logged landscape and deep-water ditches in which they are planted. They play a visually important role as landscape screening features and contribute significantly to noise pollution reduction and the Site's ecological value to wildlife *(Rushforth, 1999 & IAPT, 2018).* These semi/mature stands have trees of high quality, with Moderate to High retention values (97%) and an estimated remaining life expectancy of at least 25 years.

V. The two (2) protruding water-logged wetland areas on Site A *(see Fig.2)* are surrounded/populated by alder and grey willow boscage *(see fig.5).* The grey willows have partially submerged trunks *(see fig.6)* sending up numerous vertical stems into the canopies. The field layers beneath the grey willow boscage were unable to be identified due to the submerged conditions, however characteristically dominant bramble and ivy were observable.

VI. Via visual observation alone, these AF2 classified alder-grey willow stands are growing on/around a wet hollows with base-rich, fertile mineratrophic and organic-rich gleys, that are waterlogged, regularly inundated or within permanently submerged ground *(Cross, 2008).*

3.5.2 Site B: Subject Trees

I. The Northern most woodland *(see Fig 2)*, on the low-bearing, water-logged 'marginal land' between the stream and the N25, is populated by seventy six (76) individual trees and 6 tree groups. This native and non-native woodland is predominantly Sitka spruce *(Picea sitchensis)*, alder and grey poplar *(Populous x canescens)*, with *under-storey* species of Goat willow *(Salix caprea)*, Chilean myrtle *(Luma apiculata)* and hawthorn.

II. The heavy shade-casting trees form a dense-canopied woodland, composed of blocks of similar size trees of varying age (from juvenile to mature) and condition *(see fig.9)*. The species present are commonly found near streams, rivers and wetlands and play important roles in the dynamics of the riverine system *(see fig.7)*. However despite their hydrological function, as a result of the shade the field layer is species-poor, dominated by ivy, broad leaved buckler-fern and hard fern *(Forest Service, 2008).*

III. Despite being planted, there appears to have been no woodland management in this area. Although woodlands are non-static entities that can usually be left without interference, the overall structure and composition of this woodland is poor; with 21% of the woodland classified as dead and/or hazardous (*Byrnes, 2007b.)* These trees have severe structural defects that are not remediable such that their failure is expected within 12 months *(see fig.8)*. Only 2 alders (T713 and T714) have been categorised as high quality trees.

IV. Along the inclining bank to the South of the lowland stream, there is a predominantly non-native/ introduced, deciduous woodland *(see Fig.2)*. This woodland is is composed of 93 semi/mature individual trees and 6 tree groups. It is populated by species including sycamore *(Acer pseudoplatanus)*, Common lime *(Tilia x europaea)* and European beech *(Fagus sylvatica)*, along with native ash *(Fraxinus excelsior)* and English oaks *(Quercus robur)*.

V. The 10 different species within this woodland have formed a robust, complex and biodiverse habitat (*Rushforth, 1999 & IAPT 2018)*. Sixty five percent (65%) of the trees to be retained are of Moderate to High retention value, and are particularly good examples of their species, whilst being important components of the woodland group as whole.

VI. Soils composed of mineratrophic gleys, which are base-rich and highly fertile are characteristic of this type deciduous woodland. Although the trees on the Southern bank are under-pinned by a strong non-native element, the open character of the canopy means there appears to be well developed shrub and field layers. This woodland contributes excellent visual amenity and biodiversity to the area.

3.6 Tree Retention Values

I. In total two hundred and four (204) individual trees and forty one (41) tree groups were assessed during the course of this survey.

II. Forty six (46) individual trees and ten (10) tree groups (53% of the total trees on-site), were of a Category A (High) Retention Value. Category A trees are of high quality with an estimated useful life expectancy (ULE) of at least 40 years. They are typically trees that are particularly good examples of their species *(see fig.10)*; have particular visual importance as arboricultural and/or landscape features; or those of significant historical commemorative, or conservation value- for example Veteran trees *(see fig.11).*

III. Sixty six (66) individual trees and twenty three (23) tree groups (30% of the total trees on-site) were of a Category B (Moderate) Retention Value. Trees in this category are typically of medium size, have good structure, fair health and a ULE of more than 15 years.

IV. Forty two (42) individual trees and six (6) tree groups (11% of the total trees on-site) were of a Category C (Low) retention value. Trees in this category are of low quality, limited value or impaired condition, with an estimated remaining life expectancy of 5-15 years.

V. Thirty six (36) individual trees and two (2) tree groups (6% of the total trees on-site), were of Category U (Very low) Retention Value and require removal due to their poor/dead/hazardous condition. These trees are arguably not suitable for long term retention, and cannot realistically be retained as viable trees in the context of the current land use for longer than 5 years. As per established arboricultural and silvicultural principles; the appropriate management/ removal of these Category U trees will promote the development of better specimens elsewhere on the Site *(see Appendix B for more information).*

3.7 Photographic Documentation

All photographs were taken at the time of the site inspection by Ben Mullen and have not been altered.

Fig.3 Example of Site A's decurrent deciduous parkland trees

Fig.4 Example of Site A's alder x grey willow x ash stands

Fig.5 One of Site A's protruding wetland areas

Fig.6 Example of Site A's grey-willow boscage with partially submerged trunks

Fig.7 Site B's deep stream running East-West between the deciduous and spruce x ash x alder woodlands

Fig.8 Example of spruce x poplar x alder woodland with 21% of trees in dead/hazardous condition

Fig.9 Site B's dense-canopied spruce x poplar x alder woodland

Fig.10 Example of a Northerly phototropic kink in a main stem in Site 's deciduous woodland

Fig.11 Site B's veteran sycamore (T578) which requires specialised management programme

Fig.12 An example of a Category A high retention value mature beech in Site B's deciduous woodland

4.0 ARBORICULTURAL IMPACT DISCUSSION

4.1 Trees to be Removed

I. A review of the proposed development has been undertaken in the context of tree retention and removal in relation to the subject trees. A brief summary of the trees to be removed, tree works and incursions related to the Proposed Development are detailed below.

II. One hundred and three (103) individual trees, five (5) part-groups (i.e sections of a tree group, *proportions specified on Appendix C*) and thirteen (13) tree groups have been selected for removal to facilitate the proposed development. It is recommended that as many trees as possible are retained in the part-groups; but it is understood that those close to the existing road and proposed development will have to be removed, due to their proximity.

III. The total number of trees to be removed on-site is two hundred and seventy seven (277). This totals 32% of the total trees on-site. This includes thirteen (13) individual trees, and four (4) part-groups of high retention value (Category A); thirty six (36) individual trees, one (1) part-group and eight (8) full tree groups of moderate retention value (Category B); and thirty three (33) individual trees and four (4) full tree groups of low retention value (Category C). In addition twenty one (21) individual trees and one full tree group of very low retention value (Category U) are being removed to facilitate the proposed development- however these trees would be removed regardless of the Proposed Development.

IV. Tree removals are listed in the BS5837 Tree Survey Schedule included in Appendix C. Tree removals assume a reasonable worst case and in practice some trees may be feasible to retain subject to investigation by a suitably qualified arboriculturist.

V. Following site-clearance, where a large number of trees in close proximity to one another have been removed; an arboriculturist must carry out a site walkover immediately to determine the stability and suitability of retained trees which may/ or may not have been impacted by a loss of companion shelter.

VI. All further tree removals or pruning activities should be discussed with the tree owner/ manager and appropriate Planning Authority (PA).

VII. It is *vital* that work priority and timescales be applied to the work recommendations, after planning has been approved. This is in keeping with professional best standards and statute law in regards to negligence surrounding our professional duty of care. *Another assessment of the trees to be retained on-site, after planning has been approved, will be required in order to apply an accurate work priority schedule.*

4.2 Proposed Pruning

I. Of the trees to be retained, forty six (46) individual trees and three (3) tree groups require pruning or some level of tree maintenance. All proposed tree work are listed in the BS5837 Tree Survey Schedule in Appendix C.

II. It is anticipated that over the course of construction, pruning will be required to more retained trees than specified here. Extra pruning may be required in response to site-changes (grade change, soil profile, wind-funnelling etc.) to further facilitate development or to mitigate risk to persons on-site. Additional tree work identified should be discussed with the Project Arborist. No works should be undertaken without prior consent from the PA.

III. 'Facilitation pruning' is the pruning of a tree, to reduce or raise its crown (according to good practice) to allow vehicular access for site works. This will have to be carried out on multiple trees on both Sites, but it is yet unknown in what manner and direction the site will be accessed.

IV. No information in regards to road layout, landscape general arrangement, drainage, structures, earthworks, lighting and compounds has been reviewed to inform this assessment. As-and-when new information becomes available; prior to any facilitation pruning being carried out; a suitably qualified arboriculturist must identify and determine the stability and suitability of crown-lifting/reducing the appropriate subject trees.

V. The pruning practices recommended include: crown reduction, used to weight reduce the size of a tree; deadwood removal or 'crown cleaning', used to remove dead, diseased, broken or weakly attached branches; crown thinning, used to prune selective branches to increase light penetration and air movement through the crown; and crown lifting, used to ensure a clear height of 2-2.5m where new areas of access are proposed *(Lilly, 2010).*

VI. Reduction pruning should focus on the removal of smaller diameter branches where feasible, and remove no greater than 25% of the total crown. Branches no greater than 50cm diameter are to be removed unless specifically approved on-site by the Project Arborist.

VII. It has been recommended that seven (7) trees should have organic wood-chip mulch applied around their base. This is a prevalent recommendation for parkland trees, as mulching provides essential nutrients; adds organic matter to soil, inhibits weed growth and soil compaction. Organic mulch also helps soil retain water, by reducing groundwater evaporation, preventing the ground from becoming water-logged.

VIII. Eight (8) trees require cobra-bracing. Cobra-bracing offers a flexible, dynamic support system that does not damage trees. It is the exercise of strapping vulnerable limbs to stronger limbs, to provide support and reduce the risk of failure; ultimately mitigating risks to neighbouring targets and ensuring the tree's continued longevity.

IX. The ivy severance recommended in Appendix C should be carried out selectively. Severing Ivy will help it die-off, making it easily removable from the host tree. Ivy severance will aid further inspection, create a 'tidy' appearance suitable for a newly managed area, and minimise the retained tree's competition for light, water and nutrients. Not all Ivy should be removed from the site however- it is a preferred habitat for many wildlife species, including birds, butterflies and insects *(Perrin et al. 2008).*

X. Of the trees to be retained, three (3) have uncorrected leans/kinks due to phototropic competitive growth *(see fig.10)*. It is thought that the removal of neighbouring trees to facilitate the proposed development, will force an alteration in the growth habit of these trees, and as such the majority of them have been recommended for re-assessment in the future *(Matteck 2015).*

XI. In addition, three (3) of the trees to be retained have been recommended to be re-assessed, either in the Spring (so the condition of the tree can be more accurately ascertained), or after the proposed tree removal has been carried out.

XII. Eleven (11) trees have been recommended for bi-annual monitoring, due to their condition and proximity to targets, both proposed or already existing. The tree owner/ manager will be responsible for organising the periodic inspection of the retained tree; with the aim of assessing and addressing pruning requirements. Remedial works will to ensure the continued structural stability and safety of all trees on the Site.

XIII. All tree work is to be carried out in accordance to British Standard BS 3998: 2010 Tree Work – Recommendations *(BSI, 2010)*, by a suitably qualified and insured arborist. The level of pruning carried out should not have a significant negative impact on the health or amenity of the subject tree. No climbing spikes are to be used if climbing inspections and recommended pruning are to be carried out on live trees, except in the instance of emergency.

Table.2 *Summary of removals and pruning for individual trees to facilitate the Proposed Development*

Impact	Category A	Category B	Category C	Category U	**Total**
Individual trees to be removed to facilitate the Proposed Development	13	36	33	21	**103**
Individual trees to be pruned to facilitate the Proposed Development	14	10	5	0	**29**

Table.3 *Summary of removals and pruning for tree groups to facilitate the Proposed Development*

Impact	Category A	Category B	Category C	Category U	**Total**
Tree groups to be removed to facilitate the Proposed Development	0	8	4	1	**13**
Part-groups to be removed to facilitate the Proposed Development	4	1	0	0	**5**
Tree groups to be pruned to facilitate the Proposed Development	2	1	0	0	**3**

4.3 Root Protection Areas

I. The Root Protection Area is defined as a specified area above and below ground and at a given distance, measured radially away from the centre of the tree's trunk and which is set aside for the protection of its roots and crown. It is the area required to provide the viability and stability of the tree/s to be retained, where it is potentially subject to damage by development. The radius of the RPA is calculated by multiplying the DBH by twelve (12). RPA radius = DBH x 12 with DBH being nominally measured at 4.5ft from ground level *(Malone et al. 2009, BSI, 2012 & Lilly, 2010).*

4.4 Major and Minor Encroachment within the RPA or Canopy Spread

I. Limited encroachment within the RPA and canopy spread may occur, however this is dependent on the type of works proposed and the characteristics of the trees on-site. The British Standards state that if the encroachment is greater than 10%, trees will only remain viable should careful construction measures e.g. non-destructive excavations be carried out *(see Sections 4.5 & 5.2 for more information).*

II. A major incursion or 'encroachment' into the RPA of any tree is considered to occur when it is beyond 10% of the total RPA area. A minor encroachment is determined as being less than 10% of the total RPA area. Tree retention will be feasible where trees are considered, on balance, to be of an age, species and condition which will tolerate the disturbance of the proposed construction work (the default standpoint is not more that a maximum of 20% of the overall RPA) *(BSI, 2012).*

III. The RPA encroachment areas are located directly beside/along the pedestrian and cycle bridge. It is speculated that there will be potential future pressure for removal, either from public safety apprehension or seasonal nuisance. If these conflicts do arise, detailed architectural design should address these issues.

IV. A range of works will likely be required within or close to the RPA of trained trees. The sustained impact of the incursion zones must be minimised by ensuring the right mitigation measures are put in place prior to construction commencing. Mitigation measures must be adhered to if the cumulative effects of RPA incursions are to be avoided. A qualified project arborist must be present during construction to mitigate the risk of construction damage.

V. A more detailed methodology for sensitive construction measures and permitted activities near retained trees should be outlined in an Arboricultural Method Statement and accompanying Tree Protection Plan, when new information becomes available.

4.4.1 Major Encroachments within the RPA or Canopy Spread

I. Eight (8) individual trees will be subjected to major encroachments within their RPA or canopy spread. One (1) individual tree is Category A and seven (7) individual trees are Category B *(see Tables.4 & 5).*

II. The high retention value (Category A) individual tree is numbered: T585. The moderate retention value (Category B) individual trees are numbered: T538, T557, T595, T592, T594, T583 and. T582.

III. It must be noted that the proposed development will be elevated off the woodland floor, so these encroachments may be less invasive than customary building procedures. However, trees and tree groups will require specific root-safe protection measures during construction to ensure they are not subject to significant negative impact; and specialist working methods to ensure they remain viable following the completion of works *(see guidelines in Sections 4.5 & 5.2).* Specific regard and close monitoring of T578, is recommended due to its veteran status.

4.4.2 Minor Encroachments within the RPA or Canopy Spread

I. Seven (7) individual trees and six (6) tree groups will be subjected to minor encroachments within their RPA or canopy spread. Two (2) individual trees and five (5) tree groups are Category A; and five (5) individual trees and one (1) tree group are Category B *(see Tables. 4 & 5)*. These trees will require generic protection measures throughout the construction phase.

II. The individual tres subject to minor encroachment are: T537, T541, T591, T580, T468, T467 and T461. The tree groups subject to miner encroachment are: G15, and those having sections of their group removed: G18, G21, G19, G17 and G10.

III. There will also be construction related activities occurring outside the tree survey area and subject tree RPA. Given the close proximity of trees in woodland areas, certain construction activities need to be mindful of these trees also.

Table.4 Detailed summary of RPA encroachments for individual trees to facilitate the Proposed Development

Impact	Category A	Category B	Category C	**Total**
Individual trees with major incursions in their RPA (>10%)	1	7	0	**8**
Individual trees with minor incursions in their RPA (<10%)	2	5	0	**7**

Table.5 Detailed summary of RPA encroachments for tree groups to facilitate the Proposed Development

Impact	Category A	Category B	Category C	**Total**
Tree groups with major incursions in their RPA (>10%)	0	0	0	**0**
Tree groups with minor incursions in their RPA (<10%)	5	1	0	**6**

4.5 Additional Excavation/ Trenching within RPAs

I. In the event additional excavation is required within the RPAs of the retained subject trees, arborist involvement will be required to ensure works are undertaken in accordance with BS5837:2012 *(BSI, 2012)* and the National Joint Utilities Group guidelines for the Planning, Installation and Maintenance of Utility Apparatus in Proximity to Trees *(NJUG, 2007).*

II. Machine excavation within the RPAs of retained trees must be prohibited, unless undertaken at the direct consent from the Project Arborist. If excavation is absolutely necessary within this zone, roots should be protected, and the proposed excavation commence at the outer extent of the RPA and move inwards, to minimise root damage to retained trees. Roots discovered are to be treated with care and minor roots (<40mm diameter) pruned with a sharp sterile handsaw or secateurs. All significant roots (>40mm diameter) are to be recorded, photographed and reported to the project arborist.

III. Excavation/ trenching within the RPA of retained trees should be undertaken using sensitive construction methods, employing a 'low pressure excavation methodology', such as manual excavation, hydro-vac or air spade. A project arborist should monitor the manual excavation works and advise on which roots are to be retained.

IV. Overall, trenchless techniques should be used if possible; where possible trenches should be broken rather than continuous. Backfilling and other operations near the tree should be performed to avoid root or stem damage and unnecessary soil compaction. It is recommended that the soil structure be ameliorated or replaced following the competition of construction works on-site.

4.6 Additional Construction within RPAs

I. The constraints imposed by trees, both above and below ground, should inform the site-layout design; although it is recognised that the competing needs of development means that trees are only one factor requiring consideration.

II. To minimise disturbance within the RPAs of trees by soil excavation, an 'above ground level methodology' should be used. For example, over-engineered designs using raided foundations/ suspended slab supported by sleeved piers could be employed. Raising these structures will reduce the need for excavation within the RPA of tree/s and will reduce the overall weight and load exerted by the proposed new infrastructure.

III. The use of strip-footings between tree stem and alignment of the new installations is prohibited. Minimising disturbance of the natural hydrology and nutrient resource currently available to the retained trees is vital for their continued longevity.

IV. Appropriate 'Green' ground surface treatments must be installed above existing grade and be of a permeable nature. This will reduce soil compaction and to promote water and air penetration into the sub-soil. If the surfacing is to be load bearing, then it is suggested that a Geogrid/ web or similar is incorporated to ensure the rooting area below does not become compacted.

V. Where scaffolding is required, it should be erected outside the RPA in accordance with BS5837:2012 and the NJUG guidelines. Where it is essential for scaffolding to be erected within the RPA, branch removal should be minimised. Where this pruning is unavoidable it must be specified and approved by the project arborist *(BSI, 2012 & NJUG, 2007).*

5.0 RECOMMENDATIONS

5.1 Tree Replacement & Offset Tree Planting

I. Tree removals should be mitigated with a high-quality scheme of new tree planting. It is recommended that trees requiring removal be replaced (preferably on a one-to-one basis) elsewhere nearby. Offset planting should reflect the number of trees removed and the initial loss of biomass and amenity.

II. New trees should be of long-term potential and sourced from a reputable supplier.

III. New trees should be planted at minimum distances detailed in Annexe A, Table A.1 of BS5837:2012. This will prevent direct damage to services and structures from future tree growth *(BSI, 2012)*.

IV. New tree planting should be implemented in accordance to BS8545:2014 Trees: From nursery to establishment in landscape- Recommendations. Unethical or unprofessional tree selection and/or their placement within the landscape must be avoided *(BSI, 2014)*.

V. Newly planted trees will likely require maintenance after planting care for a period of 2-3 years, to ensure successful establishment. Mitigation plantings failing during this establishment period are to be removed and replaced (like for like).

VI. Soil replacement works, or soil amelioration may be required for new plantings- if existing areas of unsurfaced ground have not been protected during demolition and construction phases. Protection can be achieved using fit for purpose ground protection measures (such as fenced exclusion zones where feasible), in accordance to BS5837:2012, Section 6.2.3 *(BSI, 2012)*.

VII. To sustain the tree survey area's complex biodiversity, both Sites should be planted with the same proportion of native and non-native species, which have comparable form and structure upon maturation.

VIII. Replacement tree species must suit their locations on the Sites; in terms of their potential physical size and their tolerance(s) to the surrounding environmental conditions.

IX. Replacement tree species must be selected in consultation with a project arborist, who can also assist in implementing successful tree establishment techniques.

X. Replacement tree species must have the genetic potential to reach mature size potential of those trees removed. As a guide, potential height will be a minimum of 10m (or more) and produce a spreading canopy so as they may provide amenity value to the property and contribute to the tree canopy of the surrounding area in the future.

5.2 Tree Protection

I. The RPA and canopy spread of the tree to be retained will form effective Construction Exclusion Zones (CEZ). This default requirement will prevent the retained trees from suffering common types of damage, often sustained by trees during construction.

II. Commonly sustained types of damage include: the spillage, dumping or preparation of materials toxic to tree health (chemicals such as cement products) tin close proximity to subject trees; root severance (following trenching) leading to root dysfunction and/or death; and soil grade changes or soil structure damage (from machinery or footfall on unsurfaced ground).

III. An official 'project arborist' must be commissioned to oversee tree protection, any works within the RPA and complete regular monitoring compliance certification.

IV. The project arborist must have suitable industry experience in the field of arboriculture or horticulture, with relevant demonstrated experience in tree management on construction sites. Inspections are to be conducted by the project arborist at several key points during construction in order to ensure that protection measures are being adhered to during construction stages and decline in tree health, or additional measures can be identified.

V. All trees to be retained require protection during the construction stage. Tree protection measures include: Restricted access to RPA, restricted activities inside the RPA, protective fencing, trunk and ground protection, tree protection signage and project arborist compliance reports. No excavation, construction activity, grade changes, surface treatment or storage materials of any kind are permitted within the RPA.

VI. Protective fencing is to be installed around all retained trees for the extent of its RPA (or as much as is practical). Appropriate fencing outlined BS5837:2012, is of >1.8m height, with highly visible mesh between freestanding posts, each with a diameter >20mm. This fencing must be erected around individual trees and tree groups before any machinery or materials are brought onto the site- before the commencement of all works. Once erected, protective fencing and tee protection signage must not be removed or altered without approval from the project arborist.

VII. The subject trees themselves must also not be used as a billboard to support advertising materials. Affixing ferric nails or screws into main stems damages trees. As such, it is not a recommended practice in the successful retention of trees.

VIII. When access into the CEZ is necessary, special measures such as supervision by the Project Arborist and the use of ground protection (either steel plates or rumble boards, strapped over mulch/aggregate) is required.

IX. Further detailing of tree protection measures should be outlined in a subsequent Arboricultural Method Statement (AMS) and accompanying Tree Protection Plan, prior to work commencing, as-and-when further information becomes available.

6.0 CONCLUSIONS

I. One hundred and three (103) individual trees, five (5) part-groups (i.e sections of a tree group) and thirteen (13) tree groups have been selected for removal to facilitate the proposed development. The estimated total number of trees to be removed on-site is two hundred and seventy seven (277). This totals 32% of the total trees on-site. This sum is made up of eighty five (85) trees of high retention value trees (Category A); one hundred and eleven (111) trees of moderate retention value (Category B); and fifty eight (58) trees of low retention value (Category C). In addition twenty three (23) trees of very low retention value (Category U) are being removed to facilitate the proposed development- however these trees would be removed regardless of the Proposed Development.

II. Eight (8) individual trees will be subjected to major encroachments within their RPA or canopy spread. One (1) individual tree is Category A and seven (7) individual trees are Category B.

III. Of the trees to be retained, forty six (46) individual trees and three (3) tree groups require pruning or some level of tree maintenance.

IV. All proposed tree work are listed in the BS5837 Tree Survey Schedule in Appendix C. All tree work is to be carried out in accordance to British Standard BS 3998: 2010 Tree Work – Recommendations *(BSI, 2010)*, by a suitably qualified and insured arborist.

V. Any negative impact the proposed development will have on the the trees to be retained, must be mitigated by appropriate and careful construction methodologies, via the protection measures recommended. These include the use of ground protection to protect the soil structure of the unsurfaced ground, and fenced exclusion zones to protect the structural tree roots and canopies of the trees on Sites A and B.

VI. Tree protection measures should be further expanded upon through the further request and provision of an Arboricultural Method Statement and accompanying Tree Protection Plan, when more information becomes available. The AMS will detail the specifications for tree protection and how sensitive construction operations are to be achieved in proximity to retained trees. No changes may take place to the content or application of the AIA or AMS without the prior written approval of the Planning Authority. .

VII. Tree-loss should be mitigated with a high-quality and robust scheme of new tree-planting and subsequent tree management and monitoring strategies.

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APPENDICES

Appendix A: Arboricultural Reporting Assumptions and Limiting Concerns
Appendix B: Explanation of Tree Assessment Terms
Appendix C: BS5837 Tree Survey Schedule
Appendix D: Tree Clearance Plan
Appendix E: Tree Constraints Plan

APPENDIX A

Arboricultural Reporting Assumptions and Limiting Concerns

I. Any legal description provided to the consultant is assumed to be correct. Any titles and ownership of any property are assumed to be good. No responsibility is assumed for matters legal in character.

II. Inspections is limited to visual examination of accessible components, without dissection, excavation or probing. There is no warranty or guarantee expressed or implied that the problems or deficiencies of the plants or property in question, may not arise in the future.

III. It is assumed that any property/ project is not in violation of any applicable codes, ordinances, statutes or other government regulations.

IV. Information contained in the report covers only those items that were examined and reflect the condition of those items at the time of inspection.

V. Care has been taken to obtain all information from reliable sources. All data has been verified in so far as possible, however the consultant can neither guarantee nor be responsible for the accuracy of the information provided by others.

VI. Sketches, diagrams and photographs in this report, are intended as visual aids, and and are not necessarily to scale and should not be construed as engineering or architectural reports or surveys unless expressed otherwise.

VII. The consultant shall not be required to give testimony or attend court by reason of this report, unless subsequent contractual arrangements are made; including payment of an additional fee for such services.

VIII. The report and any values expressed herein represent the opinion of the consultant and the consultant's fee is in no way contingent upon the reporting of a specified value, a stipulated result, the occurrence of a subsequent event, nor upon any finding to be reported.

IX. Loss or alteration of any part of this report invalidates the entire report.

X. Neither all nor any part of the contents of this report, nor any copy thereof, shall be used for any purpose by anyone but the person to whom it is addressed, without the written consent of the consultant. Nor shall it be conveyed by anyone, including the client, to the public through advertising, public relations, news, sales, or other media, without the written consent of the consultant.

XI. Possession of this report or a copy thereof does not imply right of publication or use for any purpose by anyone but the person to whom it is addressed, without the prior written consent of the consultant.

APPENDIX B

Explanation of Tree Assessment Terms

I. **Tree Name:** Provides the botanic name (Genus, species, sub-species, variety and cultivar where applicable) in accordance with the International Code of Botanical Nomenclature (ICBN), and an accepted common name.

II. **Age:** Refers to the life cycle of the tree.

Category	**Description**
Young	Newly planted tree not fully established, may be capable of being transplanted or easily replaced.
Juvenile	Tree is small in terms of its potential physical size and had not reached its full reproductive ability.
Semi-Mature	Tree in active growth phase of life cycle and has not yet attained an expected maximum physical size for its species and/or its location.
Mature	Tree has reached an expected maximum physical size for the species and/or location and is showing a reduction in the rate of seasonal extension growth.
Senescent	Tree is approaching the end of its life cycle, and is exhibiting a reduction in vigour often evidenced by natural deterioration in health and structure.

III. **Physiological Condition:** Summarises the health and vigour of the trees

Category	**Description**
Excellent	Canopy full with dense foliage coverage throughout, leaves are entire and are of an excellent size and colour for the species, with no visible pathogen image. Excellent growth indicators, e.g. seasonal extension growth.
Good	Canopy full with minor variations in foliage density throughout, leaves are entire and are of a good size and colour for the species, with minimal or no visible pathogen damage. Good growth indicators.
Fair	Canopy with moderate variations in foliage density throughout, leaves not entire with reduced size and/or atypical in colour, moderate pathogen damage. Reduced growth indicators, visible amounts of deadwood/dieback, and epicormic growth.
Poor	Canopy density significantly reduced throughout, leaves are not entire, are significantly reduced in size and/or are discoloured, significant pathogen damage. Significant amounts of deadwood and/or epicormic growth, noticeable dieback of branch tips, possibly extensive.
Dead	No live plant material observed throughout the canopy, bark may be visibly delaminating from the trunk and/or branches.

IV. **Structural Condition:** Summarises the structure of the tree from roots to crown.

Category	**Description**
Good	Good form and branching habit. Minor structural defects that are insignificant and atypical or common within the species. E.g. included bark, co-dominant stems. No fungal pathogens present. No visible wounds to the trunk and/or root plate.
Fair	Moderate structural defects present that impact longevity, e.g. apical leaders sharing common union(s). Minor damage to structural roots. Small wounds present where decay could begin. No fungal pathogens present. A fair representation of the species.
Poor	Significant structural defects present that have a significant impact on longevity and result in a poor representation of the species, e.g. Branch/stems with included bark, with failure likely within 0-5 years. Wounding evident with cavities and/or decay present. Damage to structural roots.
Hazardous	Serious structural defects with failure determined to be imminent (<12 months). Defects may include active splits and/or partial branch or root plate failures. Tree requires immediate arboricultural works to alleviate the associated risk.

V. **Useful Life Expectancy (ULE):** Useful Life Expectancy refers to an expected period of time the tree can be retained within the landscape before its amenity value declines to a point where it may detract from the appearance of the landscape and/or becomes potentially hazardous to people and/or property. ULE values consider tree species, current age, health, structure and location. ULE values are based on the tree at the time of assessment and do not consider future changes to the tree's location and environment which may influence the ULE value.

VI. Tree Quality:

		Health**			
		Excellent/ Good	**Fair**	**Poor**	**Dead**
	Good	A	B	C	U
	Fair	B	B	C	U
	Poor	C	C	U	U
	Hazard*	U	U	U	U

** Structural hazard that cannot be remediated through mitigation works to enable safe retention.*
*** Trees of short term reduced health that can be remediated via basic, low cost plant heath care works (e.g. mulching, irrigation etc.) may be designated in a higher health rating to ensure correct retention value nomination.*

VII. Tree Retention Value:

Based upon *BS5837:2012: Trees in relation to design, demolition and construction- recommendations.*

Category and Definition	**Criteria (including sub-categories where appropriate)**		
Category U			
Trees in such a condition that they cannot realistically be retained as viable trees in the context of the current land use for longer than 5 years.	• Trees that have a severe structural defect that are not remediable such that their failure is expected within 12 months. • Trees that will become unviable after removal of other Category U trees (e.g. where for whatever reason the loss of companion shelter cannot be mitigated by pruning). • Tres that are dead or are showing signs of significant, immediate and irreversible overall decline. • Trees infected with pathogens of significance to the health and/or safety of other trees nearby. • Low quality trees suppressing adjacent trees of better quality. • Noxious weeds or species categorised as weeds within the local area. **Note:** Category U trees can have existing potential conservation value* which might make it desirable to preserve.		
	1. Arboricultural Qualities	**2. Landscape Qualities**	**3. Cultural & Environmental Values**
Category A			
Trees of High Quality with an estimated remaining life expectancy of at least 25 years and of dimensions and prominence that it cannot be readily replaced in <20 years.	Trees that are particularly good examples of their species, especially if rare or unusual (in the wild or under cultivation); or those that are important components of groups or avenues.	Trees or groups of significant visual importance as arboricultural and/ or landscape features (e.g. feature and landmark trees).	Trees, groups or plant communities of significant conservation, historical, commemorative or other value (e.g. remnant trees, critically endangered plant communities, trees listed specifically within a Heritage statement of significance).
Category B			
Trees of Moderate Quality with an estimated remaining life expectancy of 15-25 years and of dimensions and prominence that cannot be readily replaced within 10 years.	Trees that might be included within Category A but are downgraded because of diminished conditions such that they are unlikely to be suitable for retention beyond 25 years.	Trees that are visible from surrounding properties and/or the street but make little visual contribution to the wider locality.	Trees with conservation or other cultural value (trees within conservation areas or landscapes described within a statement of significance).
Category C			
Trees of Low Quality with an estimated remaining life expectancy of 5-15 years, or young trees that are easily replaceable.	Trees of very limited value or such impaired condition that they do not qualify in higher categories.	Trees offering low or only temporary/ transient landscape benefits.	Trees with no material conservation or other cultural value.

** Where trees would otherwise be categorised U, B, or C, but have significant identifiable conservation, heritage or landscape value even though only for the short term, they may be upgraded, although they might be suitable for retention only.*

APPENDIX C

BS5837 TREE SURVEY SCHEDULE

Prepared For: Cork County Council
Assessment & Report Prepared By: Heritage Tree Care Ltd.
Site: Little Island Railway Station to Eastgate Business Park

Heritage Reference No. VTA220083
Date: 31.03.23

Site A

Tree Tag No.	Group No.	Species	Height (m)	DBH (mm)	No. Stems	Canopy Spread (N, S, E, W)	Lower Branch Height (m)	Age	Physiological Condition	Structural Condition	ULE (Year)	Retention Category	Tree Quality	RPA Radial Distance (m)	RPA Area (m3)	Work Recommendations
408		Silver birch	3.47	170	1	2, 2, 2, 2	1.5	Semi-mature	Excellent	Good	>40	A	🟩	2.04	13.1	Remove to facilitate proposed development
409		Silver birch	3.65	175	1	3, 2, 4, 2	1.6	Semi-mature	Excellent	Good	>40	A	🟩	2.10	13.8	Remove to facilitate proposed development
410		Chinese elm	5.99	320	1	3, 3, 3, 3	2	Mature	Fair	Fair	>25	B	🟦	3.84	45.3	Remove to facilitate proposed development
411		Silver birch	7.62	300	1	2, 4, 2, 2	3.6	Mature	Excellent	Fair	>40	A	🟩	3.6	40.7	Remove to facilitate proposed development
412		Norway maple	5.12	410	2	4, 4, 4, 4	2	Mature	Good	Fair	>25	B	🟦	4.9	75.4	Remove to facilitate proposed development
413	**G1**	Alder (x4)	10.66	~300	1-2	2, 2, 2, 2	2	Mature	Fair	Fair	>25	B	🟦	3.6	40.7	Intersecting power line. Monitor growth. Clear brambles, sever ivy
414	**G2**	Grey willow (x40)	7.62	~150	1-2	2, 2, 2, 2	2	Young	Fair	Fair	>25	B	🟦	1.8	10.2	No work required
415		Ash	5.37	250	3	4, 4, 4, 4	1.7	Semi-mature	Good	Fair	>25	B	🟦	3.0	28.2	Included bark. Recommended bi-annual monitoring. Mulch around base.
416		Horse chestnut	6.11	310	4	3, 3, 3, 3	1.8	Mature	Good	Poor	<25	C	⬜	3.7	43.0	Bifurcated 0.3m from ground level. Remove 2 stems. Mulch around base.
417		Norway maple	6.39	480	3	4, 4, 4, 4	2	Mature	Good	Fair	>40	A	🟩	5.7	102.1	Included bark. Recommended bi-annual monitoring. Mulch around base.
418		Hornbeam	7.62	180	1	3, 1, 1, 3	0.5	Mature	Good	Fair	>40	B	🟦	2.1	13.8	Remove Willow branches growing into canopy. Mulch around base.
419	**G3**	Grey willow (x5)	8.13	~180	Multi stem 2-4	4, 1, 3, 3	1	Mature	Fair	Fair	>25	B	🟦	2.1	13.8	No work required
420		Alder	5.84	190	2	2, 2, 2, 2	3.1	Semi-mature	Excellent	Fair	>40	A	🟩	2.3	16.6	Bifurcated 0.2m from ground level. Clear epicormic growth. Mulch around base. Recommended bi-annual monitoring.
421	**G4**	Alder (x16)	10.46	~200	1	3, 1, 1, 1	2.9	Semi-mature	Good	Good	>40	A	🟩	2.4	18.1	*Not tagged due to restricted access. Good screening/drainage/ habitat amenity.* No work required
422	**G5**	Grey willow (x26)	5.23	180	1	3, 1, 1, 1	1.1	Mature	Fair	Fair	>25	B	🟦	2.1	13.8	Poor access. Good screening/drainage amenity. No work required
423	**G6**	Alder (x12)	10.89	~200	1	2.5, 2, 2, 2	3.2	Semi-mature	Good	Good	>40	B	🟦	2.4	18.1	Not tagged due to restricted access. Good screening/drainage/ habitat amenity. No work required
424	**G7**	Grey willow (x15)	8.61	~200	Multi stem 2-3	2, 2, 2, 2	1	Mature	Fair	Fair	>25	B	🟦	2.4	18.1	Not tagged due to restricted access. Good screening/drainage/ habitat amenity. No work required
425	**G8**	Alder (x4)	11.1	~300	3	2.5, 2.5, 2.5, 2.5	3	Mature	Good	Good	>40	A	🟩	3.6	40.7	Not tagged due to restricted access. Good screening/drainage/ habitat amenity. No work required
426	**G9**	Grey willow (x6)	6.24	~160	Multi stem 2-3	2, 2, 2, 2	1	Mature	Fair	Fair	>25	B	🟦	1.9	11.3	Not tagged due to restricted access. Pruned heavily around power line. Epicormic growth. Good screening/ drainage/ habitat amenity. No work required
427	**G10**	Alder (x45)	12.19	~200	1	2.5, 2.5, 2.5, 2.5	2	Semi-mature	Good	Good	>40	A	🟩	2.4	18.1	*Remove East section of G10 that crosses boundary line for proposed development.* Rest of group to be retained. *Not tagged due to restricted access.* No work required.
428		Grey willow	6.12	210	1	3, 1, 1, 1	2	Mature	Fair	Poor	>25	C	⬜	2.5	19.3	Uncorrected lean over fence line. No work required
429	**G11**	Grey willow (x4)	10.66	250	Multi stem 2-5	3.5, 3, 3, 3.5	0.8	Mature	Fair	Fair	<25	C	⬜	3.0	28.3	Remove to facilitate proposed development
430		English Oak	3.65	100	1	1.5, 1, 1, 1	0.7	Juvenile	Good	Good	>40	A	🟩	1.2	4.5	Remove to facilitate proposed development
431		Hawthorn	3.8	120	2	1, 1, 1, 1	1	Juvenile	Fair	Fair	>25	B	🟦	1.4	6.2	Remove to facilitate proposed development
432		English Oak	3.15	100	1	1, 1, 1, 1	0.6	Juvenile	Good	Good	>40	A	🟩	1.2	4.5	Remove supporting stake.
433	**G12**	Grey willow (x4)	6.15	280	1	3, 3, 3, 3	1	Mature	Poor	Poor	<25	C	⬜	3.3	34.2	Remove to facilitate proposed development
434	**G13**	Alder (x6)	6.87	~200	1	2, 2, 2, 2	2	Semi-mature	Good	Good	>25	B	🟦	2.4	18.1	*Not tagged due to restricted access.* No work required
435		Grey willow	9.14	~350	4	2, 2, 2, 2	1	Mature	Fair	Fair	>25	B	🟦	4.2	55.4	*Not tagged due to restricted access.* Epicormic shoots at base. No work required
436	**G14**	Grey willow (x4)	7.62	320	1	3, 3, 3, 3	2	Mature	Poor	Hazardous	<10	U	🟥	3.8	45.4	Remove due to hazardous condition.

Tree Tag No.	Group No.	Species	Height (m)	DBH (mm)	No. Stems	Canopy Spread (N, S, E, W)	Lower Branch Height (m)	Age	Physiological Condition	Structural Condition	ULE (Year)	Retention Category	Tree Quality	RPA Radial Distance (m)	RPA Area (m3)	Work Recommendations
437	**G15**	Alder (x25)	9.18	~250	1	2, 2, 2, 2	3	Mature	Good	Good	>40	A	🟩	3.0	28.3	Not tagged due to restricted access Good screening/drainage/ habitat amenity. No work required.
438	**G16**	Grey willow (x33)	9.28	~250	Multi-stem 3-6	2, 2, 2, 2	1	Mature	Good	Good	>40	A	🟩	3.0	28.3	Willow woodland, Good screening/ drainage/ habitat amenity. Re-assess in drier conditions.
439	**G17**	Alder (x46)	7.73	~180	1	1.5, 1.5, 1.5, 1.5	2.7	Semi-mature	Good	Good	>40	A	🟩	2.1	13.8	Remove ~1/3 of the trees (~15) (on North end) to facilitate development. All other trees to be retained. Good screening/drainage/ habitat amenity.
440	**G18**	Ash (x95)	6.78	~240	1	1, 1, 1, 1	3	Semi-mature	Good	Good	>40	A	🟩	2.8	24.6	Remove ~1/3 of the northern-most trees in group, to facilitate 3m boundary of proposed footway. All other trees in group to be retained. Good screening/drainage/ habitat amenity. Preserve as many trees as possible of group. Remove ~1/3 of the trees (on North end) to facilitate development (~30).
441	**G19**	Grey willow (x6)	4.57	180	Multi-stem 2-4	2, 2, 2, 2	1	Mature	Fair	Fair	>25	B	🟦	2.1	13.8	Remove ~1/2 of the northern-most trees in group, to facilitate 3m boundary of proposed footway. All other trees in group to be retained.
442		English oak	2.56	300	1	1, 1, 1, 1	0.5	Semi-mature	Poor	Fair	<25	C	⬜	3.6	40.7	Remove to facilitate proposed development
443	**G20**	Grey willow (x19)	7.52	180	Multi-stem 2-5	1.5, 1.5, 1.5, 1.5	1	Semi-mature	Fair	Fair	>25	B	🟦	2.1	13.8	Good screening/drainage/ habitat amenity. No work required
444	**G21**	Alder (x46)	9.32	270	1	2, 2, 2, 2	1	Mature	Good	Godd	>40	A	🟩	3.2	32.1	Remove northern ~1/3 of the trees in group to facilitate 3m boundary of proposed footway. All other trees in group to be retained. Good screening/drainage/ habitat amenity.
445	**G22**	Hazel (x4)	7.42	200	Multi-stem 2-5	2, 2, 2, 2	1	Mature	Fair	Fair	>25	B	🟦	2.4	18.1	Remove to facilitate proposed development
446	**G23**	Hawthorn (x7)	6.54	200	Multi-stem 2-5	2, 2, 2, 2	1	Semi-mature	Fair	Fair	>25	B	🟦	2.4	18.1	Remove to facilitate proposed development
447	**G24**	Hawthorn (x6)	7.12	200	Multi-stem 3-6	4, 4, 4, 4	1	Semi-mature	Fair	Fair	>25	B	🟦	2.4	18.1	Remove to facilitate proposed development
448	**G25**	Hazel (x4)	5.89	100	Multi-stem 6-8	2, 2, 2, 2	0.3	Young	Good	Good	>40	B	🟦	1.2	4.5	Remove to facilitate proposed development. Remove untagged Buddleia neighbouring G25
449	**G26**	Hazel (x6)	6.76	140	Multi-stem 6-8	2, 2, 2, 2	0.4	Semi-mature	Good	Good	>25	B	🟦	1.6	8.1	Remove to facilitate proposed development
450		Alder	6.01	130	1	1, 1, 1, 1	0.3	Young	Good	Good	>25	B	🟦	1.5	7.1	Remove to facilitate proposed development
451		Scots pine	7.54	210	1	1.5, 1.5, 1.5, 1.5	4.5	Mature	Fair	Fair	>25	B	🟦	2.5	19.6	Remove to facilitate proposed development
452		Chilean myrtle	6.91	280	1	3, 3, 3, 3	1.8	Mature	Good	Fair	>40	A	🟩	3.4	36.3	Remove to facilitate proposed development
453	**G27**	Hawthorn (x6)	3.99	90	Multi-stem 4-7	2, 2, 2, 2	1	Young	Fair	Fair	>25	B	🟦	1.1	3.8	Remove to facilitate proposed development
454		Field maple	6.55	210	3	2, 2, 2, 2	0.5	Mature	Good	Good	>40	A	🟩	2.5	19.6	No work required.
Site B																
455		Ash	24.11	340	1	0	3.65	Mature	Poor	Hazardous	<10	U	🟥	4.1	52.8	Lifted root plate, leaning into other trees at 45° angle. Remove to ground level.
456		Sycamore	24.82	340	1	0	N/A	Mature	Poor	Hazardous	<10	U	🟥	4.1	52.8	Lifted root plate, leaning into other trees at 70° angle. Remove to ground level.
457		Sitka spruce	27.43	220	1	0	N/A	Semi-mature	Poor	Hazardous	<10	U	🟥	2.6	21.2	Lifted root plate, leaning into other trees at 50° angle. Remove to ground level.
458		Sitka spruce	27.24	170	1	0	N/A	Semi-mature	Dead	Hazardous	0	U	🟥	2.1	13.8	Lifted root plate, leaning into other trees at 10° angle. Remove to ground level.
459		Sitka spruce	30.48	410	1	1, 1, 1, 1	1.2	Mature	Fair	Fair	>25	B	🟦	4.9	75.4	Visible surface roots on N side. Reassess when neighbouring trees have been removed.
460		Sitka spruce	21.36	260	1	0	0.7	Mature	Dead	Hazardous	0	U	🟥	3.1	30.1	Dead. Remove to ground level.
461		Grey poplar	31.87	570	1	5, 5, 5, 5	4.57	Mature	Fair	Fair	>25	B	🟦	6.8	145.2	Uncorrected lean, compressive loading on E side above root collar. Weight reduce canopy by 15%. Deadwood removal. Recommended bi-annual monitoring.

Tree Tag No.	Group No.	Species	Height (m)	DBH (mm)	No. Stems	Canopy Spread (N, S, E, W)	Lower Branch Height (m)	Age	Physiological Condition	Structural Condition	ULE (Year)	Retention Category	Tree Quality	RPA Radial Distance (m)	RPA Area (m3)	Work Recommendations
462		Sitka spruce	14.12	200	1	1, 1, 1, 1	0.3	Semi-mature	Fair	Fair	>25	B	🟦	2.4	18.1	Remove to facilitate proposed development
463		Alder	12.19	240	2	0	3.89	Semi-mature	Poor	Hazardous	<10	U	🟥	2.8	24.6	50% die-back. Remove to ground level. Close proximity to road.
464		Spruce	9.23	300	1	1, 1, 1, 1	7.6	Semi-mature	Fair	Fair	<25	C	⬜	3.6	40.7	Remove to facilitate proposed development
465		Sitka spruce	9.61	300	1	1, 1, 1, 1	6.4	Semi-mature	Fair	Fair	<25	C	⬜	3.6	40.7	No work required
466		European Yew	30.48	160	1	1, 1, 1, 1	3.4	Juvenile	Dead	Hazardous	0	U	🟥	1.9	11.3	Dead. Remove to ground level.
467		Sitka spruce	30.89	330	1	1, 1, 1, 1	1.8	Mature	Fair	Fair	>25	B	🟦	3.9	47.8	Leaning 5° angle Eastwards. No work required
468		Sitka spruce	24.36	190	1	1, 1, 1, 1	2.7	Semi-Mature	Fair	Fair	>25	B	🟦	2.3	16.6	No work required.
469		Sitka spruce	31.18	400	1	2, 2, 2, 2	1.6	Mature	Fair	Fair	>25	B	🟦	4.8	72.4	Remove to facilitate proposed development
470		Sitka spruce	29.37	330	1	2, 2, 2, 2	2.7	Mature	Fair	Fair	>25	B	🟦	3.9	47.8	Remove to facilitate proposed development
471		Sitka spruce	12.23	240	1	0	1.9	Mature	Dead	hazardous	0	U	🟥	2.8	24.6	Remove to facilitate proposed development
472		Grey poplar	31.27	550	1	5, 5, 5, 5	3.2	Mature	Good	Fair	>40	B	🟦	6.6	136.8	Remove to facilitate proposed development
473	**G28**	Hawthorn (x11)	4.57	140	Multi-stem 2-3	1, 1, 1, 1	1	Juvenile	Fair	Fair	<25	C	⬜	1.7	9.1	Remove to facilitate proposed development
474		Goat Willow	4.65	250	1	0	N/A	Semi-Mature	Dead	Hazardous	0	U	🟥	3.0	28.3	Remove to facilitate proposed development
475		Alder	5.62	160	2	0	N/A	Juvenile	Dead	Hazardous	0	U	🟥	1.9	11.3	Remove to facilitate proposed development
476		Alder	10.66	160	1	1, 0, 0, 0	N/A	Juvenile	Fair	Fair	>25	B	🟦	1.9	11.3	Remove to facilitate proposed development
477		Sitka spruce	12.54	300	1	1, 1, 1, 1	3.4	Mature	Poor	Poor	<10	U	🟥	3.6	40.7	Remove to facilitate proposed development
478		Sitka spruce	9.24	150	1	0	N.A	Semi-Mature	Dead	Hazardous	0	U	🟥	1.8	10.2	Remove to facilitate proposed development
479		Sitka spruce	10.2	154	1	0	N.A	Semi-Mature	Dead	Hazardous	0	U	🟥	1.8	10.2	Remove to facilitate proposed development
480		Sitka spruce	30.76	300	1	1, 1, 1, 1	N.A	Mature	Fair	Fair	>25	B	🟦	3.6	40.8	Remove to facilitate proposed development
481		Sitka spruce	31.54	400	1	1, 1, 1, 1	N.A	Mature	Fair	Good	>25	B	🟦	4.8	72.4	Remove to facilitate proposed development
482		Sitka spruce	29.78	230	1	1, 1, 1, 1	N.A	Semi-Mature	Fair	Good	>25	B	🟦	2.7	22.9	Remove to facilitate proposed development
483		Sitka spruce	31.41	320	1	1, 1, 1, 1	N.A	Mature	Good	Good	>25	B	🟦	3.8	45.4	Remove to facilitate proposed development
484		Goat willow	6.09	320	1	1, 1, 0, 1	1.3	Mature	Poor	Hazardous	<10	U	🟥	3.8	45.4	Remove to facilitate proposed development
485		Sitka spruce	6.34	140	1	0	1.9	Juvenile	Dead	Hazardous	0	U	🟥	1.6	8.0	Remove to facilitate proposed development
486		Grey poplar	30.89	460	2	4, 4, 4, 4	7.62	Mature	Fair	Poor	<25	C	⬜	5.5	95.0	Remove to facilitate proposed development
487		Sitka spruce	30.46	300	1	1, 2, 1, 1	2.6	Mature	Fair	Fair	<25	C	⬜	3.6	40.8	Remove to facilitate proposed development
488		Alder	31.24	600	1	4, 4, 4, 4	5.6	Mature	Fair	Poor	<25	B	🟦	7.2	162.8	Remove to facilitate proposed development
489		Alder	31.26	400	1	4, 4, 4, 4	7.6	Mature	Fair	Poor	<25	C	⬜	4.8	72.3	Remove to facilitate proposed development
490		Sitka spruce	14.38	260	1	1, 1, 2, 1	1.5	Mature	Fair	Fair	>25	B	🟦	3.1	30.0	Remove to facilitate proposed development
491		Ash	3.89	210	1	0	N/A	Semi-Mature	Dead	Hazardous	0	U	🟥	2.5	19.6	Remove to facilitate proposed development
492		Alder	19.3	190	1	1, 1, 1, 1	N/A	Juvenile	Poor	Poor	<25	C	⬜	2.2	15.2	Remove to facilitate proposed development
493		Alder	27.78	320	1	2, 2, 2, 2	N/A	Mature	Fair	Poor	<25	C	⬜	3.8	45.3	Remove to facilitate proposed development
494		Sitka spruce	5.89	140	1	1, 1, 1, 1	N/A	Juvenile	Fair	Fair	>25	B	🟦	1.6	8.0	Remove to facilitate proposed development
495		Sitka spruce	6.37	120	1	1, 1, 1, 1	N/A	Juvenile	Fair	Fair	>25	B	🟦	1.4	6.1	Remove to facilitate proposed development
496		Grey poplar	30.78	500	1	3, 3, 3, 3	3.5	Mature	Fair	Fair	>25	B	🟦	6.0	113.1	Remove to facilitate proposed development
497	**G29**	Sitka spruce (x2)	10.66	~150	1	2, 2, 2, 2	~2	Juvenile	Fair	Fair	>25	B	🟦	1.8	10.1	Remove to facilitate proposed development
498		Sitka spruce	6.79	130	1	0.5, 0.5, 0.5, 0.5	0.3	Juvenile	Fair	Poor	<25	C	⬜	1.5	7.0	Remove to facilitate proposed development
499		Goat willow	15.67	360	1	3, 3, 3, 3	3.6	Mature	Poor	Poor	<25	C	⬜	4.3	58.0	Remove to facilitate proposed development
500		Goat willow	4.99	280	1	0	N/A	Mature	Poor	Poor	<10	U	🟥	3.4	36.3	Remove to facilitate proposed development
501		Goat willow	9.14	300	1	0	7.6	Mature	Poor	Poor	<25	C	⬜	3.6	40.7	Remove to facilitate proposed development

Tree Tag No.	Group No.	Species	Height (m)	DBH (mm)	No. Stems	Canopy Spread (N, S, E, W)	Lower Branch Height (m)	Age	Physiological Condition	Structural Condition	ULE (Year)	Retention Category	Tree Quality	RPA Radial Distance (m)	RPA Area (m3)	Work Recommendations
502		Goat willow	10.34	400	1	3, 3, 3, 3	5.8	Mature	Fair	Poor	<25	C	▨	4.8	72.3	Remove to facilitate proposed development
503		Alder	10.88	280	1	3, 2, 2, 3	6.54	Mature	Fair	Poor	<25	C	▨	3.4	36.3	Remove to facilitate proposed development
504		Sitka spruce	6.10	130	1	1, 1, 1, 1	4.6	Juvenile	Fair	Fair	>25	C	▨	1.5	7.0	Remove to facilitate proposed development
505		Alder	30.67	330	2	2, 3, 2, 3	18.2	Mature	Fair	Fair	<25	C	▨	3.9	47.7	Remove to facilitate proposed development
506		Alder	30.23	360	1	2, 2, 2, 2	18.4	Mature	Fair	Fair	<25	C	▨	4.3	58.0	Remove to facilitate proposed development
507		Alder	30.44	300	1	3, 2, 3, 2	22.5	Mature	Fair	Fair	<25	C	▨	3.6	40.7	Remove to facilitate proposed development
508		Alder	30.26	320	1	3, 3, 3, 3	22.5	Mature	Fair	Fair	<25	C	▨	3.8	45.3	Remove to facilitate proposed development
509		Alder	30.56	330	2	2, 2, 2, 2	25.6	Mature	Fair	Fair	<25	C	▨	3.9	47.7	Remove to facilitate proposed development
510		Alder	30.41	370	1	3, 3, 3, 3	22.6	Mature	Fair	Fair	<25	C	▨	4.4	60.8	Remove to facilitate proposed development
511		Alder	30.25	360	1	4, 4, 4, 4	23.1	Mature	Fair	Fair	<25	C	▨	4.3	58.0	Remove to facilitate proposed development
512		Alder	30.76	360	2	1, 1, 1, 1	24.3	Mature	Fair	Poor	<25	C	▨	4.3	58.0	Remove to facilitate proposed development
513		Ash	18.19	250	1	0	N/A	Mature	Poor	Poor	0	U	🟥	3.0	28.2	Remove to facilitate proposed development
514		Sycamore	18.24	240	1	2, 1, 2, 1	4.5	Mature	Good	Fair	>25	B	🟦	2.8	24.6	Remove to facilitate proposed development
515		Sycamore	22.45	340	1	2, 2, 2, 2	3.6	Mature	Fair	Fair	<25	C	▨	4.1	52.8	Remove to facilitate proposed development
516		Sycamore	22.31	300	1	2, 2, 2, 2	4.3	Mature	Fair	Fair	<25	C	▨	3.6	40.7	Remove to facilitate proposed development
517		Sycamore	21.75	280	1	2, 2, 2, 2	3.2	Mature	Fair	Fair	<25	C	▨	3.4	36.3	Remove to facilitate proposed development
518		Sycamore	17.37	130	1	2, 2, 2, 2	N/A	Semi-mature	Poor	Poor	<10	U	🟥	1.5	7.1	Remove to facilitate proposed development
519		European Beech	15.54	260	1	1, 1, 1, 1	9.1	Semi-mature	Poor	Poor	<10	U	🟥	3.1	30.1	Remove to facilitate proposed development
520		Sycamore	15.24	310	1	2, 1, 3, 2	3.6	Mature	Fair	Fair	>25	C	▨	3.7	43.0	Remove to facilitate proposed development
521		Ash	30.48	350	2	3, 3, 3, 3	19.8	Mature	Fair	Poor	<25	C	▨	4.2	55.4	Remove to facilitate proposed development
522		Ash	30.12	500	1	5, 4, 4, 4	20.5	Mature	Good	Fair	>25	B	🟦	6.0	113.1	Remove to facilitate proposed development
523		European Beech	30.54	630	1	7, 7, 7, 7	0.3	Mature	Good	Good	>40	A	🟩	7.5	176.7	Remove to facilitate proposed development
524		European Beech	27.43	460	1	2, 2, 2, 2	3.49	Mature	Poor	Hazardous	<10	U	🟥	5.5	95.0	Remove to facilitate proposed development
525		Horse Chestnut	24.36	530	1	6, 6, 4, 4	4.5	Mature	Fair	Fair	>25	B	🟦	6.3	124.7	Remove to facilitate proposed development
526		Wych elm	30.79	390	1	5, 5, 5, 5	6.7	Mature	Dead	Hazardous	0	U	🟥	4.6	66.5	Remove to facilitate proposed development
527	**G30**	Beech Hedging (x43)	4.35	~150	1	1, 1, 1, 1	0.3	Juvenile	Good	Good	>40	A	🟩	1.8	10.1	Trim to maintain/ No work required.
528	**G31**	Sycamore (x6)	4.71	~180	1	1.5, 1.5, 1.5, 1.5	1	Semi-mature	Fair	Fair	<25	C	▨	2.1	13.8	Remove to facilitate proposed development
529		Common lime	4.59	160	1	2, 2, 2, 2	1.5	Semi-mature	Good	Good	>40	A	🟩	1.9	11.3	No work required.
530		Common lime	4.62	170	1	2, 2, 2, 2	1.8	Semi-mature	Good	Good	>40	A	🟩	2.0	12.5	No work required.
531		Common lime	4.59	170	1	2, 2, 2, 2	1.4	Semi-mature	Good	Good	>40	A	🟩	2.0	12.5	No work required.
532		Common lime	4.65	172	1	2, 2, 2, 2	1.2	Semi-mature	Good	Good	>40	A	🟩	2.1	13.2	No work required.
533		Common lime	4.64	171	1	2, 2, 2, 2	1.2	Semi-mature	Good	Good	>40	A	🟩	2.1	13.8	No work required.
534		Common lime	4.71	200	1	2, 2, 2, 2	1.7	Semi-mature	Good	Good	>40	A	🟩	2.4	18.1	Remove vine.
535	**G32**	Beech Hedging (x37)	4.13	100	1	1, 1, 1, 1	0.3	Young	Good	Good	>40	A	🟩	1.2	4.5	Good screening amenity, visual boundary between carparks. Trim to maintain.
536		English oak	6.09	180	1	2, 2, 2, 2	1.9	Juvenile	Good	Good	>40	A	🟩	2.2	15.2	Crown lift by 2.5m for passing cars/ persons in carpark
537		European beech	6.19	200	1	1.5, 1.5, 1.5, 1.5	1.2	Semi-mature	Good	Good	>40	A	🟩	2.4	18.1	Cut back from streetlight, crown lift by 2.5m
538		Norway maple	7.63	400	2	5, 5, 5, 5	3.1	Mature	Good	Fair	>25	B	🟦	4.8	72.3	Co-dominant at 0.4m from ground level, included bark, dense canopy. Cut back from streetlight, thin-reduce by 15%,
539		Sycamore	12.43	290	4	5, 1, 0, 5	3.2	Mature	Poor	Poor	<25	C	▨	3.5	38.5	Remove to facilitate proposed development
540		Common lime	27.43	620	2	5, 2.5, 2, 2	3.1	Mature	Good	Fair	>25	A	🟩	7.4	172.0	Remove to facilitate proposed development
541		European Beech	27.81	490	1	3, 1, 3, 3	6.1	Mature	Good	Fair	>40	A	🟩	5.8	105.7	Bifurcated at 6m from ground level. No work required.

Tree Tag No.	Group No.	Species	Height (m)	DBH (mm)	No. Stems	Canopy Spread (N, S, E, W)	Lower Branch Height (m)	Age	Physiological Condition	Structural Condition	ULE (Year)	Retention Category	Tree Quality	RPA Radial Distance (m)	RPA Area (m3)	Work Recommendations
542		European Beech	19.12	200	1	1, 1, 3, 1	4	Semi-mature	Fair	Fair	>25	B	🟦	2.4	18.1	Missing bark on N limb, 4.5m from ground level. Remove N limb.
543		European Beech	18.78	230	1	1, 1, 1, 1	1.8	Semi-mature	Good	Good	>40	A	🟩	2.7	22.9	Compressive loading at base. Remove entangled Hawthorn branches, remove backfill of compost/ leaves to prevent basal rot.
544		Ash	27.41	400	1	4, 2.5, 4, 2.5	3.2	Mature	Poor	Poor	<25	C	⬜	4.8	72.4	Phototropic tension kink 10m from ground level. Sever ivy. Recommended bi-annual monitoring. Re-assess tree at bud break/ when in leaf.
545		European Beech	31.21	550	2	4, 4, 4, 2	1.7	Mature	Fair	Fair	>25	B	🟦	6.6	136.8	2 trees adjoined in a co-dominant manner from base. Included bark. Bulge at union on N side. Weight reduce canopy by 15%. Cobra-brace to support limbs. Recommended bi-annual monitoring.
546		Ash	30.76	600	1	5, 5, 5, 5	15.4	Mature	Good	Good	>40	A	🟩	7.2	162.8	Bifurcated 10m from ground level. Previously cut on S side. Cobra-brace main stems to ensure safety, remove deadwood, sever ivy.
547		Ash	27.72	360	1	0, 2, 4, 1	9.5	Mature	Fair	Fair	>25	B	🟦	4.3	58.1	Corrected lean, previously cut on S side. Remove entangled Hawthorn branches in canopy & wrapped around trunk. Sever ivy.
548		Hawthorn	17.2	160	1	1, 1, 1, 1	3.6	Semi-mature	Fair	Fair	<25	U	🟥	1.9	11.3	Remove, detrimental to neighbouring Ash.
549		European Beech	13.51	330	3	3, 3, 2, 3.5	1.5	Semi-mature	Good	Good	>40	A	🟩	3.9	47.8	Sever ivy
550		European Beech	16.71	280	1	1.5, 1.5, 1.5, 1.5	5.6	Semi-mature	Good	Good	>40	A	🟩	3.4	36.3	Remove to facilitate proposed development
551		European Beech	16.82	300	1	3, 1, 1, 3	6.2	Semi-mature	Fair	Poor	<25	C	⬜	3.6	40.7	Remove to facilitate proposed development
552		European Beech	30.48	700	1	6, 6, 6, 6	3.1	Mature	Excellent	Good	>40	A	🟩	8.4	221.6	Remove to facilitate proposed development
553		Sycamore	27.68	300	1	2, 3, 2, 5	6.2	Mature	Fair	Fair	>25	B	🟦	3.6	40.7	Remove to facilitate proposed development
554		Holly	4.57	190	1	2, 2, 2, 2	2.5	Mature	Fair	Fair	>25	B	🟦	2.3	16.6	Remove to facilitate proposed development
555		Hawthorn	4.68	170	1	1, 1, 1, 1	1.5	Semi-mature	Fair	Fair	<25	C	⬜	2.0	12.5	Remove to facilitate proposed development
556		Hawthorn	6.10	200	1	2, 1, 1, 1	3.1	Semi-mature	Fair	Fair	<25	C	⬜	2.4	15.1	Remove to facilitate proposed development
557		Sycamore	30.49	640	1	7, 3, 3, 3	4.5	Mature	Fair	Poor	>25	B	🟦	7.7	186.2	Good visual amenity. 15% die-back in crown, orange Coral Spot fungus on dead branches. Crown clean, remove all fungal infected branches, reduce canopy by 20%, remove epicormic growth, target prune over-extended limbs. Recommended bi-annual monitoring and reassessment at budbreak/ when tree is in leaf & fungal fruiting body has developed.
558		Common lime	7.62	160	1	0	0.6	Semi-mature	Poor	Hazardou s	<10	U	🟥	1.9	11.3	Leaning NW at 35° angle. Intruding on T557. Remove.
559		Common lime	30.89	380	2	3, 3, 3, 3	2.3	Mature	Good	Fair	>40	A	🟩	4.6	66.5	Remove 2nd stem from base to prevent damage to main stem
560		Common lime	18.76	340	2	0, 3, 2, 2	0.6	Mature	Excellent	Good	>40	A	🟩	4.1	52.8	Remove epicormic growth at base, sever ivy.
561		Common lime	18.42	600	2	6, 4, 2, 3	4.5	Mature	Fair	Poor	>10	C	⬜	7.2	162.8	Good visual amenity. Unhealed occlusion 25m from ground level. Heartwood decay. Remove epicormic growth, sever ivy, remove broken hanger, weight reduce canopy by 15%. Recommended bi-annual monitoring.
562		Ash	6.51	500	1	0	N/A	Mature	Dead	Good	0	B	🟦	6.0	113.1	Preserve dead-but-stable post as eco-pole for wildlife habitat.
563		Hawthorn	5.19	120	1	1, 0, 0, 0	2.1	Juvenile	Fair	Fair	>25	C	⬜	1.4	6.1	Leaning NE at 30° angle. No work required.
564		Sycamore	18.32	170	1	0, 1, 0, 0	3.5	Juvenile	Fair	Poor	>10	C	⬜	2.0	12.6	S facing phototropic kink on main stem with accute tension angle. Remove lowest S facing limb.
565		Hawthorn	6.72	120	1	1, 1, 1, 1	3.7	Juvenile	Poor	Poor	>10	C	⬜	1.4	6.1	No work required
566		Sycamore	13.47	180	1	1, 1, 1, 1	2.8	Semi-mature	Fair	Fair	>25	B	🟦	2.1	13.8	Grown from the same base as Sycamore T567. No work required.
567		Ash	31.45	380	1	3, 3, 3, 3	10.6	Mature	Excellent	Good	>40	A	🟩	4.6	66.4	No work required.
568		Sycamore	15.31	350	1	1, 3, 1, 1	0.9	Mature	Good	Good	>40	A	🟩	4.2	55.4	No work required.
569		Sycamore	27.43	280	2	2, 2, 2, 2	1.5	Mature	Good	Good	>40	A	🟩	3.4	36.3	No work required.
570		Sycamore	13.98	180	1	1, 1, 1, 1	6.5	Semi-mature	Good	Good	>40	A	🟩	2.1	13.8	Corrected S lean. No work required.
571		Sycamore	15.42	280	3	2, 2, 2, 2	5.4	Semi-mature	Good	Good	>40	A	🟩	3.4	36.3	No work required.

Tree Tag No.	Group No.	Species	Height (m)	DBH (mm)	No. Stems	Canopy Spread (N, S, E, W)	Lower Branch Height (m)	Age	Physiological Condition	Structural Condition	ULE (Year)	Retention Category	Tree Quality	RPA Radial Distance (m)	RPA Area (m3)	Work Recommendations
572		Sycamore	15.38	390	2	3, 3, 2, 2	3.7	Mature	Fair	Fair	>25	B	🟦	4.7	69.3	Sever ivy.
573		Hawthorn	9.23	270	1	1, 0, 1, 2	0.3	Mature	Fair	Fair	>25	B	🟦	3.2	32.1	Sever ivy.
574		Common lime	32.56	~600	4	4, 4, 4, 4	3.2	Mature	Fair	Good	>25	A	🟩	7.2	162.8	Good visual amenity. 5% die-back from tip. Limited access due to epicormic growth. Cobra-brace main stems, reduce crown by 15% & crown clean.
575		European Beech	26.45	500	2	2, 2, 2, 2	3.6	Mature	Good	Good	>40	A	🟩	6.0	113.1	Included bark 3.5m from ground level. Compacted soil from passing vehicles. Cobra-brace weak unions over road, weight reduce S side by 15%, mulch around base.
576		European Beech	26.43	600	2	2, 6, 2, 5	1.9	Mature	Good	Good	>40	A	🟩	7.2	162.8	Soil compaction, heavily pruned on N side. Crown clean, weight reduce S side of canopy by 10% mulch around base.
577		European Beech	9.61	-28	1	1, 3, 2, 1	1.5	Semi-mature	Good	Good	>40	A	🟩	3.4	36.3	No work required
578		Sycamore	30.71	1000	2	10, 5, 6, 5	1.8	Veteran	Fair	Fair	>25	A	🟩	12	452.3	17% die-back in crown (characteristic of veteran trees which have reached their maximum crown-size limit). Large kink & compressive loading on E stem. Weight reduce canopy by 20%, crown clean, sever ivy. Cobra-brace stems to support bifurcation and prevent branch-failure and irreversible damage. Highly recommend bi-annual monitoring.
579		Sycamore	24.56	270	7	7, 4, 4, 5	3.7	Mature	Good	Good	>40	A	🟩	3.2	32.2	Bundle-grouping, multi-stem x 7 extending from base. Sever ivy.
580		Sycamore	25.71	250	2	2, 2, 2, 2	2.3	Semi-mature	Fair	Fair	>25	B	🟦	3.0	28.3	No visible defects.
581		Sycamore	23.89	220	1	N/A	N/A	Semi-mature	Dead	Hazardous	0	U	🟥	2.6	21.2	Leaning onto T580 at 45° angle. Lifted at rootball. Remove to ground level.
582		Sycamore	13.78	250	2	3, 2, 2, 2	3.4	Semi-mature	Good	Fair	>40	B	🟦	3.0	28.2	Weight reduce N side of canopy by 15% to reduce interference with proposed development.
583		Sycamore	30.61	530	3	5, 1, 4, 1	4.5	Mature	Fair	Fair	>25	B	🟦	6.4	128.6	Included bark compression forks between all 3 stems. Weight reduce N side of canopy by 20% to take weight out of unions. Cobra-brace to support stems. Sever ivy.
584		Ash	30.56	300	1	2, 2, 2, 2	N/A	Mature	Poor	Poor	<10	U	🟥	3.6	40.7	Remove to facilitate proposed development
585		Sycamore	30.81	480	1	6, 2, 1, 4	6.2	Mature	Good	Good	>40	A	🟩	5.7	102.1	Weight reduce N side of canopy by 10%. Crown clean, sever ivy.
586		Hawthorn	7.62	190	1	1, 0, 0, 0	2.7	Semi-mature	Poor	Poor	<10	U	🟥	2.3	16.6	Remove to facilitate proposed development
587		Ash	30.54	650	2	4, 4, 4, 4	3.8	Mature	Poor	Poor	<10	U	🟥	7.8	191.1	Remove to facilitate proposed development
588		European Beech	9.41	180	1	2, 0, 0, 0	1.8	Juvenile	Good	Fair	>40	A	🟩	2.2	15.2	Large phototropic kink 6m from ground level, northwards towards proposed development. Weight reduce N side by 5%.
589		Ash	30.57	370	1	5, 5, 5, 5	19.6	Mature	Good	Good	>40	A	🟩	4.4	60.8	Crown clean, sever ivy
590		Sycamore	6.81	190	1	0	N/A	Semi-mature	Dead	Hazardous	0	U	🟥	3.0	28.3	Remove to ground level.
591		Sycamore	30.91	320	1	4, 2, 4, 1	12.4	Mature	Fair	Fair	>25	B	🟦	3.8	45.4	Northerly phototropic kink 3m from ground level. Tree is correcting itself. Sever ivy.
592		Sycamore	30.65	520	2	6, 3, 2, 2	5.5	Mature	Fair	Fair	>25	B	🟦	6.2	120.7	Bifurcation 5m from ground level. Weight reduce N side by 5%. Sever ivy. Cobra-brace the main stems to mitigate risk of compression fork. Recommended bi-annual monitoring.
593		European Beech	15.42	260	1	4, 0, 0, 0	N/A	Semi-mature	Fair	Fair	>25	B	🟦	3.1	30.1	Remove to facilitate proposed development
594		Sycamore	33.65	470	1	5, 0, 1, 1	9.2	Mature	Fair	Fair	>25	B	🟦	5.6	98.5	Weight reduce N side of canopy by 5%. Sever ivy, remove epicormic growth.
595		Sycamore	30.45	400	2	4, 3, 1, 1	12.1	Mature	Fair	Fair	>25	B	🟦	4.8	72.4	Bifurcates at 4m from ground level. Cobra-brace main stems to mitigate risk of compression fork. Sever ivy.
596		Sycamore	19.8	260	2	5, 0, 0, 0	3.6	Mature	Fair	Fair	>25	B	🟦	3.1	30.2	Remove to facilitate proposed development
597		Hawthorn	6.12	200	1	0	2.5	Semi-mature	Dead	Hazardous	0	U	🟥	2.4	18.1	Remove to facilitate proposed development
598		Hawthorn	4.57	150	1	1, 1, 0, 0	3.0	Juvenile	Fair	Fair	<25	C	⬜	1.8	10.2	Remove to facilitate proposed development
599		European Beech	30.71	600	1	6, 4, 2, 6	7.6	Mature	Excellent	Good	>40	A	🟩	7.2	162.8	Remove to facilitate proposed development
600		Sycamore	29.99	340	2	5, 3, 2, 5	5.4	Mature	Good	Fair	>25	B	🟦	4.0	50.2	Remove to facilitate proposed development

Tree Tag No.	Group No.	Species	Height (m)	DBH (mm)	No. Stems	Canopy Spread (N, S, E, W)	Lower Branch Height (m)	Age	Physiological Condition	Structural Condition	ULE (Year)	Retention Category	Tree Quality	RPA Radial Distance (m)	RPA Area (m3)	Work Recommendations
701		Sycamore	15.24	400	2	5, 1, 4, 2	2.3	Mature	Fair	Fair	>25	B	🟦	4.8	72.4	Remove to facilitate proposed development
702		Common lime	12.19	160	1	0	N/A	Juvenile	Dead	Hazardous	0	U	🟥	1.9	11.3	Remove to facilitate proposed development
703		Common lime	6.12	180	1	1, 2, 0, 0	2.9	Juvenile	Fair	Fair	>25	B	🟦	2.1	13.8	Remove to facilitate proposed development
704		Sycamore	12.21	300	3	3, 3, 3, 3	4.3	Mature	Fair	Fair	>25	B	🟦	3.6	40.7	Remove to facilitate proposed development
705		Chilean myrtle	12.19	180	3	2, 2, 2, 2	1	Semi-mature	Good	Good	>40	A	🟩	2.1	13.8	Remove to facilitate proposed development
706		Ash	4.57	200	1	0	N/A	Semi-mature	Dead	Fair	0	C	⬜	2.4	18.1	Remove to facilitate proposed development
707		Ash	6.01	200	2	1, 1, 1, 1	4.7	Semi-mature	Fair	Poor	>25	C	⬜	2.4	18.1	Previous heavy pruning for power line clearance. No work required.
708	**G33**	Sycamore (x4)	7.82	~140	1	2, 1, 1, 1	1.5	Juvenile	Fair	Poor	>25	C	⬜	1.7	9.1	Re-shooting at branch-tip. No work required.
709		Sycamore	7.91	160	1	2, 2, 2, 2	1.9	Juvenile	Good	Good	>40	A	🟩	1.9	11.3	No work required.
710	**G34**	Ash (x6)	12.81	300	1	3, 3, 3, 3	3.5	Mature	Fair	Fair	>25	B	🟦	3.6	40.7	Remove vines. Re-assess trees when vines have been removed. Recommended bi-annual monitoring.
711	**G35**	Wild cherry (x10)	9.24	360	1	2, 2, 2, 2	2	Mature	Poor	Fair	>10	C	⬜	4.3	58.1	Crown clean, sever ivy, remove vines. Re-assess trees when vines have been removed. Recommended bi-annual monitoring.
712		Wych elm	13.45	430	1	1, 1, 1, 1	N/A	Mature	Dead	Hazardous	0	U	🟥	5.2	84.9	Remove to ground level.
713		Alder	30.73	500	1	3, 3, 3, 3	1.5	Mature	Good	Good	>40	A	🟩	6.0	113.1	Remove to facilitate proposed development
714		Alder	30.65	714	1	4, 1, 1, 4	1.5	Mature	Good	Good	>40	A	🟩	8.5	226.9	Remove to facilitate proposed development
715		Alder	30.56	340	2	2, 2, 2, 2	4.5	Mature	Fair	Fair	>25	B	🟦	4.1	52.8	Remove to facilitate proposed development
716		Alder	31.21	400	1	3, 3, 3, 3	12.5	Mature	Fair	Fair	>25	B	🟦	4.8	72.4	Remove to facilitate proposed development
717		Alder	27.43	390	1	2, 2, 2, 2	24.3	Mature	Fair	Fair	>25	B	🟦	4.7	69.4	Remove to facilitate proposed development
718	**G36**	Alder (x14)	28.2	392	1	2, 2, 2, 2	22.1	Mature	Fair	Fair	>25	B	🟦	4.7	69.4	Remove to facilitate proposed development
719																
720																
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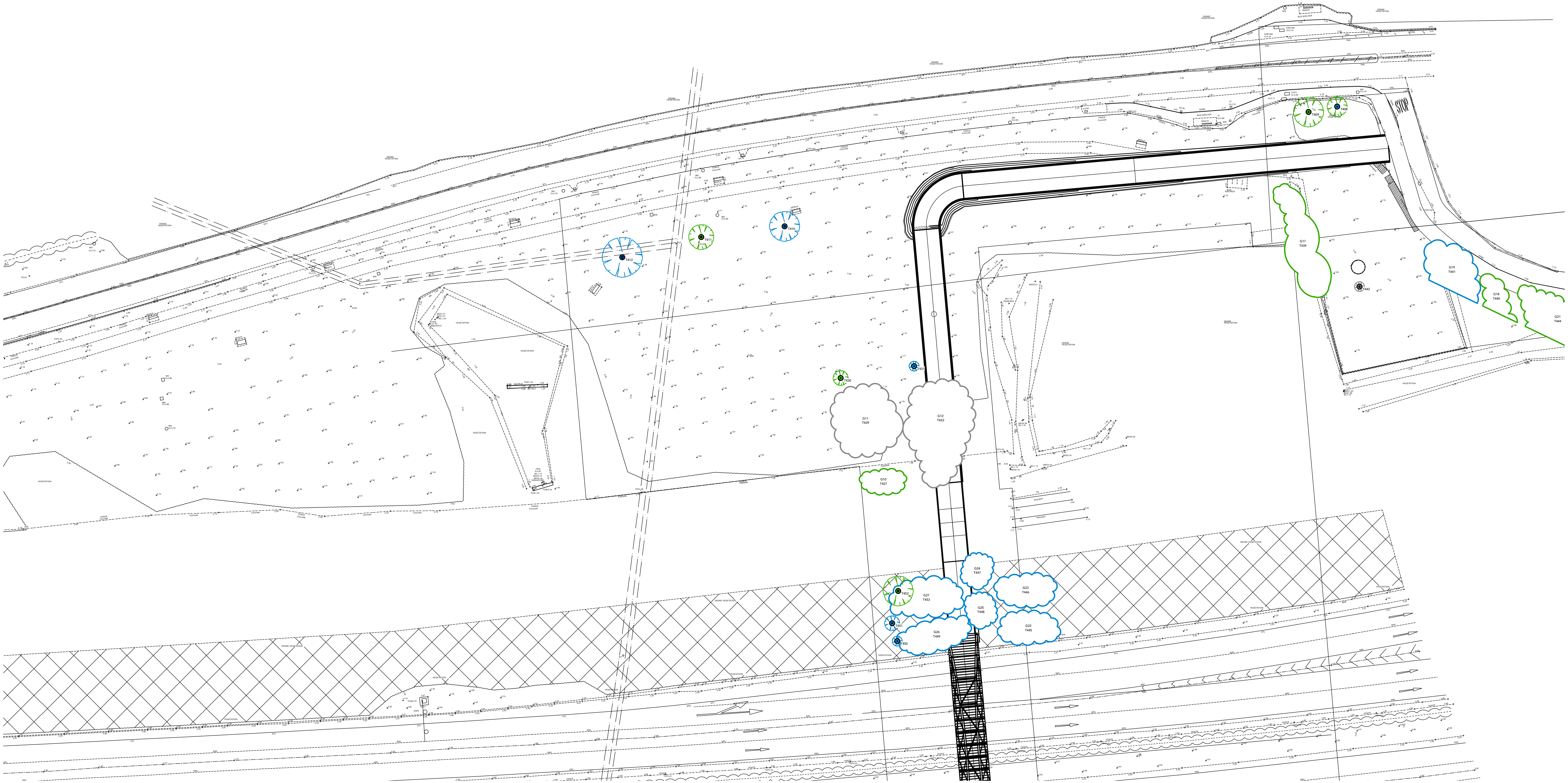
732		Goat willow	9.21	270	2	0	N/A	Mature	Dead	Hazardous	0	U	🟥	3.2	32.1	Remove to facilitate proposed development
733		Goat willow	12.19	275	1	1, 1, 1, 1	9.1	Mature	Poor	Hazardous	<10	U	🟥	3.3	34.2	Remove to facilitate proposed development
734		Goat willow	13.45	300	1	2, 2, 2, 2	0.9	Mature	Fair	Fair	>25	B	🟦	3.6	40.7	Remove to facilitate proposed development
735		Sitka spruce	12.23	170	1	1, 1, 1, 1	1.5	Semi-mature	Fair	Fair	>25	B	🟦	2.0	12.5	Remove to facilitate proposed development
736		Alder	12.56	190	3	1, 1, 1, 1	2.91	Semi-mature	Fair	Fair	>25	B	🟦	2.3	16.6	No work required.
737	**G37**	Hawthorn (x4)	6.09	120	Multi-stem 3-5	1, 1, 1, 1	0.5	Young	Fair	Fair	>25	B	🟦	1.4	6.2	No work required.
738		Goat willow	13.21	310	1	2, 2, 2, 2	6.1	Mature	Fair	Fair	>25	B	🟦	3.7	43.0	Remove to facilitate proposed development
739		Ash	12.78	240	2	1, 1, 1, 1	5.8	Semi-mature	Fair	Fair	>25	B	🟦	2.8	24.6	Remove to facilitate proposed development
740		Goat willow	4.57	280	1	0	N/A	Mature	Dead	Hazardous	0	U	🟥	3.7	43.0	Remove to facilitate proposed development

Tree Tag No.	Group No.	Species	Height (m)	DBH (mm)	No. Stems	Canopy Spread (N, S, E, W)	Lower Branch Height (m)	Age	Physiological Condition	Structural Condition	ULE (Year)	Retention Category	Tree Quality	RPA Radial Distance (m)	RPA Area (m3)	Work Recommendations
741	**G38**	Sitka Spruce (x3)	10.33	~220	1	1, 1, 1, 1	0.6	Semi-mature	Fair	Fair	>25	B	🟦	2.6	21.2	No work required. Each tree has been individually tagged due to their close proximity to the proposed development. This will aid future monitoring schedules.
742																
743																
744	**G39**	Sitka Spruce (x2)	10.12	210	1	1, 1, 1, 1	N/A	Semi-mature	Dead	Hazardous	0	U	🟥	2.5	19.6	Remove to facilitate proposed development
745																Remove to facilitate proposed development
746		Goat willow	6.31	240	1	0	N/A	Semi-mature	Poor	Hazardous	<10	U	🟥	2.8	24.6	Remove to facilitate proposed development
747		Ash	11.72	190	1	1, 1, 1, 1	9.5	Semi-mature	Fair	Fair	>25	B	🟦	2.3	16.6	No work required.
748		Alder	30.57	330	2	2, 2, 2, 2	10.3	Mature	Fair	Fair	>25	B	🟦	4.0	50.2	Remove to facilitate proposed development
749		Alder	29.46	270	1	2, 2, 2, 2	9.8	Mature	Fair	Fair	>25	B	🟦	3.2	32.1	Remove to facilitate proposed development
750		Alder	30.45	370	1	2, 2, 2, 2	19.7	Mature	Good	Poor	>25	B	🟦	4.4	60.8	Remove to facilitate proposed development
751		Alder	12.54	120	1	0	N/A	Young	Dead	Hazardous	0	U	🟥	1.4	6.1	Remove to facilitate proposed development
752	**G40**	Alder (x10)	11.8	~220	1	4, 4, 4, 4	1	Young	Good	Fair	>25	B	🟦	2.6	21.2	Not tagged due to restricted access. Remove to facilitate proposed development
753	**G41**	Grey Willow (x13)	9.7	~150	Multi-stem	3, 3, 3, 3	0.5	Young	Good	Fair	>25	B	🟦	1.8	10.2	Not tagged due to restricted access. Remove to facilitate proposed development

Table Key			**Terminology**	
🟩	Category A	High Retention Value	N	North
🟦	Category B	Moderate Retention Value	S	South
⬜	Category C	Low Retention Value	E	East
🟥	Category U	Very Low Retention Value	W	West
	Clearance Trees	Remove to facilitate proposed development		

SITE A

TREE CLEARANCE PLAN



BS5837:2012 - Tree Categories

Category A Tree
High quality and value
At least 40 years life-expectancy

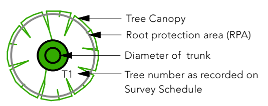
Category B Tree
Moderate quality and value
At least 20 years life-expectancy

Category C Tree
Moderate quality and value
At least 10 years life-expectancy

Category U Tree
Poor quality and value
Less than 10 years life-expectancy

Arboricultural Strategy

G1/H1	Trees/groups for removal
G1/H1	Tree group/hedge to be retained



I. The Tree Survey, Assessment and Plans were carried out by the Heritage Tree Care Ltd.
II. Tree locations are based on available aerial imagery, topographical surveys and on-site observations.
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Site	Client		
N25 Pedestrian & Cycle Bridge	Cork County Council		

Drawing Title	Status	Scale	Date
Tree Clearance Plan	Draft	1:750	02/01/2023

NORTH

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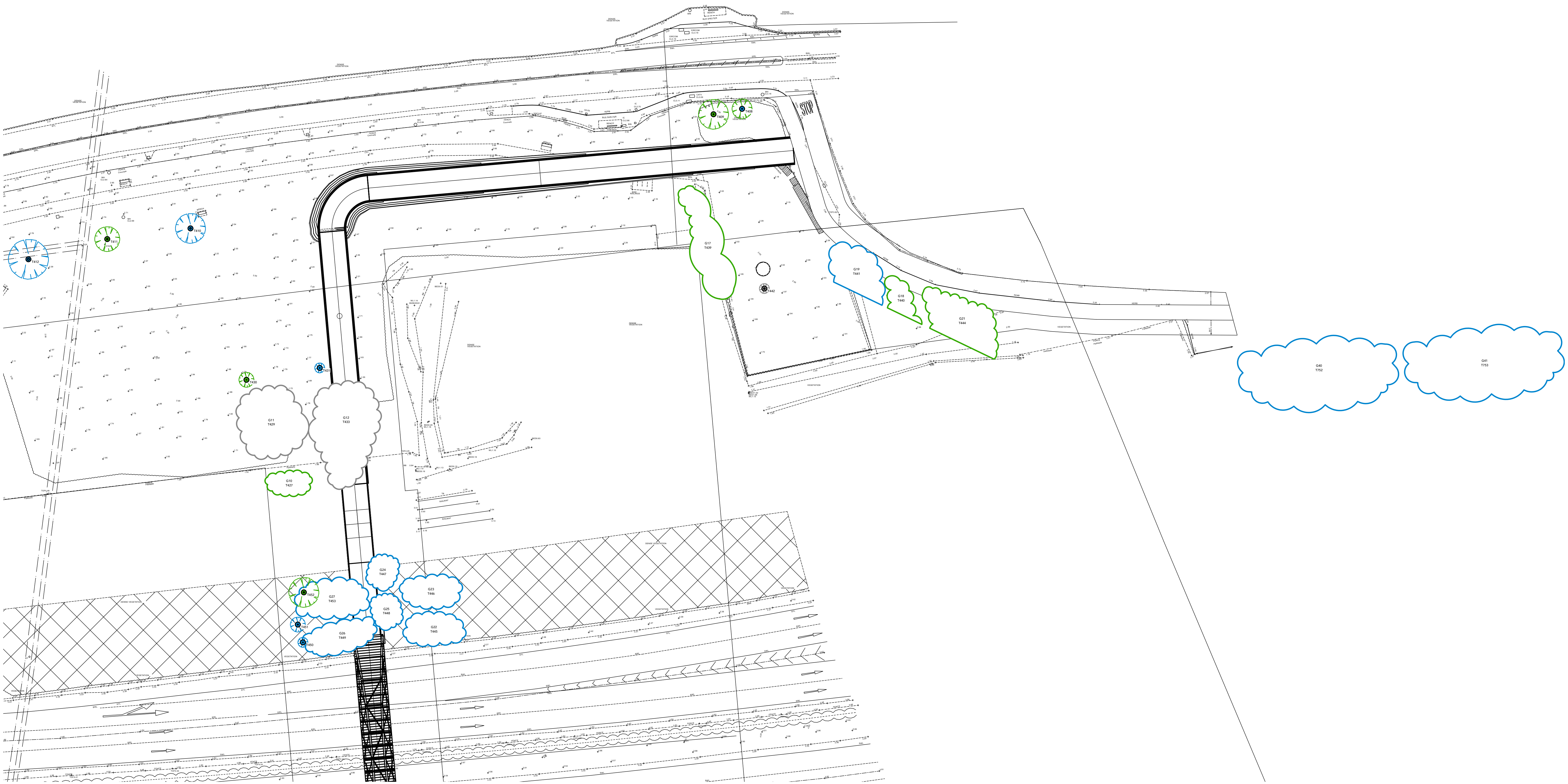
TREE CARE LTD.

SITE A

TREE CLEARANCE PLAN



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Moderate quality and value
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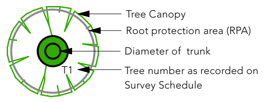
Poor quality and value
Less than 10 years life-expectancy

Arboricultural Strategy

G1/H1 Tree group/hedge



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Site
N25 Pedestrian & Cycle Bridge

Client
Cork County Council

Drawing Title
Tree Clearance Plan

Status
Final

Scale
1:750

Date
01/06/2023

NORTH

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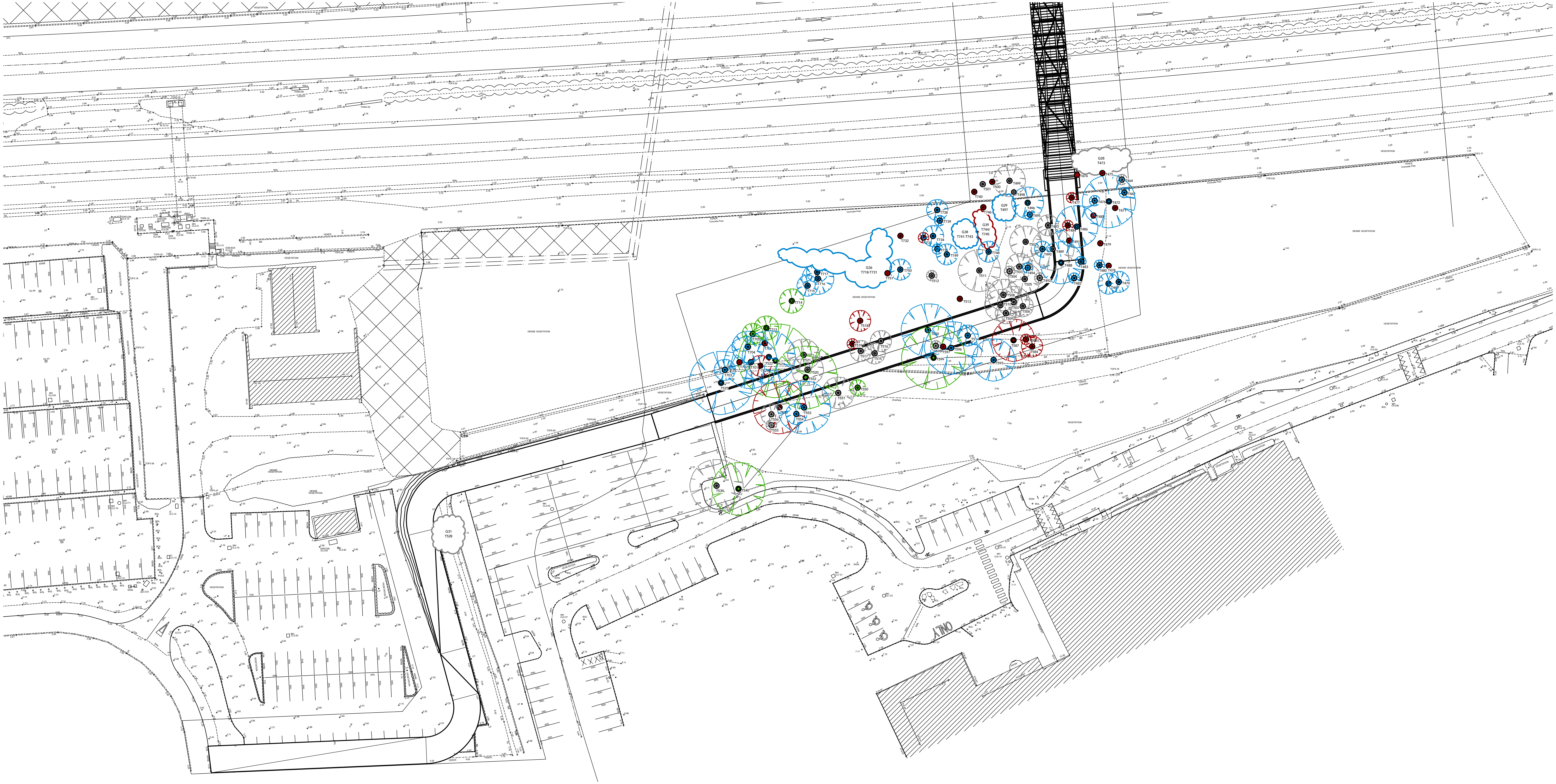
TREE CARE LTD.

SITE B

TREE CLEARANCE PLAN



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Category U Tree
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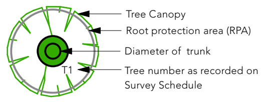
Less than 10 years life-expectancy

Arboricultural Strategy

G1/H1 Trees/groups for removal

G1/H1 Tree group/hedge to be retained



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Site
N25 Pedestrian & Cycle Bridge

Client
Cork County Council

Drawing Title
Tree Clearance Plan

Status
Draft

Scale
1:750

Date
02/01/2023

NORTH

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HERITAGE
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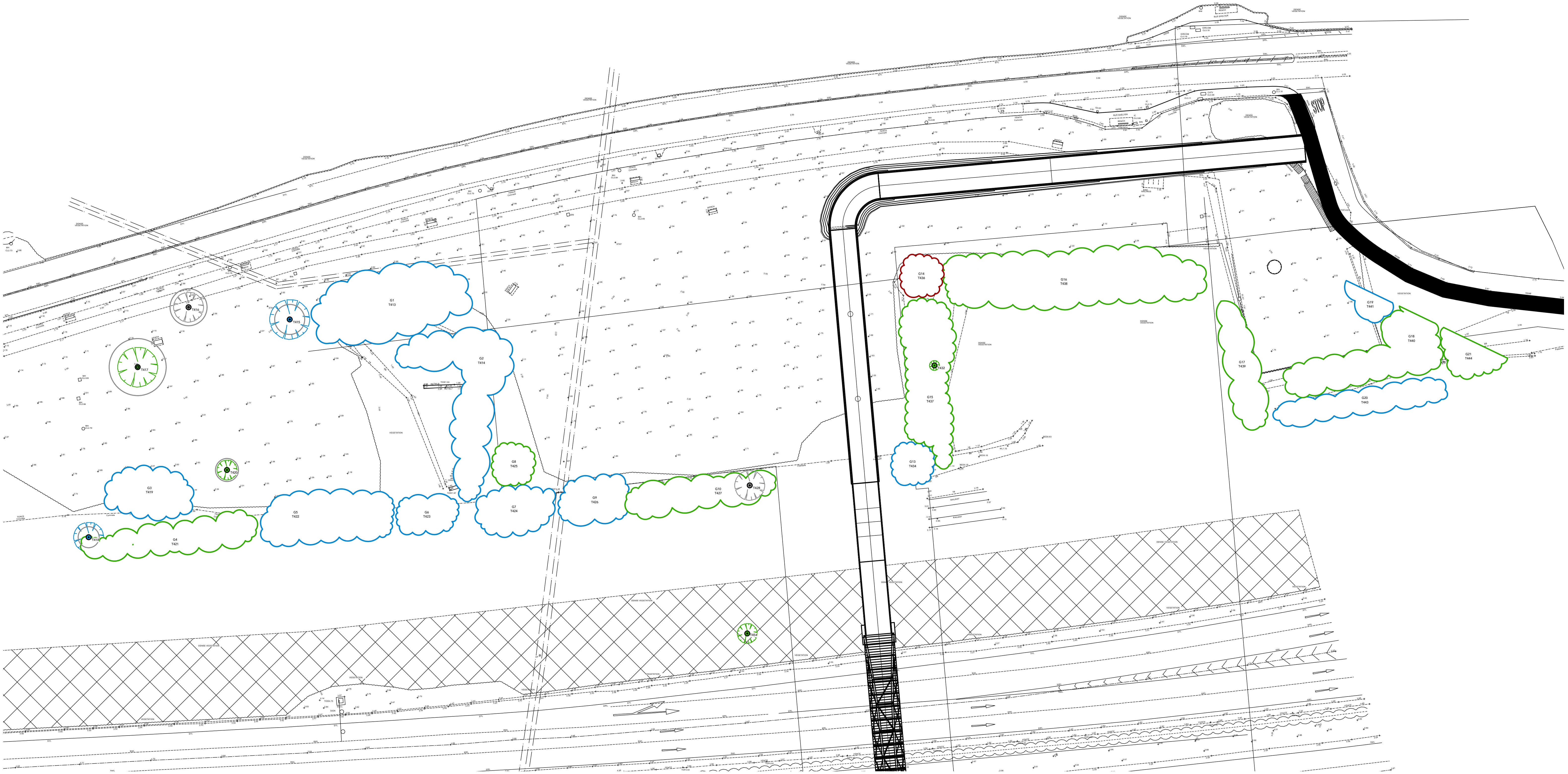
SITE A
TREE CONSTRAINTS PLAN



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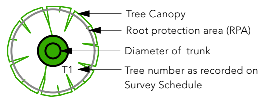
At least 20 years life-expectancy

Category C Tree
Moderate quality and value
At least 10 years life-expectancy

Category U Tree
Poor quality and value
Less than 10 years life-expectancy

Arboricultural Strategy

G1/H1	Trees/groups for removal
G1/H1	Tree group/hedge to be retained



I. The Tree Survey, Assessment and Plans were carried out by the Heritage Tree Care Ltd.
II. Tree locations are based on available aerial imagery, topographical surveys and on-site observations.
III. Plans should be read in conjunctions with the Arboricultural Impact Assessment, BS 5837 Tree Survey and Tree Clearance Plan provided by Heritage Tree Care Ltd.
IV. The original of this drawing was produced in colour. A monochrome copy should not be relied upon.

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Site	Client		
N25 Pedestrian & Cycle Bridge	Cork County Council		
Drawing Title	**Status**	**Scale**	**Date**
Tree Constraints Plan	Draft	1:750	02/01/2023

NORTH

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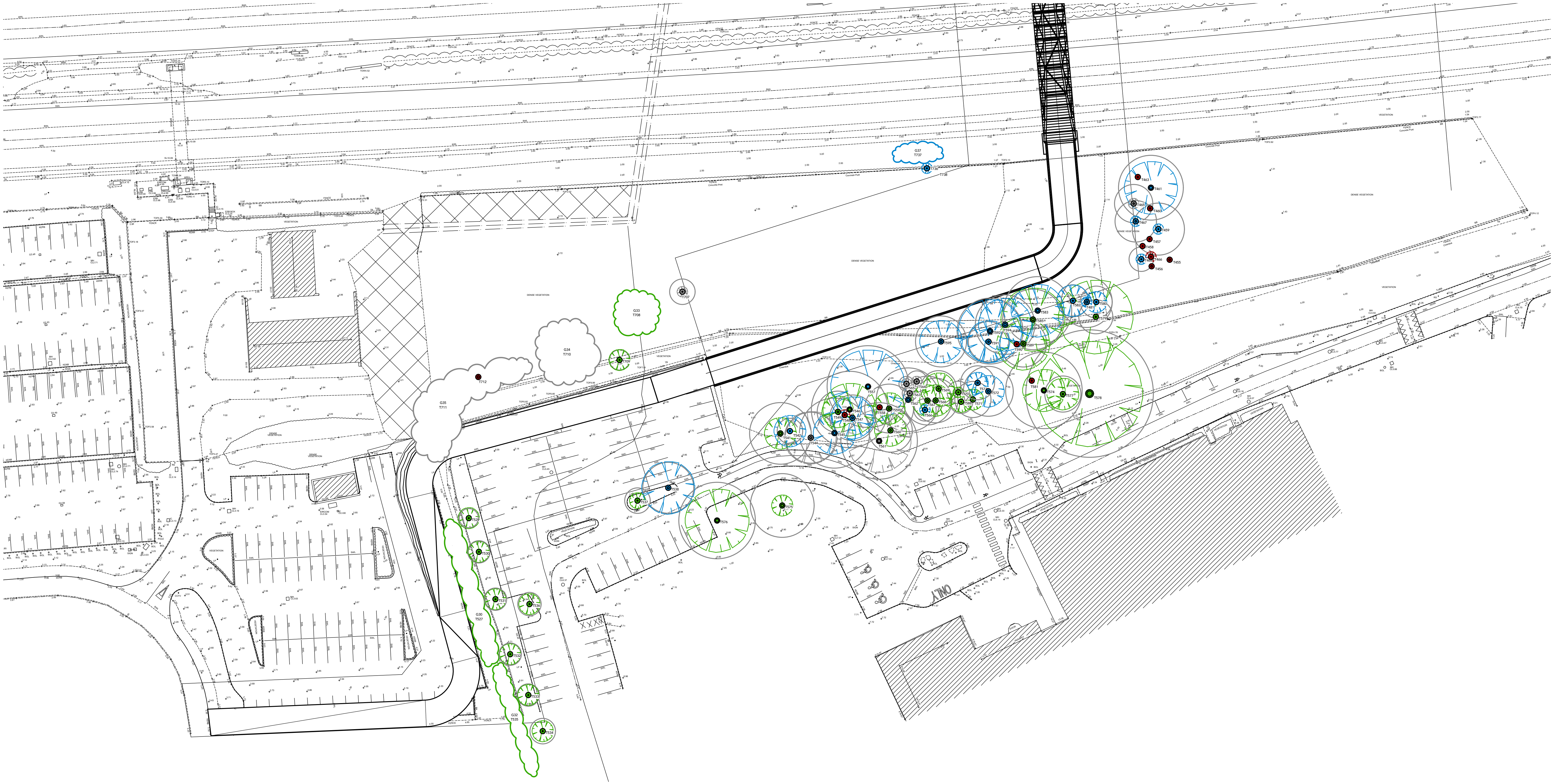
heritagetreesireland@gmail.com

HERITAGE
TREE CARE LTD.

SITE B

TREE CONSTRAINTS PLAN



BS5837:2012 - Tree Categories

Category A Tree
High quality and value
At least 40 years life-expectancy

Category B Tree
Moderate quality and value
At least 20 years life-expectancy

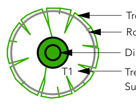
Category C Tree
Moderate quality and value
At least 10 years life-expectancy

Category U Tree
Poor quality and value
Less than 10 years life-expectancy

Arboricultural Strategy

G1/H1 — Trees/groups for removal

G1/H1 — Tree group/hedge to be retained



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Site
N25 Pedestrian & Cycle Bridge

Client
Cork County Council

Drawing Title
Tree Constraints Plan

Status
Draft

Scale
1:750

Date
02/01/2023

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N25 Little Island Pedestrian and Cyclist Bridge
Environmental Impact Assessment Report

Appendix 8.2

Photomontages

Project Number:	6953	Document Number:	RP01	Revision:	04
Project Name:	LITTLE ISLAND BRIDGE	Document Title:	PHOTOMONTAGES	Date:	26 May 2023

Figure: 1.0

Rev: 00

View Location Map

BSM Est. 1968 Brady Shipman Martin. Built. Environment.

Project Number:	6953	Document Number:	RP01	Revision:	04
Project Name:	LITTLE ISLAND BRIDGE	Document Title:	PHOTOMONTAGES	Date:	26 May 2023

< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm	ANGLE OF VISION / LENS FOCAL LENGTH	70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 1.1.1 **Rev: 00**

View 1 - Old Midleton Road
As Existing

BSM Est. 1968 Brady Shipman Martin. Built. Environment.

Project Number:	6953	Document Number:	RP01	Revision:	04
Project Name:	LITTLE ISLAND BRIDGE	Document Title:	PHOTOMONTAGES	Date:	26 May 2023

< 73.7° / 24mm | < 65.5° / 28mm | < 54.4° / 35mm | < 39.6° / 50mm | < 28.8° / 70mm   ANGLE OF VISION / LENS FOCAL LENGTH   70mm / 28.8° > | 50mm / 39.6° > | 35mm / 54.4° > | 28mm / 65.5° > | 24mm / 73.7° >

Figure: 1.1.2 **Rev: 04**

View 1 - Old Midleton Road

As Proposed

BSM Est. 1968 Brady Shipman Martin. Built. Environment.

Project Number:	6953	Document Number:	RP01	Revision:	04
Project Name:	LITTLE ISLAND BRIDGE	Document Title:	PHOTOMONTAGES	Date:	26 May 2023

< 73.7° / 24mm | < 65.5° / 28mm | < 54.4° / 35mm | < 39.6° / 50mm | < 28.8° / 70mm ANGLE OF VISION / LENS FOCAL LENGTH 70mm / 28.8° > | 50mm / 39.6° > | 35mm / 54.4° > | 28mm / 65.5° > | 24mm / 73.7° >

Figure: 1.2.1

Rev: 00

View 2 - N25 Bridge
As Existing

Brady Shipman Martin.
Built. Environment.

Project Number:	6953	Document Number:	RP01	Revision:	04
Project Name:	LITTLE ISLAND BRIDGE	Document Title:	PHOTOMONTAGES	Date:	26 May 2023

< 73.7° / 24mm | < 65.5° / 28mm | < 54.4° / 35mm | < 39.6° / 50mm | < 28.8° / 70mm | ANGLE OF VISION / LENS FOCAL LENGTH | 70mm / 28.8° > | 50mm / 39.6° > | 35mm / 54.4° > | 28mm / 65.5° > | 24mm / 73.7° >

Figure: 1.2.2

Rev: 04

View 2 - N25 Bridge
As Proposed

BSM Est. 1968 Brady Shipman Martin. Built. Environment.

Project Number:	6953	Document Number:	RP01	Revision:	04
Project Name:	LITTLE ISLAND BRIDGE	Document Title:	PHOTOMONTAGES	Date:	26 May 2023

< 73.7° / 24mm | < 65.5° / 28mm | < 54.4° / 35mm | < 39.6° / 50mm | < 28.8° / 70mm ANGLE OF VISION / LENS FOCAL LENGTH 70mm / 28.8° > | 50mm / 39.6° > | 35mm / 54.4° > | 28mm / 65.5° > | 24mm / 73.7° >

Figure: 1.3.1

Rev: 00

View 3 - East Gate
As Existing

BSM Est. 1968 Brady Shipman Martin. Built. Environment.

Project Number:	6953	Document Number:	RP01	Revision:	04
Project Name:	LITTLE ISLAND BRIDGE	Document Title:	PHOTOMONTAGES	Date:	26 May 2023

< 73.7° / 24mm | < 65.5° / 28mm | < 54.4° / 35mm | < 39.6° / 50mm | < 28.8° / 70mm | ANGLE OF VISION / LENS FOCAL LENGTH | 70mm / 28.8° > | 50mm / 39.6° > | 35mm / 54.4° > | 28mm / 65.5° > | 24mm / 73.7° >

Figure: 1.3.2

Rev: 04

View 3 - East Gate
As Proposed

BSM Est. 1968 Brady Shipman Martin. Built. Environment.

N25 Little Island Pedestrian and Cyclist Bridge
Environmental Impact Assessment Report

Chapter 09

Biodiversity

N25 Little Island Pedestrian and Cyclist Bridge
Environmental Impact Assessment Report

Appendix 9.1

NRA Guidelines

Appendix 9.1. NRA 2009 Guidelines

Examples of valuation at different geographical scales

Ecological valuation: Examples

International Importance:

- ‘European Site’ including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA) or proposed Special Area of Conservation and Proposed Special Protection Area (pSPA).

- Site that fulfils the criteria for designation as a ‘European Site’ (see Annex III of the Habitats Directive, as amended).
- Features essential to maintaining the coherence of the Natura 2000 Network.[1]
- Site containing ‘best examples’ of the habitat types listed in Annex I of the Habitats Directive.
- Resident or regularly occurring populations (assessed to be important at the national level) [2] of the following:
    - Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or
    - Species of animal and plants listed in Annex II and/or IV of the Habitats Directive.
- Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971).
- World Heritage Site (Convention for the Protection of World Cultural & Natural Heritage, 1972).
- Biosphere Reserve (UNESCO Man & The Biosphere Programme).
- Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979).
- Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979).
- Biogenetic Reserve under the Council of Europe.
- European Diploma Site under the Council of Europe.
- Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988).[3]

National Importance:

- Site designated or proposed as a Natural Heritage Area (NHA).
- Statutory Nature Reserve.
- Refuge for Fauna and Flora protected under the Wildlife Acts.
- National Park.
- Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA); Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park.
- Resident or regularly occurring populations (assessed to be important at the national level)[4] of the following:
    - Species protected under the Wildlife Acts; and/or
    - Species listed on the relevant Red Data list.
- Site containing ‘viable areas’[5] of the habitat types listed in Annex I of the Habitats Directive.

County Importance:

- Area of Special Amenity.[6]
- Area subject to a Tree Preservation Order.
- Area of High Amenity, or equivalent, designated under the County Development Plan.
- Resident or regularly occurring populations (assessed to be important at the County level)[7] of the following:
    - Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;
    - Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;

o **Species protected under the Wildlife Acts; and/or** o **Species listed on the relevant Red Data list.** • **Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance.** • **County important populations of species, or viable areas of semi-natural habitats or natural heritage features identified in the National or Local BAP, [8] if this has been prepared.** • **Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county.** • **Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.**
Local Importance (higher value): • **Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared;** • **Resident or regularly occurring populations (assessed to be important at the Local level)[9]of the following:** o **Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;** o **Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;** o **Species protected under the Wildlife Acts; and/or** o **Species listed on the relevant Red Data list.** • **Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality;** • **Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.**
Local Importance (lower value): • **Sites containing small areas of semi-natural habitat that are of some local importance for wildlife;** • **Sites or features containing non-native species that are of some importance in maintaining habitat links.**

1 See Articles 3 and 10 of the Habitats Directive.

2 It is suggested that, in general, 1% of the national population of such species qualifies as an internationally important population. However, a smaller population may qualify as internationally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

3 Note that such waters are designated based on these waters' capabilities of supporting salmon (*Salmo salar*), trout (*Salmo trutta*), char (*Salvelinus*) and whitefish (*Coregonus*).

4It is suggested that, in general, 1% of the national population of such species qualifies as a nationally important population. However, a smaller population may qualify as nationally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

5 A 'viable area' is defined as an area of a habitat that, given the particular characteristics of that habitat, was of a sufficient size and shape, such that its integrity (in terms of species composition, and ecological processes and function) would be maintained in the face of stochastic change (for example, as a result of climatic variation).

6 It should be noted that whilst areas such as Areas of Special Amenity, areas subject to a Tree Preservation Order and Areas of High Amenity are often designated on the basis of their ecological value, they may also be designated for other reasons, such as their amenity or recreational value. Therefore, it should not be automatically assumed that such sites are of County importance from an ecological perspective.

7 It is suggested that, in general, 1% of the County population of such species qualifies as a County important population. However, a smaller population may qualify as County important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

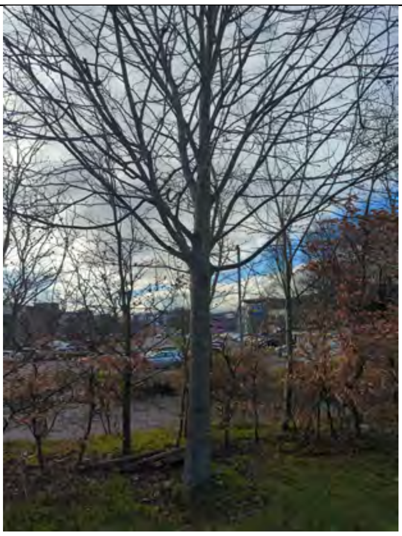
8 BAP: Biodiversity Action Plan

9 It is suggested that, in general, 1%of the local population of such species qualifies as a locally important population. However, a smaller population may qualify as locally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle

N25 Little Island Pedestrian and Cyclist Bridge
Environmental Impact Assessment Report

Appendix 9.2

Bat Tree Survey

Tree Number	Description	Photograph	Potential roost value
T532	Juvenile lime. No Ivy. No cracks or crevices negligible potential		Negligible
T321	Juvenile lime. Young tree. No cracks or crevices negligible potential		Negligible
T530	Juvenile lime. Young tree. No cracks or crevices negligible potential		Negligible

Tree Number	Description	Photograph	Potential roost value
T529	Lime. Young tree. No cracks or crevices negligible potential		Negligible
G30/T527	Beech hedging. Immature Beech trees in a planted hedge with negligible potential for bats		Negligible
G31/T528 sm SYC X 6	Small group thin stemmed Sycamore . Negligible potential		Negligible

Tree Number	Description	Photograph	Potential roost value
T525	Mature dead Chestnut. Large tree with branching from 10 ft approx. Some moderately dense ivy with occasional high diameter stem. At the base ivy coverage above minimal. No significant cracks or crevices. Low potential due to dense Ivy.		Low
T555	Semi-mature Hawthorn. Leaning on fence in poor condition ivy. Moderately dense ivy. Low to negligible potential		Low to negligible
T556	Semi-mature Hawthorn with some Ivy from base to crown.. Low to negligible potential		Low to negligible

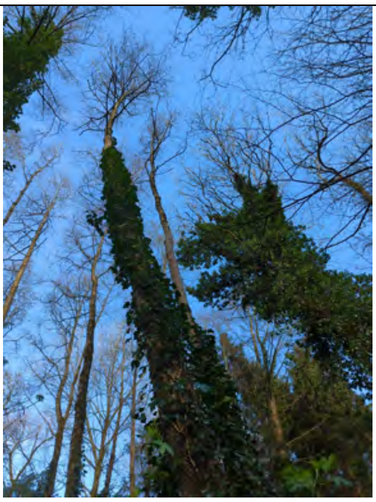
Tree Number	Description	Photograph	Potential roost value
600/523	Mature tree with tag. Mature Sycamore, tall tree in good condition. Close to river. Ivy closer to base. No significant cracks or crevices. One small rotten bow branching out of approximately 8 ft. Negligible potential for bats		Negligible
T526	Mature dead Elm. Some loose bark at the base. Low ivy coverage. Low potential, primary due to loose bark although no evidence of bats noted		Low
T524	Semi-mature lime. Large rotten crevice at the base. No Ivy coverage. One beam extending from rotten base. One rotten beam.		**Moderate**

Tree Number	Description	Photograph	Potential roost value
T523 (526)	T523 Mature beech by tag but 526 on map Very tall, mature Beech in good condition. Ivy covering is light. Multiple branching close the crown and slight branching at base with ivy coverage minimal. Low to negligible potential for bats		Low to negligible
T522	Mature Ash with very limited ivy that's patchily distributed. Large bow at 40 ft. Approx. No significant cracks or crevices. Good condition. Low to negligible potential for bats		Low to negligible
T521	Mature Ash. Multi-stemmed from base. Ivy low and patchy generally of low diameter. Low to negligible potential for bats		Low to negligible potential for bats

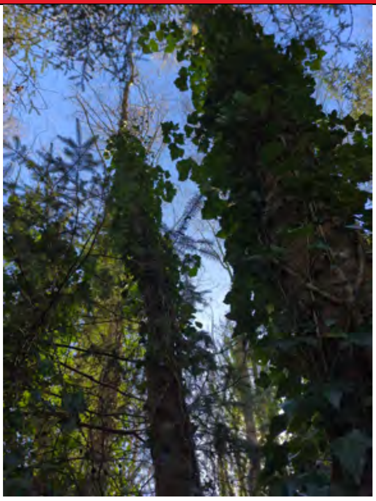
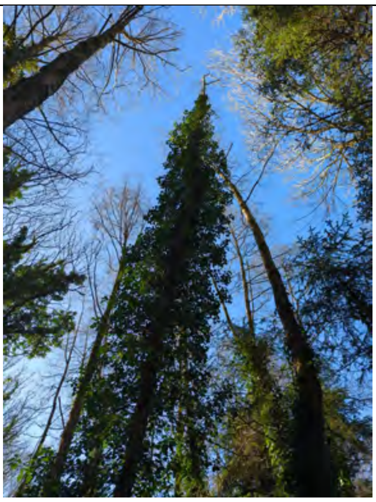
Tree Number	**Description**	**Photograph**	**Potential roost value**
T520	Mature Sycamore. Tall mature tree close to bank with dense ivy with some thick stems from base to crown. Forks at approximately 30 ft. Low to moderate potential		Low to moderate potential
T519	Semi-mature Beech. Extending at angle over the drain. Ivy extends to crown from base. Some thicker diameter stems. Main stem of the tree not particularly wide but could be temporary bat roost.		Low
T518	Semi-mature sycamore extending over the drain from the bank. Ivy at base. Negligible potential		Negligible

Tree Number	Description	Photograph	Potential roost value
T517	Mature sycamore. Close to bank of drain one small branch at 8 ft. Ivy covering light extending close to crown. Low to negligible potential		Low to negligible
T516	Mature Sycamore growing from bank extending over drain. Minimal ivy, one fork at approximately 20 ft smooth. No cracks or crevices. Negligible potential		
T515	Mature sycamore. Mature tree with fork at 15 ft approximately. Ivy covering is low and thinly spaced with lower diameter. No cracks or crevices. Low to negligible potential		Low to negligible

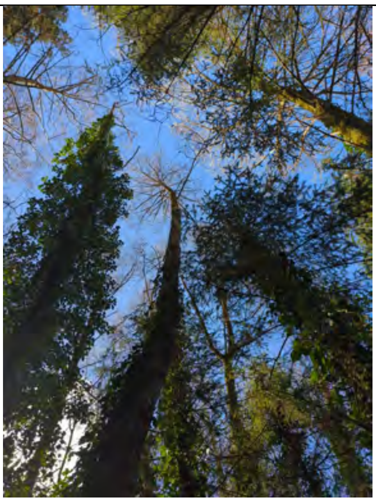
Tree Number	Description	Photograph	Potential roost value
T514	Mature Sycamore. Going from bank at an angle out over drain. Minimal Ivy. No significant cracks or crevices negligible potential		Negligible
T513	Mature Ash that has fallen over. ivy coverage low to moderate. Probably waterlogged leaning up against another tree. Negligible potential for beds		Negligible
T512	Mature Alder. Mature tree forked at 5 ft. Ivy coverage is low. Stems of relatively large diameter. No other significant side branches. No significant cracks or crevices. Low potential due primarily to some thicker ivy stems		Low

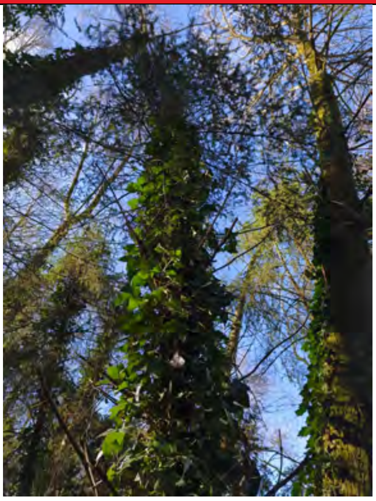
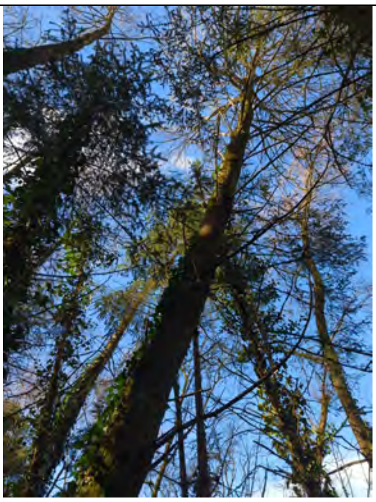
Tree Number	Description	Photograph	Potential roost value
T511	Mature Alder with mature ivy growing at quite an extreme angle. Ivy coverage is generally low. Ivy diameter stem low also no side branches. No significant cracks or crevices or loose bark. Fissures visible. Low to negligible potential		Low to negligible
T510	Mature Alder. Tall tree no side branches. Ivy extends from base to crown. Generally low diameter but some thicker areas. No significant cracks or crevices visible. Low potential for bats due primarily to ivy growth		
T509	Mature Alder. Forks into two bows from approximately 4 1/2 ft. Ivy coverage is low with stems of limited diameter. Crown poorly developed. No other significant side branches. Low to negligible potential for bats		Low to negligible

Tree Number	Description	Photograph	Potential roost value
T508	Mature Alder with ivy coverage very low. No significant cracks or crevices. Minor fissures in trunk. Low to negligible potential for bats		Low to negligible
T507	Mature Alder. Virtually no Ivy. No significant side branches. No significant crevices or cracks negligible potential		Negligible
T506	Mature Alder with no significant side bows. Ivy coverage is generally light. Stems low diameter, no significant cracks or crevices. Low to negligible potential		Low to negligible

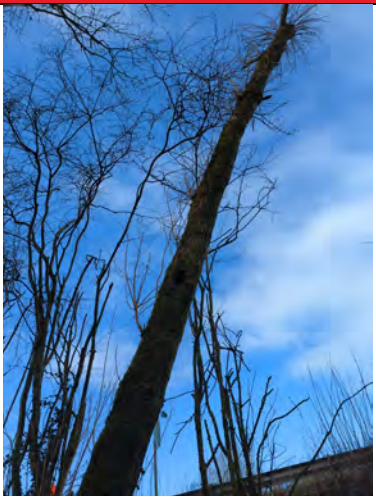
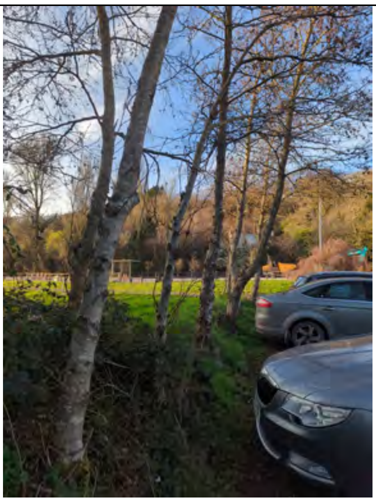
Tree Number	Description	Photograph	Potential roost value
T505	Mature Alder. Mature tree forked from approximately 4 ft into two bows. No significant other side branches. Ivy coverage is light stems of relatively lower diameter		Low to negligible
T492	Juvenile Alder. Relatively young tree with some mature growth of ivy. Stems are of high diameter but does not form dense growth. Ivy does extend to the top of the tree. No side bows. Low potential for bats		Low
T504	Juvenile Sitka Spruce. Poor quality tree. Ivy cover low and stems of limited diameter. Negligible potential for bats		Negligible

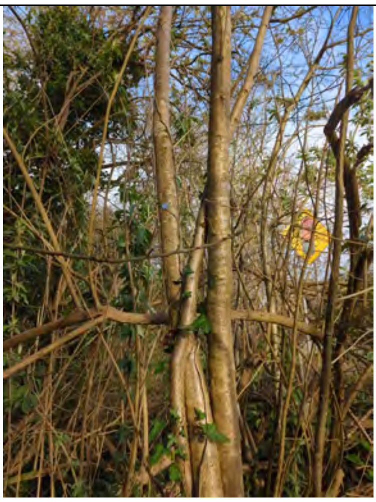
Tree Number	Description	Photograph	Potential roost value
T494	Juvenile Sitka spruce with low ivy coverage. Immature tree. Diameter of ivy which extends from base to crown low. Negligible potential		Negligible
T503	Mature Alder. Tall tree with no significant side bows. Crown limited. Ivy cover low and stems of Ivy are limited diameter. No significant cracks or crevices noted. Low to negligible		Low to negligible
T488	Mature Alder. Large mature Alder leaning slightly. Ivy moderate to crown from base. Diameter of ivy stems not large but growth relatively dense. No significant side bows no significant cracks or crevices. Low potential		Low

Tree Number	Description	Photograph	Potential roost value
T489	Mature Alder. Tall single stemmed tree with light ivy growth in lower section. Diameter of ivy is low. No significant crack so crevices. Low to negligible potential		Low to negligible
T502	Mature Goat Willow. Tall mature tree with ivy growth on lower section. Growth of ivy is not dense and stem diameter is low. No significant side bows. Low to negligible potential		Low to negligible
T493	Mature Alder. Mature tree single stems to top. No significant side. Light ivy coverage with low. Low to negligible potential		Low to negligible

Tree Number	Description	Photograph	Potential roost value
T495	Juvenile spruce with moderate covering of ivy. Stems of ivy of lower diameter. Low to negligible potential.		Low to negligible
T496	Mature Grey Poplar. Large diameter trunk, mature tree. No significant bows to side. No significant cracks or crevices. Ivy coverage is light. No significant fissures in bark. Low two negligible		Low to negligible
G29/T497 JUV SPRUCE	Small group of immature spruce ivy growth very light. Negligible potential		Negligible

Tree Number	Description	Photograph	Potential roost value
T498	Juvenile spruce. Falling at an angle light. Coverage of Ivy thin diameter. Negligible potential for bats		Negligible
T499	Goat Willow. Mature tree one bow at 20 ft. Cracked but hanging on at an angle. Ivy coverage very low. Low potential for bats		Low
T500	Goat Willow. Mature tree l that's been trimmed in the past. Some very young regrowth from the stem. Low ivy coverage. Low to negligible		Low to negligible

Tree Number	Description	Photograph	Potential roost value
T501	Mature goat willow single stem has been trimmed in the past. Some young regrowth. Hollowing tree at 15 ft. Low potential for bats		Low
G19/T441	Grey willow by six multi stemmed within existing planted area.. No significant cracks or crevices.		Negligible
G17/T439	Alder x 46 semi-mature Immature closely spaced. No complexity or cracks or crevices. No suitability for bats. Negligible potential		Negligible

Tree Number	Description	Photograph	Potential roost value
G12/T443	Group of collapsed willows relatively old. Some broken bows. Some loose park but no significant cracks or crevices. 5-6 trees. Some growing outside the railing, some growing the drainage ditch and the railway		Low to negligible
G25/T448	Hazel Young probably planted as part of the road scheme. Multi-stemmed immature. No significant Ivy. Negligible potential for bats		Negligible
G24/T447	Semi-mature Hawthorn between the road verge and the drain. Some privet and the understory moderate levels. Ivy not particularly dense. Low to negligible potential for bats		Low to negligible

Tree Number	Description	Photograph	Potential roost value
433	Willow. Mature, multi-stemmed broken boughs have being damaged in the past has also been trimmed back. Low potential for bats		Low
436	Willow. Previously on corner of woodland appears to have been removed. Small oak 432 visible in background		Low

N25 Little Island Pedestrian and Cyclist Bridge
Environmental Impact Assessment Report

Appendix 9.3

I-WeBS Data

Dunkettle I-WeBS Data 2016/2021

SubsiteCode	SubsiteName	SSGrid	Species Name	Latin Name	Display order	All Ireland_ 1pc	Flyway_1pc	Peak	2016/17	2017/18	2018/19	2019/20	2020/21
0L486	Dunkettle	W727723	Mute Swan	*Cygnus olor*	100	90	100	2				2	
0L486	Dunkettle	W727723	Light-bellied Brent Goose	*Branta bernicla hrota*	900	350	400	2		2			
0L486	Dunkettle	W727723	Shelduck	*Tadorna tadorna*	1000	100	2500	4	2	2	2	4	
0L486	Dunkettle	W727723	Wigeon	*Mareca penelope*	1100	560	14000	27	27	3	18	6	
0L486	Dunkettle	W727723	Teal	*Anas crecca*	1300	360	5000	4	4	3			
0L486	Dunkettle	W727723	Mallard	*Anas platyrhynchos*	1400	280	53000	4	4	1	3	2	
0L486	Dunkettle	W727723	Red-breasted Merganser	*Mergus serrator*	2500	25	860	15	3	15	11	7	
0L486	Dunkettle	W727723	Great Northern Diver	*Gavia immer*	3000	20	50	0				0	

SubsiteCode	SubsiteName	SSGrid	Species Name	Latin Name	Display order	All Ireland_ 1pc	Flyway_1pc	Peak	2016/17	2017/18	2018/19	2019/20	2020/21
0L486	Dunkettle	W727723	Little Grebe	*Tachybaptus ruficollis*	3100	20	4700	4	4	3	2	1	
0L486	Dunkettle	W727723	Cormorant	*Phalacrocorax carbo*	3400	110	1200	19	15	17	14	19	
0L486	Dunkettle	W727723	Little Egret	*Egretta garzetta*	3600	20	1100	9	7	9	8	7	
0L486	Dunkettle	W727723	Grey Heron	*Ardea cinerea*	3700	25	5000	14	14	2	14	10	
0L486	Dunkettle	W727723	Oystercatcher	*Haematopus ostralegus*	4100	610	8200	153	153	28	144	60	
0L486	Dunkettle	W727723	Lapwing	*Vanellus vanellus*	4500	850	72300	50	49	50	16	30	
0L486	Dunkettle	W727723	Dunlin	*Calidris alpina*	5100	460	13300	450	60	450	340	420	
0L486	Dunkettle	W727723	Snipe	*Gallinago gallinago*	5400			4	3		4	3	
0L486	Dunkettle	W727723	Black-tailed Godwit	*Limosa limosa*	5600	200	1100	521	521	177	179	304	
0L486	Dunkettle	W727723	Bar-tailed Godwit	*Limosa lapponica*	5700	170	1500	33	33	20	2	12	

SubsiteCode	**SubsiteName**	**SSGrid**	**Species Name**	**Latin Name**	**Display order**	**All Ireland_ 1pc**	**Flyway_1pc**	**Peak**	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**
0L486	Dunkettle	W727723	Curlew	*Numenius arquata*	5900	350	7600	209	61	80	209	153	
0L486	Dunkettle	W727723	Redshank	*Tringa totanus*	6100	240	2400	134	91	95	134	77	
0L486	Dunkettle	W727723	Greenshank	*Tringa nebularia*	6200	20	3300	14	14	7	8	8	
0L486	Dunkettle	W727723	Common Sandpiper	*Actitis hypoleucos*	6500			1				1	
0L486	Dunkettle	W727723	Turnstone	*Arenaria interpres*	6600	95	1400	5	2	5		2	
0L486	Dunkettle	W727723	Black-headed Gull	*Chroicocephalus ridibundus*	6800			460	245	460	309	291	
0L486	Dunkettle	W727723	Common Gull	*Larus canus*	6900			7	2	2	7		
0L486	Dunkettle	W727723	Lesser Black-backed Gull	*Larus fuscus*	7000			173	70	150	173	59	
0L486	Dunkettle	W727723	Herring Gull	*Larus argentatus*	7100			40	20	13	40	18	

SubsiteCode	SubsiteName	SSGrid	Species Name	Latin Name	Display order	All Ireland_ 1pc	Flyway_1pc	Peak	2016/17	2017/18	2018/19	2019/20	2020/21
0L486	Dunkettle	W727723	Great Black-backed Gull	*Larus marinus*	7200			39	6	39	37	22	
0L486	Dunkettle	W727723	Mediterranean Gull	*Ichthyaetus melanocephalus*	7300			1				1	
0L486	Dunkettle	W727723	Yellow-legged Gull	*Larus michahellis*	161600			1			1		

Glounthane/Slatty Waters I-Webs Data 2016-2021

SubsiteCode	SubsiteName	SSGrid	SpeciesName	LatinNameIOC	DisplayOrder	AllIreland_1pc	Flyway_1pc	Peak	2017/18	2018/19	2019/20	2020/21
0L489	Glounthane Estuary/ Slatty Water	W800726	Mute Swan	Cygnus olor	100	90	100	6	4	6	4	2
0L489	Glounthane Estuary/ Slatty Water	W800726	Canada Goose	Branta canadensis	700			5	5	4	5	
0L489	Glounthane Estuary/ Slatty Water	W800726	Shelduck	Tadorna tadorna	1000	100	2500	275	199	275	187	115
0L489	Glounthane Estuary/ Slatty Water	W800726	Wigeon	Mareca penelope	1100	560	14000	965	965	591	450	490
0L489	Glounthane Estuary/ Slatty Water	W800726	Teal	Anas crecca	1300	360	5000	516	516	437	300	368
0L489	Glounthane Estuary/ Slatty Water	W800726	Mallard	Anas platyrhynchos	1400	280	53000	83	48	16	83	35
0L489	Glounthane Estuary/ Slatty Water	W800726	Pintail	Anas acuta	1500	20	600	3		3	2	
0L489	Glounthane Estuary/ Slatty Water	W800726	Shoveler	Spatula clypeata	1600	20	650	1	1			
0L489	Glounthane Estuary/ Slatty Water	W800726	Red-breasted Merganser	Mergus serrator	2500	25	860	12	6	8	12	3
0L489	Glounthane Estuary/ Slatty Water	W800726	Great Northern Diver	Gavia immer	3000	20	50	0			0	
0L489	Glounthane Estuary/ Slatty Water	W800726	Little Grebe	Tachybaptus ruficollis	3100	20	4700	36	25	24	36	
0L489	Glounthane Estuary/ Slatty Water	W800726	Great Crested Grebe	Podiceps cristatus	3200	30	6300	1	1	1		
0L489	Glounthane Estuary/ Slatty Water	W800726	Cormorant	Phalacrocorax carbo	3400	110	1200	41	41	15	26	

SubsiteCode	SubsiteName	SSGrid	SpeciesName	LatinNameIOC	DisplayOrder	AllIreland_1pc	Flyway_1pc	Peak	2017/18	2018/19	2019/20	2020/21
0L489	Glounthane Estuary/ Slatty Water	W800726	Little Egret	Egretta garzetta	3600	20	1100	57	57	42	40	48
0L489	Glounthane Estuary/ Slatty Water	W800726	Grey Heron	Ardea cinerea	3700	25	5000	20	13	15	20	20
0L489	Glounthane Estuary/ Slatty Water	W800726	Moorhen	Gallinula chloropus	3900			6	5	4	5	6
0L489	Glounthane Estuary/ Slatty Water	W800726	Oystercatcher	Haematopus ostralegus	4100	610	8200	470	258	470	272	276
0L489	Glounthane Estuary/ Slatty Water	W800726	Golden Plover	Pluvialis apricaria	4300	920	9300	2000	1		2000	36
0L489	Glounthane Estuary/ Slatty Water	W800726	Grey Plover	Pluvialis squatarola	4400	30	2000	1		1		
0L489	Glounthane Estuary/ Slatty Water	W800726	Lapwing	Vanellus vanellus	4500	850	72300	1131	1131	655	626	378
0L489	Glounthane Estuary/ Slatty Water	W800726	Knot	Calidris canutus	4600	160	5300	150	41	20	150	
0L489	Glounthane Estuary/ Slatty Water	W800726	Dunlin	Calidris alpina	5100	460	13300	1298	613	1298	273	152
0L489	Glounthane Estuary/ Slatty Water	W800726	Snipe	Gallinago gallinago	5400			20	11	7	2	20
0L489	Glounthane Estuary/ Slatty Water	W800726	Black-tailed Godwit	Limosa limosa	5600	200	1100	2215	1985	1884	2215	1419
0L489	Glounthane Estuary/ Slatty Water	W800726	Bar-tailed Godwit	Limosa lapponica	5700	170	1500	3	1	2		3
0L489	Glounthane Estuary/ Slatty Water	W800726	Whimbrel	Numenius phaeopus	5800			2		2	1	
0L489	Glounthane Estuary/ Slatty Water	W800726	Curlew	Numenius arquata	5900	350	7600	354	342	354	280	125

SubsiteCode	SubsiteName	SSGrid	SpeciesName	LatinNameIOC	DisplayOrder	AllIreland_1pc	Flyway_1pc	Peak	2017/18	2018/19	2019/20	2020/21
0L489	Glounthane Estuary/ Slatty Water	W800726	Spotted Redshank	Tringa erythropus	6000			1	1			
0L489	Glounthane Estuary/ Slatty Water	W800726	Redshank	Tringa totanus	6100	240	2400	624	624	491	534	434
0L489	Glounthane Estuary/ Slatty Water	W800726	Greenshank	Tringa nebularia	6200	20	3300	17	15	15	17	8
0L489	Glounthane Estuary/ Slatty Water	W800726	Turnstone	Arenaria interpres	6600	95	1400	9	9	5	9	4
0L489	Glounthane Estuary/ Slatty Water	W800726	Black-headed Gull	Chroicocephalus ridibundus	6800			2100	1340	1792	1132	2100
0L489	Glounthane Estuary/ Slatty Water	W800726	Common Gull	Larus canus	6900			13	13	4	11	7
0L489	Glounthane Estuary/ Slatty Water	W800726	Lesser Black-backed Gull	Larus fuscus	7000			76	76	18	25	23
0L489	Glounthane Estuary/ Slatty Water	W800726	Herring Gull	Larus argentatus	7100			8		5	5	8
0L489	Glounthane Estuary/ Slatty Water	W800726	Great Black-backed Gull	Larus marinus	7200			66	27	66	25	22
0L489	Glounthane Estuary/ Slatty Water	W800726	Mediterranean Gull	Ichthyaetus melanocephalus	7300			2	2	1		
0L489	Glounthane Estuary/ Slatty Water	W800726	Cattle Egret	Bubulcus ibis	170550			3		3	2	
0L489	Glounthane Estuary/ Slatty Water	W800726	Great White Pelican	Pelecanus onocrotalus	171320			2		2		2

I-WeBS Carrigrenan - Great Island & Railway 2016-2021

SubsiteCode	SubsiteName	SSGrid	SpeciesName	LatinNameIOC	DisplayOrder	AllIreland_1pc	Flyway_1pc	Peak	2017/18	2018/19	2019/20	2020/21
0L426	Carrigrenan - Great Island & Railway	W775705	Mute Swan	Cygnus olor	100	90	100	7		2	7	
0L426	Carrigrenan - Great Island & Railway	W775705	Shelduck	Tadorna tadorna	1000	100	2500	48	15	12	48	
0L426	Carrigrenan - Great Island & Railway	W775705	Wigeon	Mareca penelope	1100	560	14000	59	15	59	15	16
0L426	Carrigrenan - Great Island & Railway	W775705	Teal	Anas crecca	1300	360	5000	31	22	31	29	18
0L426	Carrigrenan - Great Island & Railway	W775705	Mallard	Anas platyrhynchos	1400	280	53000	48	2	48	16	
0L426	Carrigrenan - Great Island & Railway	W775705	Goldeneye	Bucephala clangula	2300	40	11400	2	2			
0L426	Carrigrenan - Great Island & Railway	W775705	Red-breasted Merganser	Mergus serrator	2500	25	860	26	26	15	8	5
0L426	Carrigrenan - Great Island & Railway	W775705	Little Grebe	Tachybaptus ruficollis	3100	20	4700	10	6	10	10	
0L426	Carrigrenan - Great Island & Railway	W775705	Great Crested Grebe	Podiceps cristatus	3200	30	6300	9	9	8	5	
0L426	Carrigrenan - Great Island & Railway	W775705	Cormorant	Phalacrocorax carbo	3400	110	1200	64	64	32	47	
0L426	Carrigrenan - Great Island & Railway	W775705	Little Egret	Egretta garzetta	3600	20	1100	2		2	1	1
0L426	Carrigrenan - Great Island & Railway	W775705	Grey Heron	Ardea cinerea	3700	25	5000	4	2	3	4	2
0L426	Carrigrenan - Great Island & Railway	W775705	Oystercatcher	Haematopus ostralegus	4100	610	8200	465	465	185	80	53

SubsiteCode	SubsiteName	SSGrid	SpeciesName	LatinNameIOC	DisplayOrder	AllIreland_1pc	Flyway_1pc	Peak	2017/18	2018/19	2019/20	2020/21
0L426	Carrigrenan - Great Island & Railway	W775705	Ringed Plover	Charadrius hiaticula	4200	120	540	4				4
0L426	Carrigrenan - Great Island & Railway	W775705	Grey Plover	Pluvialis squatarola	4400	30	2000	8				8
0L426	Carrigrenan - Great Island & Railway	W775705	Lapwing	Vanellus vanellus	4500	850	72300	16	1	4	16	
0L426	Carrigrenan - Great Island & Railway	W775705	Knot	Calidris canutus	4600	160	5300	50	50			
0L426	Carrigrenan - Great Island & Railway	W775705	Dunlin	Calidris alpina	5100	460	13300	450		300	60	450
0L426	Carrigrenan - Great Island & Railway	W775705	Snipe	Gallinago gallinago	5400			4		1	4	4
0L426	Carrigrenan - Great Island & Railway	W775705	Black-tailed Godwit	Limosa limosa	5600	200	1100	100	100	35	2	42
0L426	Carrigrenan - Great Island & Railway	W775705	Bar-tailed Godwit	Limosa lapponica	5700	170	1500	7				7
0L426	Carrigrenan - Great Island & Railway	W775705	Curlew	Numenius arquata	5900	350	7600	84	42	84	37	64
0L426	Carrigrenan - Great Island & Railway	W775705	Redshank	Tringa totanus	6100	240	2400	97	47	70	97	17
0L426	Carrigrenan - Great Island & Railway	W775705	Greenshank	Tringa nebularia	6200	20	3300	8	1	4	8	
0L426	Carrigrenan - Great Island & Railway	W775705	Turnstone	Arenaria interpres	6600	95	1400	75	17	14	75	19
0L426	Carrigrenan - Great Island & Railway	W775705	Black-headed Gull	Chroicocephalus ridibundus	6800			250	250	226	154	162
0L426	Carrigrenan - Great Island & Railway	W775705	Common Gull	Larus canus	6900			15				15

SubsiteCode	SubsiteName	SSGrid	SpeciesName	LatinNameIOC	DisplayOrder	AllIreland_1pc	Flyway_1pc	Peak	2017/18	2018/19	2019/20	2020/21
0L426	Carrigrenan - Great Island & Railway	W775705	Lesser Black-backed Gull	Larus fuscus	7000			27	4	4	3	27
0L426	Carrigrenan - Great Island & Railway	W775705	Herring Gull	Larus argentatus	7100			192	2	21	15	192
0L426	Carrigrenan - Great Island & Railway	W775705	Great Black-backed Gull	Larus marinus	7200			51	21	42	5	51
0L426	Carrigrenan - Great Island & Railway	W775705	Sandwich Tern	Thalasseus sandvicensis	7400			1		1		

I-WeBS East Lough Mahon 2016-2021

SiteCode	Sitename	subsiteCode	Subsite	Taxonomy IOC	SpeciesName	1% National	1% International	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
0L403	Cork Harbour	0L452	East Lough Mahon	318	Mute Swan	90	100		7	9	6	2	
0L403	Cork Harbour	0L452	East Lough Mahon	435	Wigeon	560	14000		6	10	48	3	
0L403	Cork Harbour	0L452	East Lough Mahon	457	Mallard	280	53000	37	5	2	6	8	
0L403	Cork Harbour	0L452	East Lough Mahon	479	Teal	360	5000	28	25		9	22	
0L403	Cork Harbour	0L452	East Lough Mahon	518	Tufted Duck	270	8900				6		
0L403	Cork Harbour	0L452	East Lough Mahon	550	Goldeneye	40	11400	6			4	2	
0L403	Cork Harbour	0L452	East Lough Mahon	565	Red-breasted Merganser	25	860	2	30	2	23	16	
0L403	Cork Harbour	0L452	East Lough Mahon	5363	Little Grebe	20	4700			4		1	
0L403	Cork Harbour	0L452	East Lough Mahon	5411	Great Crested Grebe	30	6300	18	38	28	8	13	
0L403	Cork Harbour	0L452	East Lough Mahon	5562	Oystercatcher	610	8200	24	13	2	8	15	
0L403	Cork Harbour	0L452	East Lough Mahon	5792	Whimbrel				1				
0L403	Cork Harbour	0L452	East Lough Mahon	5806	Curlew	350	7600			1	1		
0L403	Cork Harbour	0L452	East Lough Mahon	5826	Turnstone	95	1400	40	19		21	15	

SiteCode	Sitename	subsiteCode	Subsite	Taxonomy IOC	SpeciesName	1% National	1% International	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
0L403	Cork Harbour	0L452	East Lough Mahon	5859	Dunlin	460	13300		1				
0L403	Cork Harbour	0L452	East Lough Mahon	5927	Snipe				3				
0L403	Cork Harbour	0L452	East Lough Mahon	5963	Redshank	240	2400	8	6	6	8	2	
0L403	Cork Harbour	0L452	East Lough Mahon	5973	Greenshank	20	3300	6			1		
0L403	Cork Harbour	0L452	East Lough Mahon	6089	Black-headed Gull			103	158	158	73	109	
0L403	Cork Harbour	0L452	East Lough Mahon	6122	Common Gull						4		
0L403	Cork Harbour	0L452	East Lough Mahon	6131	Great Black-backed Gull			10	1	2	1	2	
0L403	Cork Harbour	0L452	East Lough Mahon	6152	Herring Gull				1	3	13	8	
0L403	Cork Harbour	0L452	East Lough Mahon	6165	Lesser Black-backed Gull			2	2				
0L403	Cork Harbour	0L452	East Lough Mahon	6194	Sandwich Tern						1		
0L403	Cork Harbour	0L452	East Lough Mahon	6814	Cormorant	110	1200	27	110	31	20	17	
0L403	Cork Harbour	0L452	East Lough Mahon	7058	Grey Heron	25	5000	3			1		
0L403	Cork Harbour	0L452	East Lough Mahon	7111	Little Egret	20	1100	2					

N25 Little Island Pedestrian and Cyclist Bridge
Environmental Impact Assessment Report

Appendix 9.4

N25 Birdcounts Summary

N25 Birdcounts	Species	Flock Size/Number	Height	Direction	Behaviour
Date: 28/02/22	Hooded crow	1/100	25-50	s-n	flying
Cloud: 100%	Hooded crow	1/70	25-50	n-s	flying
Temp: 9	Hooded crow	1/80	50+	s-n	flying
Rain: Light drizzle	Hooded crow	1/70	50+	n-s	flying
	Buzzard	1	25-50	w-e	flying/perching
	Blackhead Gull	2/3	50+	e-w	flying
	Magpie	2/1	25-50	s-n	flying
	Blackhead Gull	2/4	50+	w-e	flying
	Dunnock	1/1	25-50	e-w	flying
	Blue Tit	1/1	25-50	e-w	flying
	Meadow Pip	2/1	50+	e-w	flying
	Herring Gull	3/4	50+	e-w	flying

N25 Birdcounts	Species	Flock Size/Number	Height	Direction	Behaviour
Date: 29/02/22	Hooded crow	1/70	25-50	s-n	flying
Cloud: 0%	Hooded crow	1/80	25-50	n-s	flying
Temp: 11	Hooded crow	1/100	50+	s-n	flying
Rain: None	Hooded crow	1/90	50+	n-s	flying
	Buzzard	1	25-50	s-n	flying
	Blackheaded Gull	10/2	50+	w-e	flying
	Blackheaded Gull	1/40	50+	w-e	flying
	Herring Gull	1/10	50+	e-w	flying

N25 Birdcounts	Species	Flock Size/Number	Height	Direction	Behaviour
Date: 15/03/22	Hooded crow	3/70	50+	e-w	flying
Cloud: 90%	Goldfinch	1/10	50+	s-n	flying
Temp: 11	Buzzard	1	50+	s-n	flying
Rain: None	Blackheaded Gull	3/1	50+	n-s	flying
	Hooded crow	2/40	50+	s-n	flying
	Hooded crow	1/20	25	n-s	flying
	Buzzard	1	50+	s-n	flying
	Herring Gull	3/1	50+	n-s	flying
	Hooded Crow	10/10	50+	e-w	flying
	Hooded Crow	5/12	50+	n-s	flying
	Starling	20/1	50+	s-n	flying

N25 Birdcounts	Species	Flock Size/Number	Height	Direction	Behaviour
Date: 21/03/22	Hooded crow	1/70	50+	e-w	flying
Cloud: 100%	Hooded crow	3/100	50+	w-e	flying
Temp: 12	Hooded crow	5/60	50+	e-w	flying
Rain: None	Jackdaw	4/30	25-50	e-w	flying
Wind: High	Jackdaw	5/40	50+	w-e	flying
	Rook	1/50	50+	e-w	flying
	Rook	3/60	50+	w-e	flying
	Wood pigeon	1/45	50+	e-w	flying
	Wood pigeon	3/30	100+	e-w	flying

N25 Birdcounts	Species	Flock Size/Number	Height	Direction	Behaviour
Date: 25/11/22	Rook	1/20	15	e-w	flying
Cloud: 100%	Rook	1/30	15	n-s	flying
Temp: 10	Rook	3/20	10	e-w	flying
Rain: 0%	Rook	1/20	20	s-n	flying
Wind: High	Rook	1/30	50		flying
	Rook	4/10	20	s-n	flying
	Rook	4/15	50	n-s	flying
	Feral pigeon	2/20	15	e-w	flying

N25 Birdcounts	Species	Flock Size/Number	Height	Direction	Behaviour
Date: 03/12/22	Rook	2/30	20	e-w	flying
Cloud: 0%	Jackdaw	1/20	15	n-s	flying
Temp: 8	Rook	3/20	10	e-w	flying
Rain: None	Pigeon	2/15	10	w-e	flying
	Rook	1	2015	s-n	flying
	Starling	8/1	2015	s-n	flying
	Rook	4/10	50	n-s	flying
	Feral pigeon	2/10	15	e-w	flying

N25 Birdcounts	Species	Flock Size/Number	Height	Direction	Behaviour
28/12/22	Jackdaw	5/10	<25	e-w	flying
Cloud: 30%	Blackbird	1/3	<25	w-e	flying
Temp: 9	Starling	5/2	50+	w-e	flying
Rain: Light drizzle	Magpie	1/5	50+	w-e	flying
	Blackbird	1/3	50+	e-w	flying
	Wren	½	5+	w-e	flying
	Blackbird	½	<20	e-w	flying
	Starling	5/2	50+	e-w	flying

N25 Birdcounts	Species	Flock Size/Number	Height	Direction	Behaviour
28/1/23	Hooded crow	2/3	50+	e-w	flying
Cloud: 40%	Blackbird	1/2	<25	w-e	flying
Temp: 10	Hooded crow	1/6	<25	n-s	flying
Rain: None	Buzzard	1/2	50+	n-s	flying
	Herring Gull	1/3	20+	s-n	flying
	Hooded Crow	¼	50+	e-w	flying
	Jackdaw	3/10	50+	n-s	flying
	Starling	8/1	20+	s-n	flying

N25 Birdcounts	Species	Flock Size/Number	Height	Direction	Behaviour
29/1/23	Magpie	1/3	50+	w-e	flying
Cloud: 30%	Blackbird	1/10	50+	w-e	flying
Temp: 11	Wren	½	<25	w-e	flying
Rain: None	Blackbird	1/3	20+	n-s	flying
	Starling	3/2	50+	w-e	flying
	Buzzard	1/2	50+	s-n	flying
	Herring Gull	1/2	50+	n-s	flying
	Hooded Crow	1/15	20+	e-w	flying
	Hooded Crow	2/10	20+	s-n	flying
	Starling	2/2	50+	s-n	flying

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Chapter 15

Resources and Waste

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Appendix 15.1

Legislation, Policy and Guidance

Legislation

European Legislation

Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives (Text with EEA relevance)

Directive 2008/98/EC, known as the "Waste Framework Directive" came into force on 12th December 2008, and Ireland had two years from this date to implement it into national law. It provides for a general framework of waste management requirements and sets the basic waste management definitions for the EU.

The Directive lays down the five-step hierarchy of waste management options, with waste prevention as the preferred option, followed by re-use, recycling, recovery and safe disposal, in descending order. In addition, the Directive also deals with the issue of 'end of waste' and clarifies the definitions of recovery, disposal and by-product. The directive states that, "*The recovery of waste and the use of recovered material as raw materials should be encouraged in order to conserve natural resources.*"

Directive 2008/98/EC amending Directive 2008/98/EC on waste

This Directive amends the Waste Framework Directive or Directive 2008/98/EC. It provides a number of updated waste management definitions. The Directive allows Member States to use economic instruments including taxes and levies as an incentive for the application of the waste hierarchy. The Directive was transposed into national law in August 2020 - S.I. No. 322 of 2020.

The Directive sets targets for the preparing for re-use and the recycling of municipal waste as follows:

- By 2025, at a minimum 55% (by weight) will be prepared for re-use or recycling.
- By 2030, at a minimum 60% (by weight) will be prepared for re-use or recycling.
- By 2035, at a minimum 65% (by weight) will be prepared for re-use or recycling.

With regards construction and demolition waste, Member States must take measures to promote selective demolition in order to enable removal and safe handling of hazardous substances, facilitate re-use and high-quality recycling. It obligates Member States to take measures to prevent waste generation including reduction of waste generation in processes related to construction and demolition, taking into account best available techniques.

Commission Decision of 18 December 2014, amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC of the European parliament and of the Council (2014/955/EEC) and Commission Regulation (EU) No 1357/2014 of 18 December 2014, replacing Annex III to Directive 2008/98/EC of the European Parliament and of the Council on waste and repealing certain Directives.

This decision (referred to as 'the List of Waste' (LoW)) and regulation consolidate the legislation relating to waste classification and allow the generators of waste to classify the waste as hazardous or non-hazardous and in the process assign the correct List of Waste entry codes. Each list of waste entry is a six digit code which is closely linked to the list of the main characteristics which render waste hazardous contained in Annex III to the Waste Framework Directive. It is noted that Council Regulation (EU) 2017/997 of 8 June 2017 amending Annex 111 to Directive 2008/98//EC of the European parliament and of the Council as regards the hazardous property HP 14 'Ecotoxic' provides additional criteria in relation to determining whether the ecotoxicity of wastes would result in a hazardous classification.

National Legislation

Circular Economy and Miscellaneous Provisions Act 2022

The Circular Economy and Miscellaneous Provisions Act 2022 aims to place the Whole-of-Government Circular Economy Strategy 2022-2023, and the commitment to a circular economy, on a clear statutory footing.

This Act places the Strategy and the commitment to a circular economy on a clear statutory footing. It underpins Ireland's shift from a "take-make-waste" linear model to a more sustainable pattern of production and consumption, that retains the value of resources in our economy for as long as possible and that will to significantly reduce our greenhouse gas emissions. The Act is a key step in the successful transition of Ireland's economy to a circular economy and is evidence of Government's commitment to the achievement of that goal.

Waste Management Acts, 1996, as amended and Regulations Made under the Acts

The Waste Management Act, 1996 was enacted in May 1996 and sets out the responsibilities and functions of various persons in relation to waste. This was subsequently amended by a number of subsequent acts including the Waste Management (Amendment) Act 2001 and the Protection of the Environment Act 2003. The Act:

- Prohibits any person from holding, transporting, recovering or disposing of waste in a manner which causes or is likely to cause environmental pollution.
- Requires any person who carries on activities of an agricultural, commercial or industrial nature to take all such reasonable steps as are necessary to prevent or minimise the production of waste.
- Prohibits the transfer of waste to any person other than an authorised person (i.e. a holder of a waste collection permit or a local authority).
- Requires the Environmental Protection Agency (EPA) to make a national plan in relation to hazardous waste.
- Requires local authorities to make waste management plans in relation to non-hazardous waste.
- Imposes certain obligations on local authorities to ensure that a service is provided for collection of household waste and to provide facilities for the recovery and disposal of such waste.
- Enables the Minister for the Environment and Local Government to make Regulations for various purposes to promote better waste management.
- Provides for substantial penalties for offences including fines, imprisonment and/or liability for clean-up measures.

Waste Management (Collection Permit) Regulations, 2007, S.I. No 820 of 2008, as amended

Waste from the proposed development may only be collected by the holder of a waste collection permit or a local authority. Waste collection permits are granted in accordance with the Waste Management (Collection Permit) Regulations, 2007 as amended. Waste storage and collection areas on site should be designed to prevent environmental pollution. These regulations were amended and updated in 2008, 2012 and 2019.

Waste Management (Shipments of Waste) Regulations 2007, S.I. No. 419 of 2007

Where waste from the proposed development is exported outside of Ireland for recovery or disposal the National Transfrontier Shipment (TFS) Office within Dublin City Council must be notified. Certain financial guarantees must be in place and a certificate issued by the National TFS Office prior to the waste movement taking place.

S.I. No. 323/2020 - European Union (Waste Directive) Regulations 2020 amending European Communities (Waste Directive) Regulations 2011, S.I. No.0126 of 2011

The amended regulations which were adopted in 2011 significantly changed the provisions of the Waste Management Acts, 1996 to 2008.

The 2011 regulations are now amended by S.I. No. 323/2020 - European Union (Waste Directive) Regulations 2020 giving effect to Directive 2018/8511 of the European Parliament and of the Council of 30 May 2018 on waste as per the above. This amends definition of "waste" and "non-hazardous waste."

The Regulations define "waste disposal" and "waste recovery" as well as setting out tests which must be complied with in order for material to be described as a "by-product" or achieve "end of waste" status.

The Regulations formally set out the following waste hierarchy which shall apply as a priority order in waste prevention and management legislation and policy:

(a) prevention;

(b) preparation for re-use;

(c) recycling;

(d) other recovery (including energy recovery); and

(e) disposal.

The Regulations require that all waste management plans and hazardous waste management plans in existence at the commencement of the Regulations shall be evaluated by 31 December 2012 and where appropriate be revised to be brought into line with Directive 2006/12/EC on Waste.

The Regulations also require the Environment Agency to establish a waste prevention programme by December 2013.

European Union (Waste Directive) Regulations 2020 S.I. No. 323/2020

These regulations give effect to Directive 2018/8511 of the European Parliament and of the Council of 30 May 2018 on waste as per the above.

This provides new definitions for a number of key terms including "waste" and "non-hazardous waste", "bio-waste", "waste management", "waste prevention", "backfilling" and "construction and demolition waste".

Policy

European Policy

7th Environmental Action Programme, European Commission (2014)

The 7th Environmental Action Programme came into force in January 2014 and will guide European environment policy until 2020. A key objective of the programme is to turn the Union into a resource-efficient, green and competitive low carbon economy. There is a special focus on turning waste into a resource, with more prevention, re-use and recycling, and phasing out wasteful and damaging practices like landfilling. By 2020 the European Union and member states are to ensure that:

- The environment and human health are protected by preventing or reducing the adverse impacts of the generation and management of waste.
- Per capita waste generation and waste generation in absolute terms are reducing.
- Landfilling is phased out for recyclables and recoverable wastes and limiting energy recovery to non-recyclable materials.

The European Commission published a proposal for an 8th Environmental Action Programme on 14th October 2020. The proposal supports the environment and climate action objectives of the European Green Deal and will form the EU's basis for achieving the United Nation's 2030 Agenda and its Sustainable Development Goals. It is expected that the 8th Environmental Action Programme will be adopted in 2021 – however, a date is yet to be confirmed.

European Commission Circular Economy Strategy (2015; 2018; 2020)

In December 2015, the European Commission adopted an ambitious Circular Economy Package, which includes revised legislative proposals on waste to stimulate Europe's transition towards a circular economy.

The Circular Economy Package consists of an EU Action Plan for the Circular Economy that establishes a programme of action, with measures covering the whole cycle: from production and consumption to waste management and the market for secondary raw materials. The annex to the action plan sets out the timeline when the actions will be completed.

The proposed actions will contribute to "closing the loop" of product lifecycles through greater recycling and re-use and bring benefits for both the environment and the economy.

The revised legislative proposals on waste set clear targets for reduction of waste and establish an ambitious and credible long-term path for waste management and recycling. Key elements of the revised waste proposal include:

- An EU target for recycling 65% of municipal waste by 2030;
- An EU target for recycling 75% of packaging waste by 2030;
- A target to reduce landfill to maximum of 10% of all waste by 2030;
- A ban on landfilling of separately collected waste;
- Promotion of economic instruments to discourage landfilling;
- Simplified, improved definitions and harmonised calculation methods for recycling rates throughout the EU;
- Concrete measures to promote re-use and stimulate industrial symbiosis - turning one industry's by-product into another industry's raw material;
- Economic incentives for producers to put greener products on the market and support recovery and recycling schemes (e.g. for packaging, batteries, electric and electronic equipment, vehicles).

The Circular Economy Package was updated in 2018 to comprise a new set of measures including:

- A Europe-wide EU Strategy for Plastics in the Circular Economy;
- A Communication on options to address the interface between chemical, product and waste legislation;
- A Monitoring Framework on progress towards a circular economy at EU and national level; and
- A Report on Critical Raw Materials and the circular economy.

Key legislative measures adopted to date under the plan include:

- Directive (EU) 2018/851 amending Directive 2008/98/EC on waste;
- Directive (EU) 2018/850 amending Directive 1999/31/EC on the landfill of waste;
- Directive (EU) 2018/852 amending Directive 94/62/EC on packaging and packaging waste; and
- Directive (EU) 2018/849 amending Directives 2000/53/EC on end-of-life vehicles, Directive 2006/66/EC on batteries and accumulators and waste batteries and accumulators, and Directive 2012/19/EU on waste electrical and electronic equipment.

European Commission, 2020. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – A new Circular Economy Action Plan For a cleaner and more competitive Europe. COM (2020).

The European Commission has adopted a new Circular Economy Action Plan, which is one of the main blocks of the European Green Deal, Europe's new agenda for sustainable growth.

The new Action Plan announces initiatives along the entire life cycle of products, targeting for example their design, promoting circular economy processes, fostering sustainable consumption, and aiming to ensure that the resources used are kept in the EU economy for as long as possible.

The new Action Plan introduces legislative and non-legislative measures targeting areas where action at the EU level brings real added value.

The new Circular Economy Action Plan presents measures to:

- Make sustainable products the norm in the EU;
- Empower consumers and public buyers;
- Focus on the sectors that use most resources and where the potential for circularity is high such as: electronics and ICT; batteries and vehicles; packaging; plastics; textiles; construction and buildings; food; water and nutrients;
- Ensure less waste;
- Make circularity work for people, regions and cities; and
- Lead global efforts on circular economy.

European Commission (2019) European Green Deal

The European Green Deal, published by the European Commission in December 2019, provides an action plan to boost the efficient use of resources by moving to a clean, circular economy while cutting pollution and restoring biodiversity.

The plan outlines investments needed and financing tools available. It explains how to ensure a just and inclusive transition.

National Policy

Introduction

The first national waste policy statement was published by the Department of Environment and Local Government in 1998. A number of statements have been published since, each of which builds on the objectives of the previous plans to improve how waste is managed in Ireland, move waste away from landfill and towards a more sustainable option. The statements published to date include:

- Department of the Environment and Local Government (1998). 'Waste Management - Changing Our Ways' – A Policy Statement.
- Department of the Environment and Local Government (2002). Preventing and Recycling Waste – Delivering Change – A Policy Statement.
- Department of the Environment, Heritage and Local Government (2004). Waste Management - Taking Stock and Moving Forward.
- Department of the Environment, Heritage and Local Government (2006). National Strategy on Biodegradable Waste Management.
- Department of the Environment, Heritage and Local Government (2012). A Resource Opportunity- Waste Management Policy in Ireland.

More recent policy documents and reports are summarised below.

EPA National Waste Statistics and Bulletins

The EPA publishes national statistics and bulletins relating to waste generation, management and disposal in Ireland. The published data provides information on key statistics and trends in waste as well as information on Ireland's progress in meeting EU waste collection, recovery and disposal targets. Key topics include municipal waste generation and management; packaging waste, waste electronic and electrical equipment, end of life vehicles, tyres, hazardous waste, construction and demolition waste and waste infrastructure. The data is available on the EPA website at *http://www.epa.ie/nationalwastestatistics/.*

EPA (2014) National Municipal Waste Recovery Capacity. An Assessment for the Department of the Environment, Community and Local Government

In 2012 the EPA were tasked by the Department of the Environment, Community and Local Government (DoECLG) to undertake an assessment of municipal waste recovery infrastructural capacities in the State. This report documents the outcome of that assessment. This task was articulated in the DoECLG publication 'A Resource Opportunity – Waste Management Policy in Ireland' (2012) (see above).

The EPA assessment, undertaken during 2013, has yielded an electronic register holding estimated municipal waste recovery capacity figures for authorised waste activities. The Capacity Register compromises different worksheets containing capacity data on:

- EPA waste licences;
- EPA IPPC licences;
- Sites authorised under an EPA Certificate of Registration;
- Local Authority issued Waste Facility Permits; and
- Local Authority issued Certificates of Registration.

The data in this study reflects a snapshot in time – May 2013 when there was an estimated 5,800 to 6,000 'live' waste facility authorisations in the state. This assessment report presents a synthesis of the Capacity Resister information.

Environmental Protection Agency (2021). National Hazardous Waste Management Plan, 2021 – 2027

An updated National Hazardous Waste Management Plan was published by the Environmental Protection Agency in 2021.

This Plan sets out objectives to be met over the six year life of the plan as follows:

- Support and drive priority prevention actions by industry and the public to reduce the generation of hazardous waste;
- Support the identification of adequate and appropriate collection infrastructure for all hazardous wastes with a view to mitigating environmental and health impacts;
- Endorse the proximity principle such that hazardous wastes are treated as close to the point of production as possible – including within Ireland, taking into account the need for specialised installations for certain types of waste;
- Support effective regulation of the movement and management of hazardous wastes in line with national policy priorities; and
- Promotion of safe reuse and recycling pathways in support of the circular economy.

The plan also includes a range of targets and indicators which provide a means of measuring progress towards the plan objectives.

EPA (2019) Waste Classification – List of Waste and Determining if Waste is hazardous or Non-Hazardous.

Waste classification is based on:

- Commission Decision of 18 December 2014, amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC of the European parliament and of the Council (2014/955/EEC;
- Commission Regulation (EU) No 1357/2014 of 18 December 2014, replacing Annex III to Directive 2008/98/EC of the European Parliament and of the Council on waste and repealing certain Directives; and
- Council Regulation (EU) 2017/997 of 8 June 2017 amending Annex 111 to Directive 2008/98//EC of the European parliament and of the Council as regards the hazardous property HP 14 'Ecotoxic'.

This waste classification system applies across the EU and is the basis for all national and international waste reporting obligations. This document consolidates the Decision and Regulations and provides guidance on how to follow them.

There are two main elements:

- List of Waste (LoW) (Appendix 1); and
- Determining if waste is hazardous or non-hazardous (Appendix 2).

Government of Ireland (2020) A Waste Action Plan for a Circular Economy Ireland's National Waste Policy 2020-2025.

The 'Waste Action Plan for a Circular Economy' is an action focused plan that reflects the 2020 Circular Economy Action Plan 'For a cleaner and more competitive Europe' from the European Commission (see above).

The overarching objectives of this action plan are to:

- Shift the focus away from waste disposal and treatment to ensure that materials and products remain in productive use for longer thereby preventing waste and supporting reuse through a policy framework that discourages the wasting of resources and rewards circularity;
- Make producers who manufacture and sell disposable goods for profit environmentally accountable for the products they place on the market;
- Ensure that measures support sustainable economic models (for example by supporting the use of recycled over virgin materials);

- Harness the reach and influence of all sectors including the voluntary sector, R&D, producers / manufacturers, regulatory bodies, civic society; and
- Support clear and robust institutional arrangements for the waste sector, including through a strengthened role for Local Authorities (LAs).

The plan identifies opportunities for the application of circular economy principles across a range of areas in Ireland including:

- Municipal waste;
- Consumer Protection;
- Food waste;
- Plastic and packaging waste;
- Construction and demolition waste;
- Textiles; and
- Procurement.

Department of the Environment, Climate and Communications (2023) Climate Action Plan

The Climate Action Plan 2023 was published on the 21 December 2022 and represented the second annual update to the Climate Action Plan 2019. The Plan sets out the actions the Government intends to take to address climate breakdown across sectors such as electricity, transport, built environment, industry and agriculture.

The Plan provides that the Government will lead the transformation from waste management to circular economy practice through delivery of a new national policy. The implementation plan for actions by Government and other actors in relation to waste and the circular economy are as follows:

- Publish a Whole-of-Government Circular Economy Strategy and promote the Circular Economy;
- Establish a Circular Economy Innovation Scheme;
- Reduce demand for virgin raw materials and support re-use, by keeping material out of waste streams through streamlined end-of-waste and by-product decision-making processes and national end-of-waste decisions for specific construction and demolition waste streams;
- Continue to drive the rollout of CirculEire, the national programme for circular manufacturing and innovation;
- Develop a Food Waste Prevention Roadmap that sets out a series of actions to deliver the reductions necessary to halve our food waste by 2030 and promote our transition to a circular economy;
- Enhance food waste segregation, collection and treatment (anaerobic digestion and composting);
- Develop and implement a new Regional Waste Management Plans that will guide our transition to a circular economy;
- Develop new and expanded environmental levies to encourage reduced resource consumption and incentivise higher levels of re-use and recycling;
- Begin work on consumer information actions to inform consumer choice aimed at driving improvements in the environmental sustainability of the electronic communications sector;
- Implement Regulation (EU) No 517/2014 on F-Gases; and
- Separate collection obligations extended to include bio-waste by end of 2023.

Department of the Environment, Climate and Communications (2020) Waste Strategy for a Circular Economy

The Waste Action Plan for a Circular Economy fulfils the commitment in the Programme for Government (2020) to publish and start implementing a new National Waste Action Plan. This new national waste policy will inform and give direction to waste planning and management in Ireland over the coming years. It will be followed later this year by an All of Government Circular Economy Strategy.

The previous national waste policy, A Resource Opportunity – Waste management policy in Ireland, drove delivery on national targets under EU legislation, but the Irish and international waste context has changed in the years since its launch. The need to embed climate action in all strands of public policy aligns with the goals of the European Green Deal.

The policy document shifts focus away from waste disposal and moves it back up the production chain. To support the policy, regulation is already being used (Circular Economy Legislative Package) or in the pipeline (Single Use Plastics Directive). The policy document contains over 200 measures across various waste areas including Circular Economy, Municipal Waste, Consumer Protection and Citizen Engagement, Plastics and Packaging, Construction and Demolition, Textiles, Green Public Procurement and Waste Enforcement.

Regional Policy

The Southern Region Waste Management Plan 2015 - 2021

For the purposes of waste management planning, Ireland is now divided into three regions: Southern, Eastern-Midlands, Connacht-Ulster. The Southern Region Includes Cork City Council.

The Southern Region Waste Management Plan 2015 - 2021 was launched in 2015. The strategic approach of the plan places a stronger emphasis on preventing wastes and material reuse activities. Three strategic targets have been set in the plan which include:

- 1% reduction per annum in the quantity of household waste generated per capita over the period of the plan;
- Achieve a recycling rate of 50% of managed municipal waste by 2020; and
- Reduce to 0% the direct disposal of unprocessed residual municipal waste to landfill in favour of higher value pre-treatment processes and indigenous recovery practices.

The plan looks to 2030 and includes a goal of reaching a recycling rate of 60%. Note that the Southern Region Waste Management Plan 2015 - 2021 is currently out of date – however, an updated version of this Plan has not yet been published.

Cork County Development Plan 2022-2028

The Cork County Development Plan 2022-2028 (Cork County Council, 2022) sets out Cork County Council's policies and objectives for the development of the County over the Plan period.

The Council includes a number of waste prevention and management objectives as part of Chapter 15 Biodiversity and Environment. Objectives relevant to the proposed development include the following:

"Objective BE 15-14: Waste Prevention and Management:

a) Support the policy measures and actions outline in

- 'A Waste Action Plan for a Circular Economy Ireland's National Waste Policy 2020-2025', and

- Southern Region Waste Management Plan 2015 – 2021, or any successor plans

b) Support circular and climate resilient economy principles and associated strategic infrastructure, prioritising prevention, reuse, recycling and recovery, and to sustainably manage all types of waste by ensuring the provision of adequate waste recovery, recycling and disposal facilities for the county."

"Objective BE 15-17: Waste Prevention and Management:

a) ....

b) ...

c) Construction and Environmental Management Plans (CEMPs)/ Construction and Demolition Management Plans shall be prepared for larger scale projects as set out in paragraph 15.12.24 and this requirement shall be assessed on a case-by-case basis as part of the development management process.

d) Support the implementation of the recommendations and policies of the National Hazardous Waste Management Plan 2014-2020."

Sections 15.12.23 to Section 15.12.25 of the Cork County Council Development Plan 2022-2028 also outline specific considerations for Construction and Demolition (C&D) waste.

RPS (2020) Construction and Demolition Waste Soil and Stone Recovery/Disposal Capacity Eastern Midlands Region / Connacht Ulster Region / Southern Region Waste Management Plans 2015 – 2021.

This report was undertaken on behalf of the Irish regional waste management offices to analyse the national waste capacity market for safe treatment of waste soils. A review was undertaken of soil waste generation and available capacity to accept soil waste in authorised facilities within the three waste regions.

The report identifies that the future authorised capacity available to recover soil and stones is an issue in each waste region in the context of likely strong construction activity. Possible options recommended include expanding capacities at existing sites and the use of Article 27 By-Product notifications.

Guidance

EPA (2021) Best Practice Guidelines for the Preparation of Resource Management Plans for Construction and Demolition Projects

These guidelines supersede the 'Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Waste Projects' which were published by the Government in July 2006. The replacement guidelines reflect current waste legislation and policy including *'A Waste Action Plan for a Circular Economy Ireland's National Waste Policy 2020-2025'* published in September 2020. Since the publication of the 2006 guidelines, waste management legislation and policy have evolved towards prioritising waste prevention and life-cycle thinking as follows:

- An increased emphasis on waste prevention, in line with the waste hierarchy, through established principles such as designing out waste and the use of green procurement.
- The guidelines have also been prepared to promote more circular design and construction principles in line with the EU Circular Economy Action Plan under the EU Green Deal. The circular economy model tries to avoid using unnecessary resources in the first place and keep resources 'in flow' by means of effective and smart reuse and recycling strategies reducing the use of virgin materials.

The guidelines provide a practical and informed mechanism to document the prevention and management of C&D wastes and resources from design to construction or demolition of a project. They provide clients, developers, designers, practitioners, contractors, sub-contractors and competent authorities with a common approach to preparing and determining Resource and Waste Management Plans (RWMP) for the construction and demolition sector in Ireland.

The guidelines address the best practice approach for the following phases of a project:

- Prior to Construction – including the stages of design, planning and procurement in advance of works on site; and
- During Construction – relating to the effective management of resources and wastes during construction or demolition operations.

European Commission (2016) EU Construction & Demolition Waste Management Protocol

This protocol was published by the European Commission in September 2016.

The overall aim of the protocol is to increase confidence in the C&D waste management process and the trust in the quality of C&D recycled materials. This will be achieved by:

a) Improved waste identification, source separation and collection;

b) Improved waste logistics;

c) Improved waste processing;

d) Quality management; and

e) Appropriate policy and framework conditions.

EPA (2019) Guidance on Soil and Stone By-products in the context of Article 27 of the European Communities (Waste Directive) Regulations 2011

Article 27 of the European Communities (Waste Directive) Regulations, 2011, as substituted by Reg. 15 S.I. No. 323 of 2020, states the following:

'*Economic operators may decide, in accordance with the following conditions of article 27, that their substance or object is a by-product:*

> (a) further use of the substance or object is certain;
>
> (b) the substance or object can be used directly without any further processing other than normal industrial practice;
>
> (c) the substance or object is produced as an integral part of a production process; and
>
> (d) further use is lawful in that the substance or object fulfils all relevant product, environmental and health protection requirements for the specific use and will not lead to overall adverse environmental or human health impacts.'

Decisions made by economic operators under article 27 must be notified to the Environmental Protection Agency. Conditions a) to d) must be satisfied for an Article 27 notification to be successful.

The purpose of the guidance is to inform economic operators how to prevent waste soil and stone by classifying it as a by-product in accordance with the legislation and the EPA's regulatory approach to determinations on soil and stone by-products. This guidance document covers soil and stone only.

It is aimed at local authorities, developers, the construction sector, the waste management sector and consultants.

Its environmental objective is by making certain that excess uncontaminated soil and stone is beneficially used with no overall adverse impacts on the environment or human health, a material producer will ensure that the material is regarded as a by-product rather than a waste.

EPA (2020) By Product - Guidance Note. A guide to by-products and submitting a by-product notification under Article 27 of the European Communities (Waste Directive) Regulations, 2011

This guidance note published in 2020 applies to all other sectors and materials apart from soil and stones. It aims to inform economic operators how to prevent waste by classifying it as a by-product in accordance with the applicable Regulations.

EPA (2020) Draft End of Waste Guidance Part 1 and Part 2

Part 1: describes the context and benefits and introducing the end-of-waste test to potential under Article 28.
Part 2: provides guidance for applicants on how to address the requirements of the end-of-waste test under Article 28 of the European Communities (Waste Directive) Regulations, 2011.

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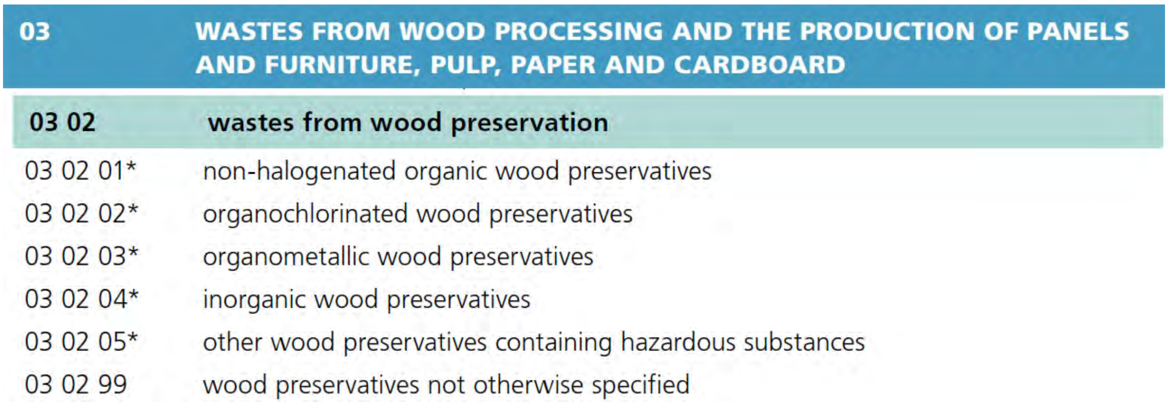
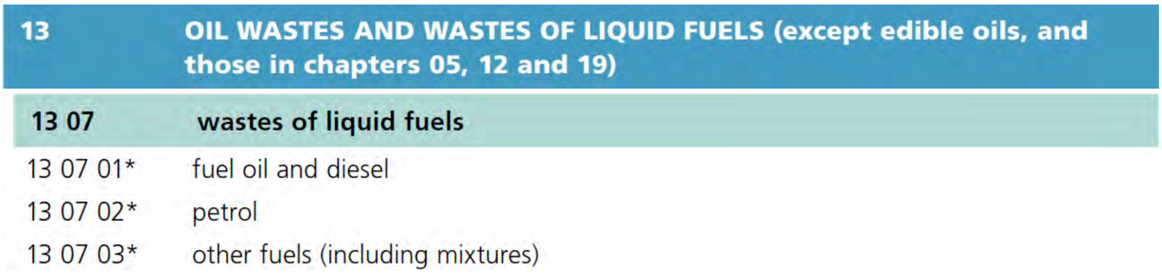
Appendix 15.2

List of Waste Codes for Construction and Demolition Wastes

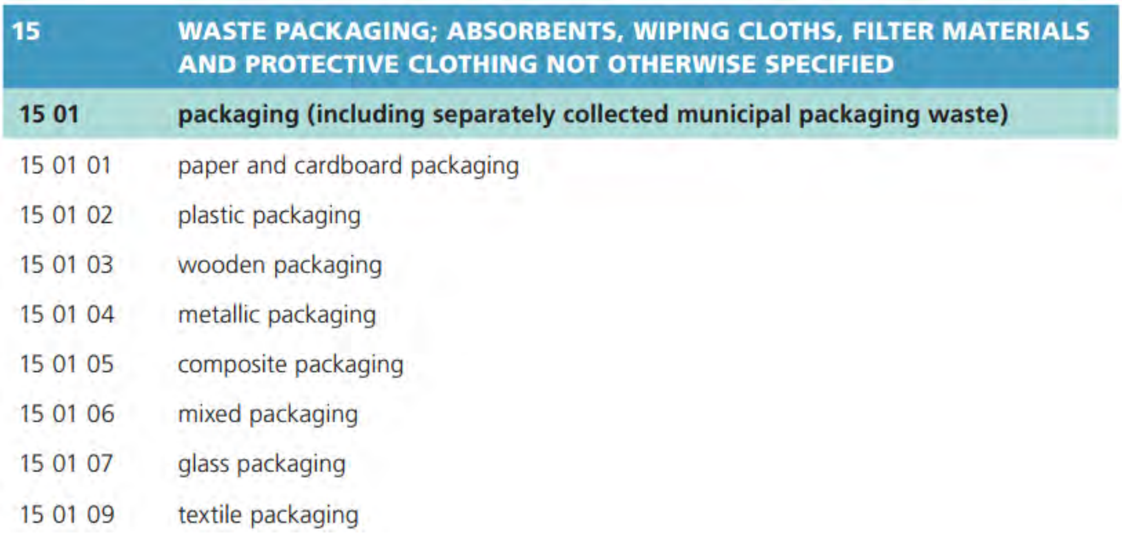
Relevant Waste EWC Codes and Corresponding Waste Descriptions



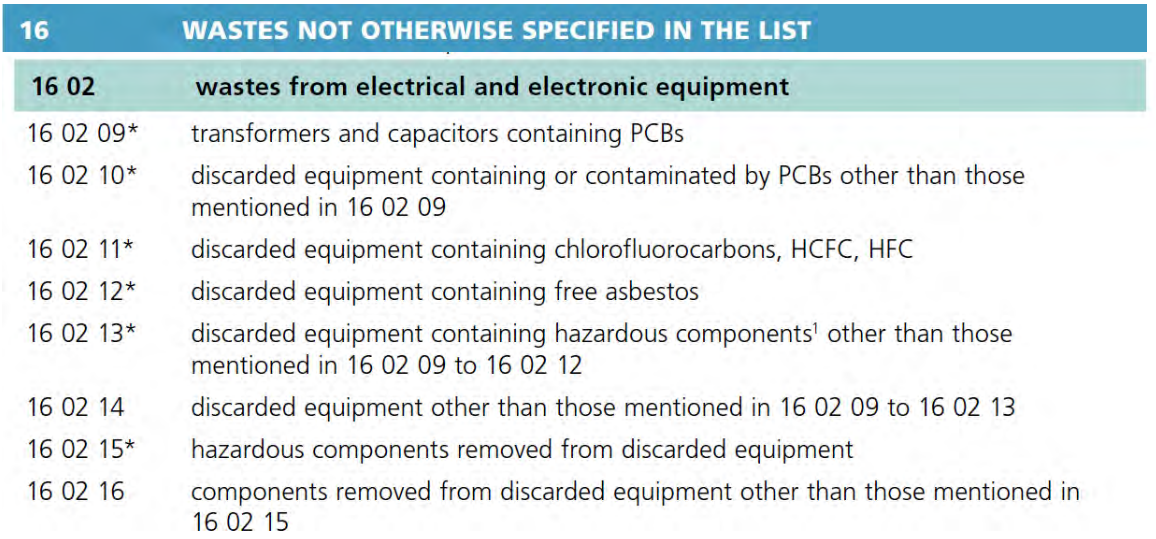
03	WASTES FROM WOOD PROCESSING AND THE PRODUCTION OF PANELS AND FURNITURE, PULP, PAPER AND CARDBOARD
03 02	**wastes from wood preservation**
03 02 01*	non-halogenated organic wood preservatives
03 02 02*	organochlorinated wood preservatives
03 02 03*	organometallic wood preservatives
03 02 04*	inorganic wood preservatives
03 02 05*	other wood preservatives containing hazardous substances
03 02 99	wood preservatives not otherwise specified



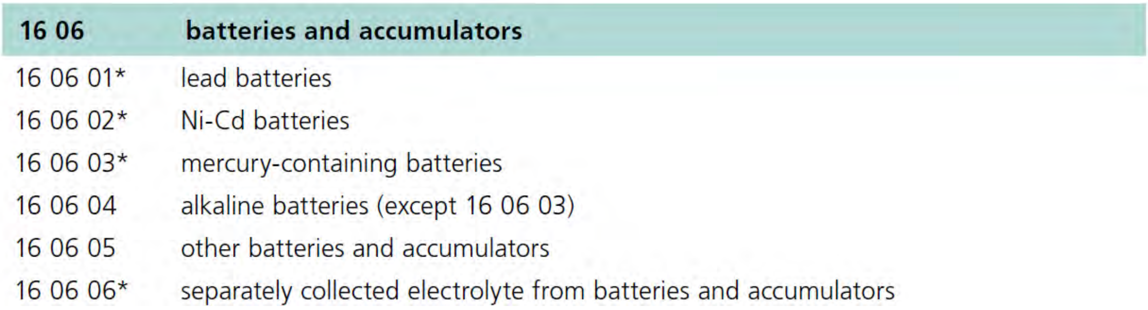
13	OIL WASTES AND WASTES OF LIQUID FUELS (except edible oils, and those in chapters 05, 12 and 19)
13 07	**wastes of liquid fuels**
13 07 01*	fuel oil and diesel
13 07 02*	petrol
13 07 03*	other fuels (including mixtures)



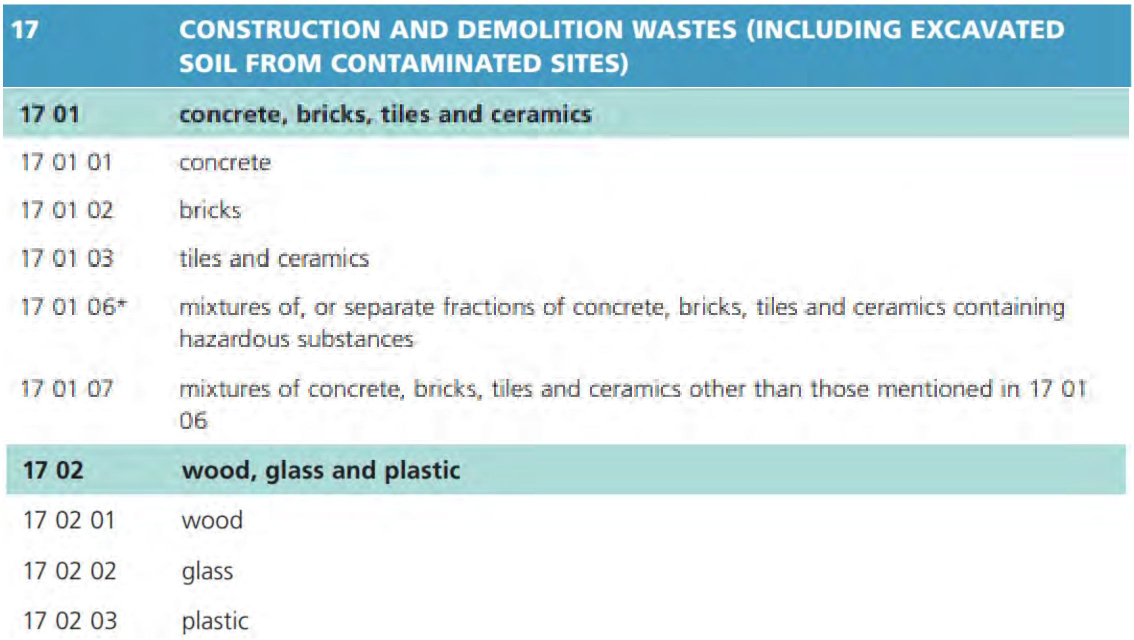
15	WASTE PACKAGING; ABSORBENTS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED
15 01	**packaging (including separately collected municipal packaging waste)**
15 01 01	paper and cardboard packaging
15 01 02	plastic packaging
15 01 03	wooden packaging
15 01 04	metallic packaging
15 01 05	composite packaging
15 01 06	mixed packaging
15 01 07	glass packaging
15 01 09	textile packaging



16	WASTES NOT OTHERWISE SPECIFIED IN THE LIST
16 02	**wastes from electrical and electronic equipment**
16 02 09*	transformers and capacitors containing PCBs
16 02 10*	discarded equipment containing or contaminated by PCBs other than those mentioned in 16 02 09
16 02 11*	discarded equipment containing chlorofluorocarbons, HCFC, HFC
16 02 12*	discarded equipment containing free asbestos
16 02 13*	discarded equipment containing hazardous components[1] other than those mentioned in 16 02 09 to 16 02 12
16 02 14	discarded equipment other than those mentioned in 16 02 09 to 16 02 13
16 02 15*	hazardous components removed from discarded equipment
16 02 16	components removed from discarded equipment other than those mentioned in 16 02 15



16 06	**batteries and accumulators**
16 06 01*	lead batteries
16 06 02*	Ni-Cd batteries
16 06 03*	mercury-containing batteries
16 06 04	alkaline batteries (except 16 06 03)
16 06 05	other batteries and accumulators
16 06 06*	separately collected electrolyte from batteries and accumulators



17	CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)
17 01	**concrete, bricks, tiles and ceramics**
17 01 01	concrete
17 01 02	bricks
17 01 03	tiles and ceramics
17 01 06*	mixtures of, or separate fractions of concrete, bricks, tiles and ceramics containing hazardous substances
17 01 07	mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06
17 02	**wood, glass and plastic**
17 02 01	wood
17 02 02	glass
17 02 03	plastic

17 02 04*	glass, plastic and wood containing or contaminated with hazardous substances
17 03	**bituminous mixtures, coal tar and tarred products**
17 03 01*	bituminous mixtures containing coal tar
17 03 02	bituminous mixtures other than those mentioned in 17 03 01
17 03 03*	coal tar and tarred products
17 04	**metals (including their alloys)**
17 04 01	copper, bronze, brass
17 04 02	aluminium
17 04 03	lead
17 04 04	zinc
17 04 05	iron and steel
17 04 06	tin
17 04 07	mixed metals
17 04 09*	metal waste contaminated with hazardous substances
17 04 10*	cables containing oil, coal tar and other hazardous substances
17 04 11	cables other than those mentioned in 17 04 10
17 05	**soil (including excavated soil from contaminated sites), stones and dredging spoil**
17 05 03*	soil and stones containing hazardous substances
17 05 04	soil and stones other than those mentioned in 17 05 03
17 05 05*	dredging spoil containing hazardous substances
17 05 06	dredging spoil other than those mentioned in 17 05 05
17 05 07*	track ballast containing hazardous substances
17 05 08	track ballast other than those mentioned in 17 05 07
17 06	**insulation materials and asbestos-containing construction materials**
17 06 01*	insulation materials containing asbestos
17 06 03*	other insulation materials consisting of or containing hazardous substances
17 06 04	insulation materials other than those mentioned in 17 06 01 and 17 06 03
17 06 05*	construction materials containing asbestos
17 08	**gypsum-based construction material**
17 08 01*	gypsum-based construction materials contaminated with hazardous substances
17 08 02	gypsum-based construction materials other than those mentioned in 17 08 01
17 09	**other construction and demolition wastes**
17 09 01*	construction and demolition wastes containing mercury

17 09 02*	construction and demolition wastes containing PCB (for example PCB-containing sealants, PCB-containing resin-based floorings, PCB-containing sealed glazing units, PCB-containing capacitors)
17 09 03*	other construction and demolition wastes (including mixed wastes) containing hazardous substances
17 09 04	mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03

20	**MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS**
20 01	**separately collected fractions (except 15 01)**
20 01 01	paper and cardboard
20 01 02	glass
20 01 08	biodegradable kitchen and canteen waste
20 01 11	textiles
20 01 21*	fluorescent tubes and other mercury-containing waste
20 01 25	edible oil and fat
20 01 27*	paint, inks, adhesives and resins containing hazardous substances
20 01 33*	batteries and accumulators included in 16 06 01, 16 06 02 or 16 06 03 and unsorted batteries and accumulators containing these batteries
20 01 36	discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35
20 01 39	plastics
20 01 40	metals
20 03	**other municipal wastes**
20 03 01	mixed municipal waste
20 03 07	bulky waste

Appendix 15.3

Construction Resource and Waste Management Plan

Contents

Tables

Images

Appendices

1. Introduction

1.1 Overview

This report sets out the Construction Resource and Waste Management Plan (CRWMP) prepared by Arup as part of the planning application for the proposed pedestrian and cyclist bridge at Little Island, Co. Cork (hereafter referred to as the '*Proposed Development*').

The content presented in this CRWMP has regards to the guidance outlined in the following documents:

- Environmental Protection Agency Best Practice Guidelines for the Preparation of Resource Management Plans for Construction and Demolition Projects – (EPA, 2021) (Tier 2 development guidance applied); and
- The EU Construction & Demolition Waste Management Protocol (European Commission, 2016).

Waste management objectives, policy and legislation are outlined in this Section.

Subsequent Sections are included in this report which address the roles and responsibilities of relevant personnel (**Section 3**), details regarding wastes arising (**Section 4.2** – **Section 4.4**), the costs of waste management (**Section 4.6**), waste collection (**Section 5.3**), waste recovery/disposal off site (**Section 5.4**), and record keeping (**Section 5.5**).

Following appointment, the contractor will be responsible for detailing and maintaining this report and updating it as appropriate. The responsibilities as set out in the EPA Guidelines are included in **Appendix A**.

1.2 Waste Management Objectives

The principal objective of sustainable resource and waste management is to use material resources more efficiently, to re-use, recycle and recover material and to reduce the amount of waste requiring final disposal. The value of products, material and resources should be maintained in the economy for as long as possible such that the generation of waste is minimised.

To achieve resource efficiency there is a need to move from a traditional linear economy to a circular economy (refer to **Image 1**).

The Department of Environment, Climate and Communication's (DECC) A Waste Action Plan for a Circular Economy – Ireland's National Waste Policy 2020 – 2025 (DECC 2020) notes that:

> *"In a circular economy the value of products and materials is maintained for as long as possible; waste and resource use are minimised, and resources are kept within the economy when a product has reached the end of its life, to be used again and again to create further value."*

The EU Circular Economy Action Plan (European Commission, 2020) notes that:

> *"the EU needs to accelerate the transition towards a regenerative growth model that gives back to the planet more than it takes, advance towards keeping its resource consumption within planetary boundaries, and therefore strive to reduce its consumption footprint and double its circular material use rate in the coming decade."*

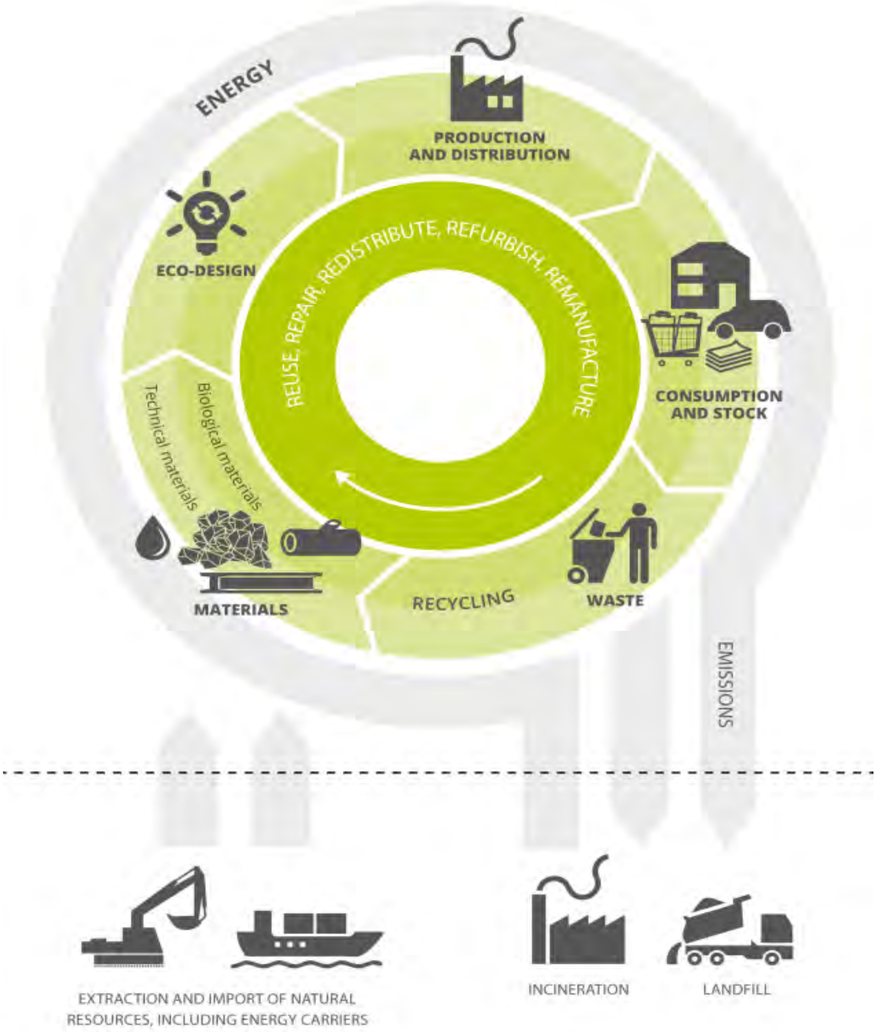


Image 1: A simplified model of the circular economy for materials and energy (European Environment Agency, 2016)

Where residual waste generation is unavoidable, it will be dealt with in a way that follows the waste hierarchy (as illustrated in **Image 2**) and set out in Directive 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste (hereafter referred to as the 'Waste Framework Directive').

The European Commission has adopted a new Circular Economy Action Plan (EC, 2020) - one of the main blocks of the European Green Deal, Europe's new agenda for sustainable growth. The Circular Economy Action Plan identifies buildings and construction as a key area where there are opportunities for resource efficiency and circularity.

The Department of the Environment, Climate and Communications published the Irish Waste Action Plan for a Circular Economy in September 2020 (DECC, 2020). The Plan outlines the commitment in the new Programme for Government to implement a new National Waste Action Plan providing new waste policy and giving direction to waste planning and management in Ireland.

The policy document contains over 200 measures across various waste areas including Circular Economy, Municipal Waste, Consumer Protection and Citizen Engagement, Plastics and Packaging, Construction and Demolition, Textiles, Green Public Procurement and Waste Enforcement.

The Plan includes the target of preparing for reuse, recycling and other material recovery (including beneficial backfilling operations using waste as a substitute) of 70% by weight of Construction and Demolition non-hazardous waste (excluding natural soils & stone).

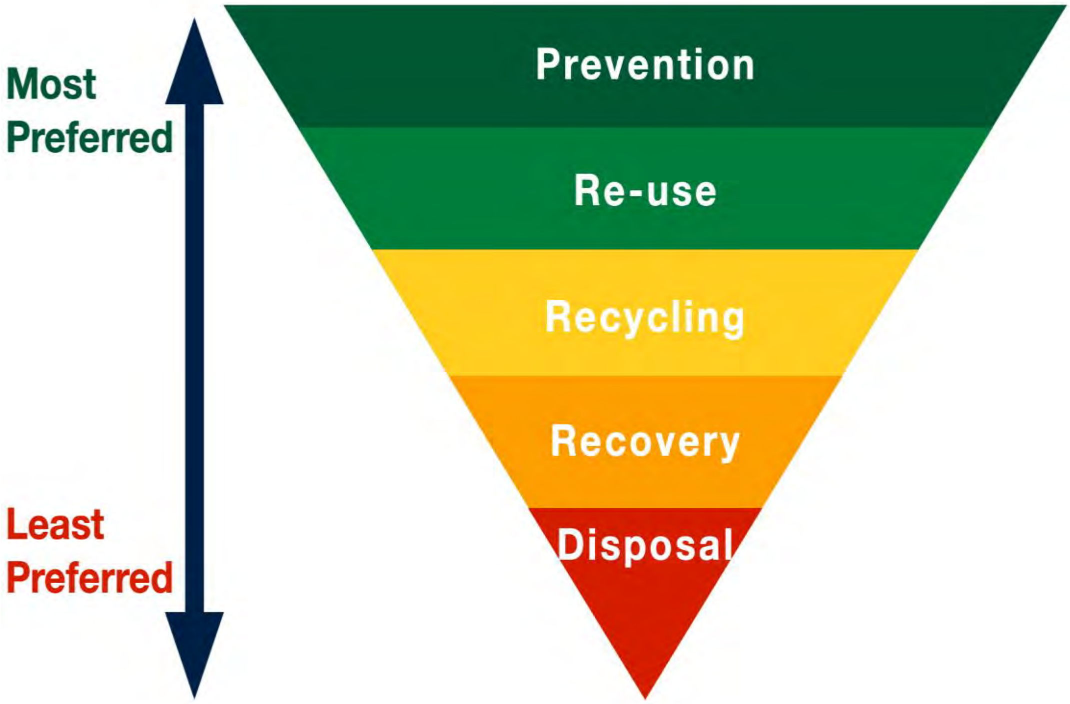


Image 2: Waste hierarchy

The Department of Environment, Climate and Communications published the 'Whole-of-Government Circular Economy Strategy 2022-2023' (DECC, 2021a) in December 2021. The Strategy aims to support and implement measures that significantly reduce Ireland's circularity gap, so that Ireland's rate is above the EU average by 2030.

In July 2022, the Circular Economy and Miscellaneous Provisions Act 2022 was signed into law (Government of Ireland, 2022). This Act aims to place the Strategy, and the commitment to a circular economy, on a clear statutory footing. It underpins Ireland's shift from a "take-make-waste" linear model to a more sustainable pattern of production and consumption, that retains the value of resources in our economy for as long as possible and that will to significantly reduce our greenhouse gas emissions. The Act is a key step in the successful transition of Ireland's economy to a circular economy and is evidence of Government's commitment to the achievement of that goal.

It also aims to streamline the statutory mechanisms for construction and demolition material reuse which are known as 'Article 27' and 'Article 28'.

The objectives of this CRWMP will facilitate reuse and recycling and divert waste from landfill. The content and headings used in this CRWMP comply with the EPA Best Practice Guidelines for the Preparation of Resource Management Plans for Construction and Demolition Projects (EPA, 2021).

Following appointment, the contractor will be responsible for detailing and maintaining this CRWMP and updating it as appropriate.

1.3 Waste Management Legislation, Policy and Guidance

Resource and waste management takes place in a legislative and policy framework. Applicable legislation, policy and best practice guidance was reviewed during preparation of this CRWMP.

The key components of EU, national and local policy, legislation and guidance relevant to proposed site clearance and construction are summarised as follows:

- prevention and minimisation of waste is the preferred option;
- where construction waste is generated, it should be source separated to facilitate reuse and recycling and to maximise diversion of waste from landfill;
- where waste may not be prevented or recycled it should be transported and disposed of in accordance with applicable legislation and without causing environmental pollution; and
- waste may only be transferred by a waste collection permit holder and delivered to an authorised waste facility.

An overview of relevant legislation, policy and best practice guidance related to waste management is presented in **Appendix B**, with a summary of key documents provided below.

1.3.1 Southern Region Waste Management Plan 2015 - 2021

For the purposes of waste management planning, Ireland is now divided into three regions: Southern, Eastern-Midlands, Connacht-Ulster. The Southern Region includes Cork County Council. The Southern Region Waste Management Plan 2015 - 2021 was launched in 2015 (Limerick City & County Council/Tipperary County Council, 2015). The strategic approach of the plan places a stronger emphasis on preventing wastes and material reuse activities. Three strategic targets have been set in the plan which include:

- 1% reduction per annum in the quantity of household waste generated per capita over the period of the plan;
- Achieve a recycling rate of 50% of managed municipal waste by 2020; and
- Reduce to 0% the direct disposal of unprocessed residual municipal waste to landfill in favour of higher value pre-treatment processes and indigenous recovery practices.

The plan looks to 2030 and includes a goal of reaching a recycling rate of 60%. Note that the Southern Region Waste Management Plan 2015 - 2021 is currently out of date – a National Waste Management Plan for a Circular Economy is currently being prepared to replace the existing Regional Waste Management Plans, including the Southern Region Waste Management Plan 2015 – 2021.

1.3.2 A Waste Action Plan for a Circular Economy – Ireland’s National Waste Policy 2020-2025

‘A Waste Action Plan for a Circular Economy’ was published in 2020 (DECC, 2020) and fulfils the commitment in the Programme for Government to publish and start implementing a new National Waste Action Plan. The policy document shifts focus away from waste disposal and moves it back up the production chain. It contains over 200 measures across various waste areas including Circular Economy, Municipal Waste, Consumer Protection and Citizen Engagement, Plastics and Packaging, Construction and Demolition, Textiles, Green Public Procurement and Waste Enforcement.

The overarching objectives of this action plan are to:

- Shift the focus away from waste disposal and treatment to ensure that materials and products remain in productive use for longer, thereby preventing waste and supporting reuse through a policy framework that discourages the wasting of resources and rewards circularity;
- Make producers who manufacture and sell disposable goods for profit environmentally accountable for the products they place on the market;
- Ensure that measures support sustainable economic models (for example by supporting the use of recycled over virgin materials);
- Harness the reach and influence of all sectors including the voluntary sector, R&D, producers / manufacturers, regulatory bodies, civic society; and
- Support clear and robust institutional arrangements for the waste sector, including through a strengthened role for local authorities.

The plan identifies opportunities for the application of circular economy principles across a range of areas in Ireland, including C&D waste.

1.3.3 Construction and Demolition Waste Soil and Stone Recovery / Disposal Capacity Update Report 2020

The Regional Waste Management Planning Offices (RWMPOs) quantified and analysed national capacity within the market for the management of soil and stone waste arisings, including hazardous material, based on 2018 data, and published this in 2020. This report (RWMPOs, 2020) updates the most recent previous Soil and Stone Recovery / Disposal Capacity report published in 2016.

The report shows that the Covid-19 crisis significantly impacted development and construction. The forecast for 2023 predicted a continued gradual return to normal economic activity. By the end of 2029, it is forecast that C&D waste will grow to a total of 10.1m tonnes per annum. The corresponding forecast data for soil and stone waste is 8.7m tonnes by end of 2029. The report indicates that there is sufficient capacity at licenced facilities. As per the report, there are seven soil recovery facilities in the EPA licensing system for the Southern Region (SR). The annual active licenced capacity for the SR, at end-2018, was 525,000 tonnes.

1.3.4 Cork County Development Plan 2022 – 2028

The Cork County Development Plan 2022-2028 (Cork County Council, 2022) sets out Cork County Council's policies and objectives for the development of the County over the Plan period.

The Council includes a number of waste prevention and management objectives as part of Chapter 15 Biodiversity and Environment. Objectives relevant to the Proposed Development include the following:

"Objective BE 15-14: Waste Prevention and Management:

a) Support the policy measures and actions outline in

- 'A Waste Action Plan for a Circular Economy Ireland's National Waste Policy 2020-2025', and

- Southern Region Waste Management Plan 2015 – 2021, or any successor plans

b) Support circular and climate resilient economy principles and associated strategic infrastructure, prioritising prevention, reuse, recycling and recovery, and to sustainably manage all types of waste by ensuring the provision of adequate waste recovery, recycling and disposal facilities for the county."

"Objective BE 15-17: Waste Prevention and Management:

a) Planning applications for infilling of marginal land through soil importation will be supported where it can be demonstrated that the developments accord with proper planning and sustainable development, *ensuring that they are compatible with the protection of environmental resources including water quality, Natura 2000 sites, biodiversity, archaeological and landscape resources.*

b) Support will be provided for locating suitable sites within the county for the safe disposal of construction and demolition waste in conjunction with the Southern Waste Region.

c) Construction and Environmental Management Plans (CEMPs)/Construction and Demolition Management Plans shall be prepared for larger scale projects as set out in paragraph 15.12.24 and this requirement shall be assessed on a case-by-case basis as part of the development management process.

d) Support the implementation of the recommendations and policies of the National Hazardous Waste Management Plan 2014-2020."

Sections 15.12.23 to Section 15.12.25 of the Cork County Council Development Plan 2022-2028 also outline specific considerations for Construction and Demolition (C&D) waste.

1.3.5 European Commission (2016) EU Construction & Demolition Waste Management Protocol

This protocol was published by the European Commission in September 2016 (European Commission, 2016). The overall aim of the protocol is to increase confidence in the Construction and Demolition (C&D) waste management process and the trust in the quality of C&D recycled materials. This will be achieved by:

a) Improved waste identification, source separation and collection;

b) Improved waste logistics;

c) Improved waste processing;

d) Quality management; and

e) Appropriate policy and framework conditions.

1.3.6 Best Practice Guidelines for the Preparation of Resource Management Plans for Construction and Demolition Projects (EPA, 2021)

These guidelines were published in 2021 (EPA, 2021) and supersede the guidelines published by the Government in 2006 (DEHLG, 2006).

The replacement guidelines reflect current waste legislation and policy including 'A Waste Action Plan for a Circular Economy: Ireland's National Waste Policy 2020-2025' (DECC, 2020). Since the publication of the 2006 guidelines, waste management legislation and policy have evolved towards prioritising waste prevention and life-cycle thinking through an increased emphasis on waste prevention and the promotion of circular design and construction principles in line with the EU Circular Economy Action Plan under the EU Green Deal.

The guidelines address the best practice approach for the following phases of a project:

- Prior to Construction – including the stages of design, planning and procurement in advance of works on site; and
- During Construction – relating to the effective management of resources and wastes during construction or demolition operations.

2. Description of the Proposed Development

2.1 Proposed Development

The Proposed Development will include the construction of a new pedestrian and cyclist bridge and associated ramps over the existing N25. The Proposed Development will be located approximately 10km to the east of Cork City and will cross over the N25 and the Cork City to Middleton Cobh railway line, connecting the Little Island Train Station, the Glounthaune Road and the future greenway to the Eastgate Business Park in Little Island, Cork. The Proposed Development site is bounded by the Glounthuane Road to the north and the Eastgate Business Park to the south. When operational, it will function as an active travel link for pedestrians and cyclists to travel from the Little Island Train station and surrounds to the Eastgate Business Park and further surrounds of Little Island.

Refer to **Image 3** for a site location map showing the site boundary.

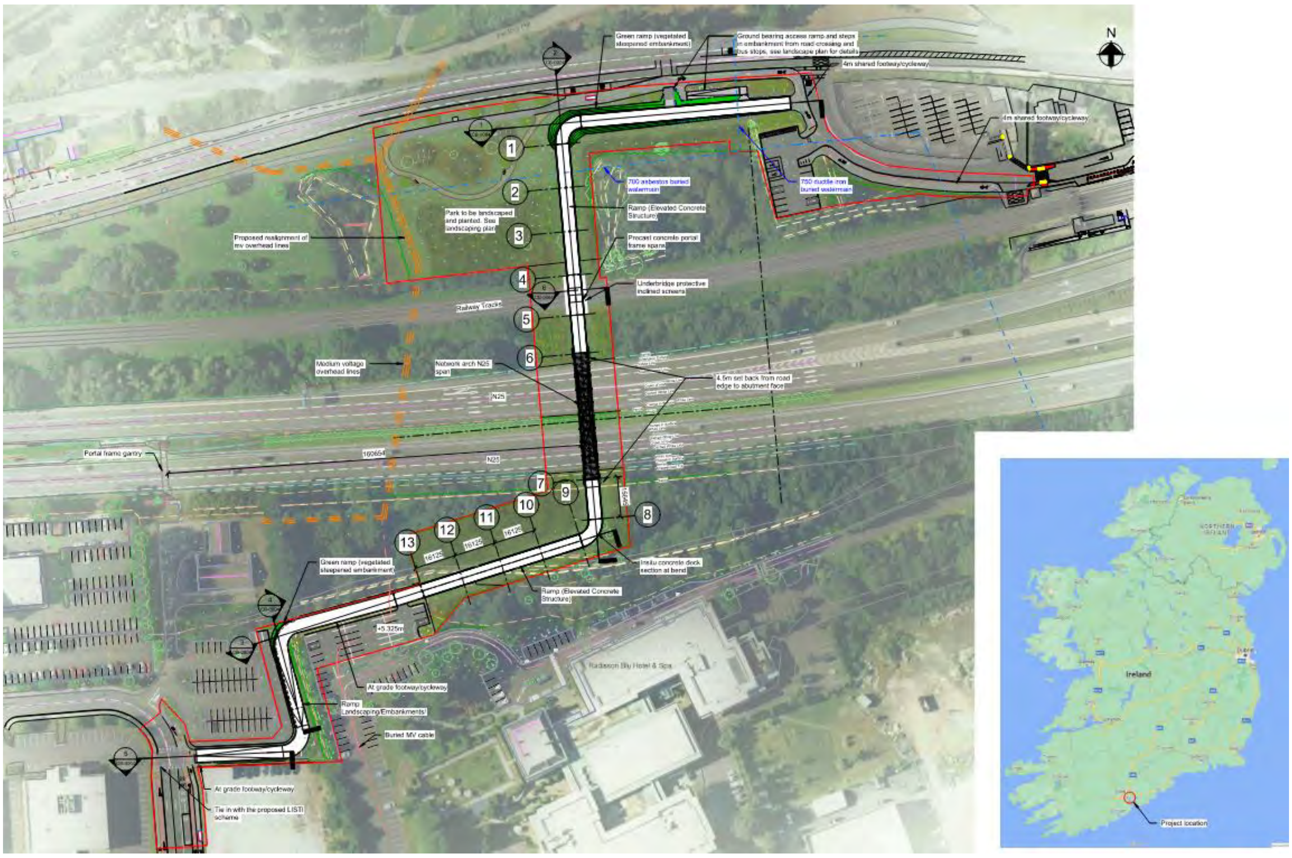


Image 3: Site location map showing site boundary. Not to scale.

There are no buildings or structures currently present on the proposed site which will require demolition. However, clearance of some areas of the site will be required, with the resultant generation of organic materials. Excavated material will also be generated from the Proposed Development. This material will generally consist of made ground, topsoil and subsoil, and pile generated spoil material.

2.2 Receiving Environment

In 2021, the latest year for which there are published statistics available, 9 million tonnes of C&D waste were generated in Ireland, representing an increase of 0.8 million tonnes from 2020 (EPA, 2023a). Of this waste, approximately 7.7 million tonnes comprised soil and stones, making up approximately 85% of the material waste stream.

A breakdown of the composition of C&D waste in Ireland in 2021 is set out in **Table 1**. These figures should be considered as a guide only as C&D waste can vary significantly from one project to another, depending on the nature of the development and the waste management practices employed on-site.

Table 1: Composition of C&D waste material collected in Ireland in 2021 (EPA, 2023a)

C&D waste type	Quantity (tonnes)	% of material stream in reference to total
Soils, stones & dredging spoil	7,696,287	85.1%
Concrete, brick, tile & gypsum	608,235	6.7%
Mixed C&D waste	362,380	4.0%
Metal	257,558	2.8%
Bituminous mixtures	87,343	1.0%
Segregated wood, glass & plastic	31,946	0.4%
Total	**9,043,749**	**100%**

Data issued by the EPA demonstrates that final treatment operations (backfilling, recycling, energy recovery, disposal) of C&D waste materials varied greatly between material streams. By far the largest quantity of C&D waste was used for backfilling (a recovery operation), which mainly reflects the dominance of soil and stones in the overall composition mix.

The EPA reports that Ireland achieved 85% material recovery of construction and demolition waste in 2021 (EPA, 2023a). Under the Waste Framework Directive (2008/98/EC) Member States must achieve 70% of material recovery of non-hazardous, non-soil-and-stone C&D waste by 2020.

Article 27 of the European Union (Waste Directive) Regulations 2020 allows a material producer to declare, under prescribed circumstances, that a material is a by-product and not a waste and so can be reused onsite or offsite within the industry.

On receipt of Article 27 notifications at the EPA, materials can be determined as a waste or a by-product. In some cases, no determination is issued by the EPA, meaning the material has not been determined as a waste. In 2021, the EPA assessed 123 by-product notifications. The EPA determined that 459,836 tonnes of the soil and stone notified were by-product, and 600 tonnes were waste. Notifications for 152,400 tonnes were withdrawn (EPA, 2023a).

The EPA reports that a total of 466,941 tonnes of hazardous waste was generated in Ireland in 2021, representing a decrease of 16 per cent (over 90,000 tonnes) from 2020 (EPA, 2023b). Hazardous waste types include wastes from dredging spoil, contaminated soils, waste treatment, solvents and hazardous elements of waste electrical and electronic equipment. In 2021, 52% of hazardous waste was treated in Ireland and 48% of hazardous waste was exported. Hazardous waste treatment in Ireland takes place on site of generation (95,130 tonnes) or at Irish hazardous waste management facilities (148,575 tonnes).

A report entitled Essential Aggregates: Providing for Ireland’s Needs to 2040 (Irish Concrete Federation, 2019) was published in 2019 which details and quantifies Ireland’s natural aggregate reserves. At the time of publication of that report, Ireland had approximately 500 active large commercial quarries, approximately 220 ready mixed concrete plants, 20 large scale precast concrete plants and 40 plants producing bitumen bound road surfacing materials.

The Irish Concrete Federation quantifies the annual production of these materials in Ireland on their website (Irish Concrete Federation, 2023), with the 2019 figures (the most recent available) being as follows:

- Five million cubic metres of ready-mixed concrete;
- 135 million concrete blocks;
- 38 million tonnes of aggregates;
- Two million tonnes of bituminous road surfacing materials; and
- Two million square metres of paving products.

3. Role and Responsibilities

Copies of the CRWMP will be made available to all relevant personnel on site. All site personnel and sub-contractors will be instructed about the objectives of the CRWMP and informed of their responsibilities.

The nominated Resource Manager (RM) responsible for implementation of this CRWMP will be identified prior to construction commencement. The RM will be responsible for informing contractor staff and sub-contractors of content of the CRWMP and for maintaining and keeping the Records set out in **Section 5**. In the event of the RM leaving the project team the contractor will nominate a suitable replacement.

The RM will be responsible for conducting ongoing resource audits at the site during construction. The RM shall ensure that where training is required regarding the handling and management of wastes on site that this is provided to staff as required.

4. Key Materials, Quantities and Costs

4.1 Introduction

Construction and demolition (C&D) waste is defined as waste which arises from construction, renovation and demolition activities.

Also included within the definition are surplus and damaged products and materials arising in the course of construction work or used temporarily during the course of on-site activities.

Typical construction waste types which are likely to arise during the proposed site clearance, excavation and construction works are set out **Appendix C**, including EPA List of Wastes (LOW) codes.

The contractor will ensure that waste generation on site is minimised, and that waste removed from site for recovery or disposal is reduced where feasible.

Further details on site clearance, excavation and construction waste arisings during the construction works are presented in **Section 4.2** to **Section 4.4** below, along with information on the import of materials required for the construction of the proposed bridge (**Section 4.5**). Details on the costs associated with resource and waste management are presented in **Section 4.6**.

4.2 Site Clearance Waste Arisings

The first stage of the construction works will involve site preparation and clearance. Clearance of the site will include the removal of any vegetation, soil and stone or other materials.

Organic materials, including vegetation from shrub, tree or grass clearance or deposits removed from within drainage ditches, will generate only minor quantities of waste material for treatment at organic waste facilities.

It is estimated that approximately 415 tonnes of cleared vegetation will be generated as a result of the Proposed Development.

There are no buildings or structures currently present on the proposed site which will require demolition.

Further details on the management of site clearance waste are provided in **Section 5.1**.

4.3 Excavation Waste Arisings

Excavation waste will arise from such activities as:

- Excavation for utility diversions;
- Excavation for footways / embankments;
- Excavation for piling works; and
- Excavation for foundations / piers.

In total, it is estimated that the construction of the Proposed Development will require the excavation of approximately 5,950 tonnes (bulk weight) of material. This material will comprise made ground, topsoil and subsoil.

It is estimated that approximately 300mm will need to be excavated under the proposed embankments and tie ins at grade footways / cycleways to allow for competent formation layers to be placed. The total amount of material estimated to be generated from these works will be approximately 2,260 tonnes (bulk weight).

In addition to the excavated topsoil, it is estimated that approximately 1,950 tonnes (bulk weight) of piling spoil material and approximately 1,740 tonnes (bulk weight) of excavated material for the pile caps will be generated.

Following the completion of the construction works, it is estimated that approximately 32,400 tonnes of construction surfacing material will be removed from site.

Refer to **Chapter 17**, *Land, Soils, Geology and Hydrogeology* in **Volume 2** of EIAR for further details on the excavation material within the Proposed Development site.

Further details on the management of excavation waste are provided in **Section 5.1**.

4.4 Construction Waste Arisings

A description of typical wastes from construction projects including their respective LoW Codes are outlined in **Table 2**.

Table 2: Typical construction waste LoW codes and corresponding waste descriptions (EPA, 2019)

LoW Code	Waste Categories
17 01*	Concrete, bricks, tiles and ceramics
17 02*	Wood, Glass and Plastic
17 03*	Bituminous mixtures, coal tar and tarred products
17 04*	Metals
17 05*	Soil (incl. excavated soil from contaminated sites), stones and degrading spoil
17 08*	Gypsum-based construction materials
17 09*	Other Construction and Demolition Waste
16 02*	WEEE
16 06*	Batteries
03 02*	Wood Preservatives
17 05 03**	Contaminated Soils
13 07*	Liquid Fuels

*May include hazardous wastes

**Hazardous

In the case of the Proposed Development, the most likely type of general construction waste will be surplus concrete and steel that may arise on-site. Quantities of these materials are estimated to be small, assumed to be between approximately 5% to 15% of construction material delivered to site (WRAP, 2014). There is adequate capacity for the management of such wastes. Segregation facilities will be provided to ensure that recovery and recycling of such wastes are maximised. The contractor will ensure that waste generation on site is minimised, and that waste removed from site for recovery or disposal is reduced where feasible.

4.5 Imported Material

The Construction Phase will require the importation of a number of key construction materials for the Proposed Development works. Importation of material to the Proposed Development site will be carried out throughout the Construction Phase, with different materials being required at different times. This material will include items such as primarily concrete, crushed stone, embankment build-up, footway / cycleway paving materials, steelwork, reinforcement steel and precast concrete sections.

Table 3 provides an estimate of the quantities of the major materials required to complete the Construction Phase of the Proposed Development.

Table 3: Estimated quantities of major construction materials required.

Material	Estimated quantity
Concrete	3,000 tonnes
Clause 804 Hardcore	32,400 tonnes
Reinforcing steel	187,000 kg
Structural steelwork	55 tonnes N25 span + 33 tonnes parapets
Precast concrete elements	930 tonnes

Material	Estimated quantity
Embankment fill	5,560 tonnes
Link footway / cycleway surfacing	1,930 tonnes

The quantities of materials listed in **Table 3** represent a very small proportion of the Irish quantities manufactured per year. As an example, the estimated quantity of concrete required represents less than one percent of the total quantity produced in Ireland per annum.

4.6 Costs of Resource Management

As required by the Best Practice Guidelines for the Preparation of Resource Management Plans for Construction and Demolition Projects (EPA, 2021), this section addresses costs of resource management.

While landfill disposal has been the most commonly used method for waste management in Ireland in the past, waste to energy incinerators are also now in operation at Poolbeg, Dublin 4 and in Carranstown, County Meath.

Typically, the current cost of disposal of waste to landfill in Ireland exceeds €170 per tonne. In accordance with the Waste Management (Landfill Levy) Regulations 2015, the 'landfill levy' is €75 per tonne for waste disposed to landfill. Disposal of hazardous waste can cost from €350 upwards.

In addition to landfill operator fees and landfill levies, there are additional costs included in the 'true cost of resource management' including:

- The purchase cost of waste materials (including imported soil);
- Handling costs;
- Storage and transportation costs; and
- Revenue generated from sales.

Therefore, in order to reduce costs associated with resource management, surplus materials should be reused and recycled where possible, and materials should be carefully stored and handled to minimise risk of damage.

5. Site Management

The contractor will ultimately be responsible for the management of resources on a project and agreeing and revising as necessary any commitments or targets included in the CRWMP developed at design/planning with the Client for acceptance and adoption in the CRWMP for construction.

The contractor will allocate responsibility for resource management to one or more individuals of sufficient seniority to put the relevant procedures into practice. The contractor will nominate a suitably qualified Resource Manager (RM) with expertise in waste and resource management to implement the CRWMP.

The nominated RM responsible for implementation of this CRWMP will be identified prior to construction commencement.

Copies of the CRWMP will be made available to all relevant personnel on site.

All site personnel and sub-contractors will be provided with a copy of the CRWMP and will be informed of the objectives of the CRWMP and their responsibilities in relation to compliance with the CRWMP.

The RM shall ensure that where training is required regarding the handling and management of wastes on site that this is provided to staff as required and that the CRWMP is included in site induction training.

The RM will be responsible for informing contractor staff and sub-contractors of content of the CRWMP and for maintaining and keeping the Records set out below.

In the event of the RM leaving the project team the contractor will nominate a suitable replacement.

5.1 Site Clearance and Excavation Waste Management

Organic materials (such as vegetation from shrub, tree or grass clearance or deposits removed from within drainage ditches) will be removed from site by a waste collection permit holder and delivered to an authorised composting or organic waste facility. The extent of vegetation clearance will not be significant. The vegetation clearance will be kept to the minimum required to facilitate construction.

Possibilities for re-use of clean, non-hazardous excavation material in construction works, as fill or in landscaping works on site will be considered following appropriate testing to ensure the material is suitable for its proposed end use. Should such suitable material arise and be re-used on site it will be exempt from waste regulations.

Excavation material, which is not suitable for reuse on site, or surplus to requirements, will be stockpiled, tested and classified. Where feasible classification for reuse on other construction site(s), for example as a “by product” under Article 27, will be considered. Where the material is not suitable for reuse it will be categorised in accordance with the EPA List of Waste and Determining if Waste is Hazardous or Non-hazardous (EPA, 2018).

Waste may only be transferred from site by a waste collection permit holder and delivered to an authorised waste facility (i.e., a facility which holds a Certificate of Registration, Waste Facility Permit or Waste Licence) for the specific waste types it receives.

Where removal from site of construction by-products for further use is proposed, this will take place in compliance with Article 27 of the European Communities (Waste Directive) Regulations, 2011, where appropriate. The contractor will be responsible for ensuring compliance with this article where appropriate.

Should excavated material containing hazardous substances be discovered as part of the Proposed Development, this will be treated at an authorised facility either in Ireland or abroad. Export of hazardous waste from the Proposed Development outside of the State is subject to a Europe-wide control system founded on EU Regulation 1013/2006 on the Shipments of Waste (known as the Transfrontier Shipment Regulations), as amended. This legislation is supplemented by the Waste Management (Shipments of Waste) Regulations 2007, as amended, which makes Dublin City Council responsible for the enforcement of this regulatory system throughout Ireland. In 2021 in Ireland, 466,941 tonnes of hazardous waste was generated and of this, 48% was exported for treatment (EPA, 2023b). The above procedures will be applied to any hazardous waste generated during the Construction Phase. Export of hazardous waste from site outside the state will comply with the procedures set out in this legislation.

As noted in **Section 1**, following appointment, the contractor will be responsible for detailing and updating this CRWMP. The detailed CRWMP will include a description of how site clearance and excavation material from the Proposed Development will be managed. A full list of all facilities to which uncontaminated site clearance and excavation material will be sent will be provided in the detailed CRWMP.

5.1.1 Article 27

Surplus excavation material may be declared a by-product under (under Article 27 of the EC Waste Directive Regulations, 2011-2020) for reuse in one or more known construction projects.

By-product notifications to the EPA provide an opportunity for reuse of surplus clean soil and stone material arising from construction activity. This can apply to locations other than authorised recovery facilities e.g., quarries operating under planning permission, parks or other developments requiring earthworks and importation of clean soil and stone. This option can bring significant economic benefits while facilitating beneficial re-use of by-products. This plays a role in Ireland's implementation of Circular Economy principles.

An Article 27 notification to the EPA under Article 27 (S.I. No. 323/2020) European Union (Waste Directive) Regulations 2020 is required to achieve by-product status for soil and stones. It is noted that the use of Article 27 is limited to clean soil and stone, and it must be demonstrated to the EPA that the following four conditions are met:

- further use of the soil and stone is certain;
- the soil and stone can be used directly without any further processing other than normal industrial practice;
- the soil and stone is produced as an integral part of a production process; and
- further use is lawful in that the soil and stone fulfil all relevant requirements for the specific use and will not lead to overall adverse environmental or human health impacts.

Where it is proposed to use an Article 27 EPA notification in relation to excavation material from the Proposed Development, the contractor is responsible for submission of the Article 27 notification to the EPA. Where it is proposed to use soil from off-site with an Article 27 notification, the contractor is responsible for carrying out any necessary due diligence regarding the material and ensuring that all EPA guidelines relating to that Article 27 notification have been complied with before the soil is imported into the site. Where feasible, appropriate and available Article 27 materials arising from other sites will be used in the development of this site.

The contractor is responsible for ensuring all applicable regulatory requirements under waste, planning and other laws are complied with prior to movement of excavation material.

5.1.2 Soil Recovery at Sites Holding Waste Facility Permits or EPA Licences

Where removal of wastes from the Proposed Development is unavoidable it will be delivered by the contractor only to facilities which are authorised under the Waste Management Act, 1996 as amended and which hold the appropriate certificate of registration, waste facility permit or EPA licence.

The Waste Management (Facility Permit and Registration) Regulations 2007, as amended sets out the classes of waste activity requiring waste facility permits and certificate of registration. The most relevant class of activity in relation to soil recovery facilities is:

Class 5 (Third Schedule, Part 1 of the Regulations) for the *"Recovery of excavation or dredge spoil, comprising natural materials of clay, silt, sand, gravel or stone and which comes within the meaning of inert waste, through deposition for the purposes of the improvement or development of land, where the total quantity of waste recovered at the facility is less than 100,000 tonnes."*

For waste facility permits and certificate of registration the capacity is typically a lifetime capacity, and when reached, the facility typically closes. Waste facility permits and certificates of registration are granted to private operators by local authorities.

EPA licensed waste activities authorised to accept soil and stones for recovery and disposal include soil recovery sites, landfills, transfer stations and materials recovery facilities. These typically handle a larger tonnage of wastes than facilities holding certificates of registration of waste facility permits.

EPA licences typically include an annual maximum intake capacity and a maximum lifetime capacity for the licenced facility.

Where the contractor proposes to deliver excavated materials from the Proposed Development to facilities holding a certificate of registration, waste facility permit or EPA waste licence the contractor is responsible for ensuring the authorisation is valid and allows acceptance of the relevant List of Waste Code.

A copy of the authorisation will be included in the CRWMP and evidence will be provided that the proposed facility will have capacity to accept the required quantity of waste from the Proposed Development.

5.2 Construction Waste Management

The contractor shall take the following measures to prevent waste, facilitate recycling and minimise waste disposal during the Construction Phase:

- Where waste generation cannot be avoided, waste disposal will be minimised;
- Opportunities for reuse of materials, by-products and wastes will be sought throughout the Construction Phase of the Proposed Development;
- Possibilities for reuse of clean non-hazardous excavation material as fill on the site or in landscaping works will be considered following appropriate testing to ensure material is suitable for its proposed end use;
- Where non-hazardous excavation material cannot be reused within the Proposed Development works, material will be sent for recycling or recovery, where practicable;
- Excavations of made ground will be monitored by an appropriately qualified person to ensure that any hotspots of possible contamination are properly identified, with the contaminated material segregated and disposed of appropriately. Any potential contaminated material identified will be segregated and stored in an area where there is no possibility of runoff generation or infiltration to ground or surface water drainage. Care will be taken to ensure that the hotspot does not cross contaminate clean soils elsewhere throughout the site;
- If encountered, any potential asbestos during the Construction Phase will be managed using standard health and safety measures as outlined in ‘Asbestos-containing Materials (ACMs) in Workplaces: Practical Guidelines on ACM Management and Abatement’ (HSA, 2013). This document states that “*removal of asbestos from contaminated soil will require a specialist asbestos contractor for any friable asbestos to be removed*” and “*a risk assessment by an independent competent person should determine the most appropriate control measures and remediation strategies*” (HSA, 2013);
- Only a suitably experienced contractor shall be used to carry out the excavation works. During construction, they shall employ standard practices to manage risk from contaminated soils. These will be determined by the contractor depending on their construction practices but are likely to include the use of gloves, dust masks and potentially disposable overalls. These and other appropriate measures will minimise the exposure of site workers and members of the public;
- The site will be maintained to prevent litter and regular litter picking will take place throughout the site;
- ‘Just-in-time’ delivery will be used, where practicable, to minimise material wastage;
- Paints, sealants and hazardous chemicals will be stored in secure, bunded locations;
- All staff on-site will be trained on how to minimise waste (i.e., training, induction, inspections and meetings);
- Materials on-site will be correctly and securely stored;

- Where possible, recyclable material will be segregated and removed off site to a permitted / licensed facility for recycling. Waste stream colour coding and photographs will be used to facilitate segregation;
- On-site municipal waste arising swill be source separated at least into dry mixed recyclables, biodegradable and residual wastes;
- Waste bins, containers, skip containers and storage areas will be clearly labelled with waste types which they should contain, including photographs as appropriate;
- Segregated skips will be used within a designated waste segregation area to be located in the on-site construction compound (particularly for hazardous, inert waste and general waste);
- The appointed contractor will record the quantity in tonnes and types of waste and materials leaving the site during the Construction Phase. The name, address and authorisation details of all facilities and locations to which waste and materials are delivered will be recorded along with the quantity of waste in tonnes delivered to each facility. Records will show material, which is recovered, which is recycled, and which is disposed of;
- Waste generated on-site will be removed as soon as practicable following generation for delivery to an authorised waste facility;
- The appointed contractor will ensure that any off-site interim storage facilities for excavation material have the appropriate waste licences or waste facility permits in place;
- Where Article 27 notifications are required in relation to the Proposed Development, the appointed contractor will complete and submit these Article 27 notifications to the EPA for by-product reuse; and
- The relevant appropriate waste authorisation will be in place for all facilities that wastes are delivered to (i.e., EPA Licence, Waste Facility Permit or Certificate of Registration).

The appointed contractor will be required to produce a detailed CRWMP prior to commencement of the proposed works. This will include the names, addresses and authorisation details of the facilities to which waste from the Proposed Development will be delivered. **Appendix D** provides further details of the information which shall be contained in the detailed CRWMP.

5.3 Waste Collection

Waste from construction will be transported by authorised waste collectors in accordance with the Waste Management (Collection Permit) Regulations, 2007 as amended.

A list of currently authorised waste collectors is available on the following website: https://www.nwcpo.ie/permitsearch.aspx.

An up-to-date list of all waste collectors used to transport waste from site during the Proposed Development will be maintained on site and updated by the contractor. Copies of valid appropriate waste collection permits will be held on site by the contractor.

5.4 Waste Recovery and Disposal Offsite

Waste from construction will be delivered to authorised waste facilities in accordance with the Waste Management Acts 1996 to 2011, as amended.

The following authorisations are applicable:

- Certificates of Registration (CoR) from the Local Authority (issued to private sector);
- Certificates of Registration (CoR from the EPA (issued to Local Authority);
- Waste Facility Permit (WFP) from the Local Authority;

- Waste or Industrial Emissions Licence from the EPA.

A list of currently authorised (CoR or WFP) waste sites in each Local Authority is available on the following website: http://facilityregister.nwcpo.ie/.

Lists of sites currently licensed by the EPA (Industrial Emissions or Waste Licence) are available on the following websites:

- Environmental Protection Agency (epa.ie) (for Waste Licensed sites);
- Environmental Protection Agency (epa.ie) (for Industrial Emission Licensed waste facilities).

An up-to-date list of all waste facilities to which waste from the site will be delivered will be maintained on site and updated by the contractor. Copies of valid facility Certificates of Registration, Waste Facility Permits, and Waste Licences will be held on site by the contractor.

5.5 Record Keeping and Auditing

The appointed RM will arrange for audits to be completed on the Proposed Development prior to any construction works commencing and during the construction works. Audits will be of all existing structures and hard surfaces within the Proposed Development site which will be impacted by the works. The audits will identify and quantify the key materials associated with the Proposed Development, outline potential reuse and recycling applications for these materials, identify reuse, recycling and landfill diversion targets for these materials and identify potential local recovery and recycling facilities to which these materials may be delivered.

The contractor will record the quantity in tonnes and types of waste and materials leaving the development site during site clearance, excavation and construction of the Proposed Development. Quantities will be regularly reviewed and compared with targets set during initial audits (including the pre-demolition audit).

The name, address and authorisation details of all facilities and locations to which waste and materials from the Proposed Development are delivered will be recorded along with the quantity of waste in tonnes delivered to each facility and the date of the waste movement. Records will show material which is recovered and disposed of.

A sample resource and waste inventory as included in the EPA Guidance is included in **Appendix E**.

6. Site Infrastructure

The following infrastructure requirements must be adopted by the contractor at construction stage:

- While earthworks are underway, sufficient space will be made available for wastes, by-products and material storage, as necessary. It will be the responsibility of the contractor to ensure all necessary relevant waste authorisations are in place for any such storage in accordance with the Waste Management Act, 1996 as amended;
- Waste storage areas may include stockpiles (for soil and stone, aggregates, etc.), skips (for metals, etc.) or secure containers for hazardous materials. All waste storage areas should be assessed as fit for purpose and should be suitably contained, bunded or defined as required;
- The waste storage areas should be set out to reduce any potential for impact on sensitive human (e.g., residential) or natural (e.g., water courses) receptors and a suitable buffer should be applied to mitigate any impact;

- Labelling and signage shall be used on site to inform personnel of key waste storage area requirements and restrictions with clear signage provided;
- Signage is also required to provide information to assist good resource practice across the site;
- In relation to resource storage, the Waste Management Act 1996, as amended, allows for the temporary storage of resources defined as ‘waste’ at the site where it was produced. The Act defines the phrase ‘the temporary storage of waste’ limiting it to having a six-month duration. As such, it is acceptable to store waste on the site of generation for up to six months without the need for any further waste permit / licence.

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Waste Management Acts, 1996 to 2011 and regulations made under the acts.

Waste Management (Collection Permit) Regulations, 2007 as amended.

Waste Management (Shipments of Waste) Regulations 2007 (S.I. No. 419 of 2007)

Appendix A

Responsibilities as set out in the EPA Guidelines

A.1 Responsibilities as set out in the EPA Guidelines

The contractor procured by the Client to undertake the construction operations is responsible for the following:

- Preparing, implementing and reviewing the CRWMP through construction (including the management of all suppliers and sub-contractors) as per the requirements of these guidelines;
- Identifying a designated and suitably qualified Resource Manager (RM) who will be responsible for implementing the CRWMP;
- Identifying all hauliers to be engaged to transport each of the resources / wastes off-site. Note that any resource that is legally a ‘waste’ must only be transported by a haulier with a valid Waste Collection Permit (refer to Appendix F of the Guidelines for a resource to find a suitably permitted local haulier);
- Identifying all destinations for resources taken off site. As above, any resource that is legally a ‘waste’ must only be transported to a facility holding a valid Cert of Registration, Waste Permit or Waste/Industrial Licence (refer to Appendix F of the Guidelines for a resource to find a suitably authorised facility);
- Maintaining full records of all resources (both wastes and other resources) should be maintained for the duration of the project; and
- Preparing a CRWMP Implementation Review Report at project handover.

Appendix B

Waste Management Legislation, Policy and Best Practices Review

B.1 European Legislation

Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives

Directive 2008/98/EC, known as the “Waste Framework Directive” came into force on 12th December 2008. It provides for a general framework of waste management requirements and sets the basic waste management definitions for the EU.

The Directive lays down the five-step hierarchy of waste management options, with waste prevention as the preferred option, followed by re-use, recycling, recovery and safe disposal, in descending order. In addition, the Directive deals with the issue of ‘end of waste’ and clarifies the definitions of recovery, disposal and by-product. The directive states that, “The recovery of waste and the use of recovered material as raw materials should be encouraged in order to conserve natural resources.”

Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste

This Directive amends Directive 2008/98/EC. It provides a number of updated waste management definitions. The Directive allows Member States to use economic instruments including taxes and levies as an incentive for the application of the waste hierarchy. The Directive was transposed into Irish law in August 2020 by S.I. No. 322 of 2020.

The Directive sets targets for the preparing for re-use and the recycling of municipal waste as follows:

- By 2025, at a minimum 55% (by weight) will be prepared for re-use or recycling;
- By 2030, at a minimum 60% (by weight) will be prepared for re-use or recycling;
- By 2035, at a minimum 65% (by weight) will be prepared for re-use or recycling.

With regard to construction and demolition waste, Member States must take measures to promote selective demolition in order to enable removal and safe handling of hazardous substances, facilitate re-use and high-quality recycling. The Directive obliges Member States to take measures to prevent waste generation including reduction of waste generation in processes related to construction and demolition, taking into account best available techniques.

Commission Decision of 18 December 2014, amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC of the European parliament and of the Council (2014/955/EEC) and Commission Regulation (EU) No 1357/2014 of 18 December 2014, replacing Annex III to Directive 2008/98/EC of the European Parliament and of the Council on waste and repealing certain Directives.

This decision (referred to as ‘the List of Waste’ (LoW)) and regulation consolidate the legislation relating to waste classification and allow the generators of waste to classify the waste as hazardous or non-hazardous and in the process assign the correct List of Waste entry codes. Each list of waste entry is a six-digit code which is closely linked to the list of the main characteristics which render waste hazardous contained in Annex III to the Waste Framework Directive. It is noted that Council Regulation (EU) 2017/997 of 8 June 2017 amending Annex 111 to Directive 2008/98//EC of the European parliament and of the Council as regards the hazardous property HP 14 ‘Ecotoxic’ provides additional criteria in relation to determining whether the ecotoxicity of wastes would result in a hazardous classification.

B.2 National Legislation

Circular Economy and Miscellaneous Provisions Act 2022

The Circular Economy and Miscellaneous Provisions Act 2022 aims to place the Whole-of-Government Circular Economy Strategy 2022-2023, and the commitment to a circular economy, on a clear statutory footing.

The Circular Economy and Miscellaneous Provisions Act is a key step in the successful transition of Ireland's economy to a circular economy and is evidence of Government's commitment to the achievement of that goal.

Waste Management Acts, 1996 as amended and Regulations Made under the Acts

The Waste Management Act, 1996 sets out the responsibilities and functions of various persons in relation to waste. The 1996 Act has been amended by a number of subsequent acts including the Waste Management (Amendment) Act 2001 and the Protection of the Environment Act 2003. The Act:

- Prohibits any person from holding, transporting, recovering or disposing of waste in a manner which causes or is likely to cause environmental pollution.
- Requires any person who carries on activities of an agricultural, commercial or industrial nature to take all such reasonable steps as are necessary to prevent or minimise the production of waste.
- Prohibits the transfer of waste to any person other than an authorised person (i.e., a holder of a waste collection permit or a local authority).
- Requires the Environmental Protection Agency (EPA) to make a national plan in relation to hazardous waste.
- Requires local authorities to make waste management plans in relation to non-hazardous waste.
- Imposes certain obligations on local authorities to ensure that a service is provided for collection of household waste and to provide facilities for the recovery and disposal of such waste.
- Enables the Minister for Environment, Climate and Communications to make regulations for various purposes to promote better waste management.
- Provides for substantial penalties for offences including fines, imprisonment and/or liability for clean-up measures.

Waste Management (Collection Permit) Regulations, 2007, S.I. No 820 of 2007, as amended

A waste collection permit is required by anyone collecting waste on a commercial basis to ensure that the waste is gathered, sorted and transported correctly. Waste collection permits are granted in accordance with the Waste Management (Collection Permit) Regulations, 2007 as amended. All Waste Collection Permits are issued by the National Waste Collection Permit Office (NWCPO).

Waste Management (Shipments of Waste) Regulations 2007, S.I. No. 419 of 2007

Where waste is exported from Ireland for recovery or disposal the National Transfrontier Shipment (TFS) Office within Dublin City Council must be notified. Certain financial guarantees must be in place and a certificate issued by the National TFS Office prior to the waste movement taking place.

European Communities (Waste Directive) Regulations 2011, S.I. 126 of 2011

These regulations significantly changed the provisions of the Waste Management Acts, 1996 to 2008. The Regulations define "waste disposal" and "waste recovery", as well as setting out tests which must be complied with in order for material to be described as a "by-product" or achieve "end of waste" status.

The Regulations formally set out the following waste hierarchy which must be applied as a priority order in waste prevention and management legislation and policy:

(a) prevention;

(b) preparation for re-use;

(c) recycling;

(d) other recovery (including energy recovery); and

(e) disposal

The Regulations require that all waste management plans and hazardous waste management plans in existence at the commencement of the Regulations to be evaluated by 31 December 2012 and where appropriate, be revised to be brought into line with Directive 2006/12/EC on Waste.

The Regulations also require the Environment Agency to establish a waste prevention programme by December 2013.

European Union (Waste Directive) Regulations 2020 S.I. No. 323 of 2020

These regulations give effect to Directive 2018/851/EC of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste. Directive 2018/851/EC provides new definitions for a number of key terms including "waste" and "non-hazardous waste", "bio-waste", "waste management", "waste prevention", "backfilling" and "construction and demolition waste".

The Regulations give partial effect to the following: Directive 2006/66/EC on batteries and accumulators and waste batteries and accumulators as amended by Directive (EU) 2018/849, Directive 2000/53/EC on end-of-life vehicles as amended by Directive (EU) 2018/849, Directive 2012/19/EU on waste electrical and electronic equipment as amended by Directive (EU) 2018/849, Directive (EU) 2018/852 amending Directive 94/62/EC on packaging and packaging waste and Directive (EU) 2018/850 amending Directive 1999/31/EC on the landfill of waste. The Regulations set out additional measures to protect the environment and human health by preventing or reducing the generation of waste, the adverse impacts of the generation and management of waste and by reducing overall impacts of resource use and improving the efficiency of such use, which are crucial for the transition to a circular economy and long-term competitiveness.

B.3 European Policy

7th Environmental Action Programme, European Commission (2014)

The 7th Environmental Action Programme came into force in January 2014 and will guide European environment policy until 2020. A key objective of the programme is to turn the Union into a resource-efficient, green and competitive low carbon economy. There is a special focus on turning waste into a resource, with more prevention, re-use and recycling, and phasing out wasteful and damaging practices like landfilling. By 2020 the European Union and member states are to ensure that:

- The environment and human health are protected by preventing or reducing the adverse impacts of the generation and management of waste.
- Per capita waste generation and waste generation in absolute terms are reducing.
- Landfilling is phased out for recyclables and recoverable wastes and limiting energy recovery to non-recyclable materials.

The European Commission published a proposal for an 8th Environmental Action Programme on 14th October 2020. The proposal supports the environment and climate action objectives of the European Green Deal and will form the EU's basis for achieving the United Nation's 2030 Agenda and its Sustainable Development Goals. It is expected that the 8th Environmental Action Programme will be adopted in 2021 – however, a date is yet to be confirmed.

European Commission Circular Economy Strategy (2015; 2018; 2020)

In December 2015, the European Commission adopted an ambitious Circular Economy Package, which includes revised legislative proposals on waste to stimulate Europe's transition towards a circular economy.

The Circular Economy Package consists of an EU Action Plan for the Circular Economy that establishes a programme of action, with measures covering the whole cycle: from production and consumption to waste management and the market for secondary raw materials. The annex to the action plan sets out the timeline when the actions will be completed.

The proposed actions will contribute to "closing the loop" of product lifecycles through greater recycling and re-use and bring benefits for both the environment and the economy.

The revised legislative proposals on waste set clear targets for reduction of waste and establish an ambitious and credible long-term path for waste management and recycling. Key elements of the revised waste proposal include:

- An EU target for recycling 65% of municipal waste by 2030;
- An EU target for recycling 75% of packaging waste by 2030;
- A target to reduce landfill to maximum of 10% of all waste by 2030;
- A ban on landfilling of separately collected waste;
- Promotion of economic instruments to discourage landfilling;
- Simplified, improved definitions and harmonised calculation methods for recycling rates throughout the EU;
- Concrete measures to promote re-use and stimulate industrial symbiosis - turning one industry's by-product into another industry's raw material;

- Economic incentives for producers to put greener products on the market and support recovery and recycling schemes (e.g., for packaging, batteries, electric and electronic equipment, vehicles).

The Circular Economy Package was updated in 2018 to comprise a new set of measures including:

- A Europe-wide EU Strategy for Plastics in the Circular Economy;
- A Communication on options to address the interface between chemical, product and waste legislation;
- A Monitoring Framework on progress towards a circular economy at EU and national level; and
- A Report on Critical Raw Materials and the circular economy.

Key legislative measures adopted to date under the plan include:

- Directive (EU) 2018/851 amending Directive 2008/98/EC on waste;
- Directive (EU) 2018/850 amending Directive 1999/31/EC on the landfill of waste;
- Directive (EU) 2018/852 amending Directive 94/62/EC on packaging and packaging waste; and
- Directive (EU) 2018/849 amending Directives 2000/53/EC on end-of-life vehicles, Directive 2006/66/EC on batteries and accumulators and waste batteries and accumulators, and Directive 2012/19/EU on waste electrical and electronic equipment.

European Commission, 2020. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – A new Circular Economy Action Plan For a cleaner and more competitive Europe. COM (2020).

The European Commission has adopted a new Circular Economy Action Plan, which is one of the main blocks of the European Green Deal, Europe's new agenda for sustainable growth.

The new Action Plan announces initiatives along the entire life cycle of products, targeting for example their design, promoting circular economy processes, fostering sustainable consumption, and aiming to ensure that the resources used are kept in the EU economy for as long as possible.

The new Action Plan introduces legislative and non-legislative measures targeting areas where action at the EU level brings real added value.

The new Circular Economy Action Plan presents measures to:

- Make sustainable products the norm in the EU;
- Empower consumers and public buyers;
- Focus on the sectors that use most resources and where the potential for circularity is high such as: electronics and ICT; batteries and vehicles; packaging; plastics; textiles; construction and buildings; food; water and nutrients;
- Ensure less waste;
- Make circularity work for people, regions and cities; and
- Lead global efforts on circular economy.

European Commission (2019) European Green Deal

The European Green Deal, published by the European Commission in December 2019, provides an action plan to boost the efficient use of resources by moving to a clean, circular economy while cutting pollution and restoring biodiversity.

The plan outlines investments needed and financing tools available. It explains how to ensure a just and inclusive transition.

B.4 National Policy

Introduction

The first national waste policy statement was published by the Department of Environment and Local Government in 1998. A number of statements have been published since, each of which builds on the objectives of the previous policy statements to improve how waste is managed in Ireland and move waste away from landfill and towards a more sustainable option. The statements published in the past include:

- Department of the Environment and Local Government (1998). 'Waste Management - Changing Our Ways' – A Policy Statement.
- Department of the Environment and Local Government (2002). Preventing and Recycling Waste – Delivering Change – A Policy Statement.
- Department of the Environment, Heritage and Local Government (2004). Waste Management - Taking Stock and Moving Forward.
- Department of the Environment, Heritage and Local Government (2006). National Strategy on Biodegradable Waste Management.
- Department of the Environment, Heritage and Local Government (2012). A Resource Opportunity- Waste Management Policy in Ireland.

More recent policy documents and reports are summarised below.

EPA National Waste Statistics and Bulletins

The EPA publishes national statistics and bulletins relating to waste generation, management and disposal in Ireland. The published data provide information on key statistics and trends in waste as well as information on Ireland's progress in meeting EU waste collection, recovery and disposal targets. Key topics include municipal waste generation and management, packaging waste, waste electronic and electrical equipment, end of life vehicles, tyres, hazardous waste, construction and demolition waste and waste infrastructure. The data are available on the EPA website at *http://www.epa.ie/nationalwastestatistics/.*

Environmental Protection Agency (2021). National Hazardous Waste Management Plan, 2021 - 2027

The Fourth National Hazardous Waste Management Plan was published by the Environmental Protection Agency in 2021.

This Plan set out priority actions to be taken over the six-year life of the plan in relation to:

- Prevention of hazardous waste.
- Improved collection rates for certain categories of hazardous waste.
- Steps required to improve Ireland’s self-sufficiency in hazardous waste management.
- Support effective regulation of the movement and management of hazardous wastes in line with national policy priorities.
- Promote safe reuse and recycling pathways in support of the circular economy.

Four issues are highlighted for completion during the lifetime of the plan, including the following:

1. Strengthen systemic resilience for management of hazardous waste.
2. By 2024, establish nationwide collection and transfer of farm hazardous wastes, including unused veterinary products.
3. By 2023, establish national collection of surplus / out-of-date medicines from household waste stream.
4. By 2023, establish collection platforms for surplus paint from household and commercial waste streams.

EPA (2021) The Circular Economy Programme 2021 - 2027

This document outlines Ireland’s The Circular Economy Programme which will be led by the EPA. The Circular Economy Programme incorporates and builds upon the previous National Waste Prevention Programme to support national-level, strategic programmes to prevent waste and drive the Circular Economy in Ireland. The development of the Circular Economy Programme responds to the commitment within the national policy document *The Waste Action Plan for a Circular Economy* to reconfigure the National Waste Prevention Programme into Ireland’s Circular Economy Programme.

EPA (2020) Guidance to Planners, Planning Authorities and An Bord Pleanála on the Management of Excess Soil and Stone from Developments

Excess soil and stone material may be generated in the course of developments taking place. This material must be managed in an environmentally sound manner and in doing so, may be managed either as a waste or as a by-product of the production process (the production process being the development taking place). Specific regulatory requirements apply to the management of the material as a by-product or a waste.

The aim of this guidance document is to assist planners, planning authorities and An Bord Pleanála and is prepared in accordance with the provisions set out in Section 56 of the EPA Act 1992. The guidance document is intended to be used when assessing applications for development involving either 1) the export of excess soil and stone material from a site arising out of the construction of a development, or 2) the importation of soil and stone as part of the development, or both.

EPA (2020) By-Product – Guidance Note. A guide to by-products and submitting a by-product notification under Article 27 of the European Communities (Waste Directive) Regulations, 2011

The purpose of this guidance is to:

- Encourage the presentation of waste including the lawful and beneficial use of by-products; and
- Set out the Environmental Protection Agency’s (EPA) regulatory approach to determining notifications on by-products and to provide guidance to interested parties.

The guidance has two key objectives:

- Provide the reader with guidance on how to assess whether a substance or object is a by-products or waste; and
- Explain how to submit a complete by-product notification to the EPA which clearly demonstrates compliance with the conditions of Article 27.

EPA (2018) Waste Classification – List of Waste and Determining if Waste is hazardous or Non-Hazardous.

Waste classification is based on:

- Commission Decision of 18 December 2014, amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC of the European parliament and of the Council (2014/955/EEC);
- Commission Regulation (EU) No 1357/2014 of 18 December 2014, replacing Annex III to Directive 2008/98/EC of the European Parliament and of the Council on waste and repealing certain Directives; and
- Council Regulation (EU) 2017/997 of 8 June 2017 amending Annex 111 to Directive 2008/98//EC of the European parliament and of the Council as regards the hazardous property HP 14 'Ecotoxic'.

This waste classification system applies across the EU and is the basis for all national and international waste reporting obligations. This document consolidates the Decision and Regulations and provides guidance on how to follow them.

There are two main elements:

- List of Waste (LoW) (Appendix 1);
- Determining if waste is hazardous or non-hazardous (Appendix 2).

Government of Ireland (2020) A Waste Action Plan for a Circular Economy Ireland's National Waste Policy 2020-2025.

The 'Waste Action Plan for a Circular Economy' is an action focused plan that reflects the 2020 Circular Economy Action Plan 'For a cleaner and more competitive Europe' from the European Commission (see above).

The Waste Action Plan for a Circular Economy fulfils the commitment in the Programme for Government (2020) to publish and start implementing a new National Waste Action Plan. This new national waste policy will inform and give direction to waste planning and management in Ireland over the coming years.

The previous national waste policy, A Resource Opportunity – Waste management policy in Ireland, drove delivery on national targets under EU legislation, but the Irish and international waste context has changed in the years since its launch. The need to embed climate action in all strands of public policy aligns with the goals of the European Green Deal.

The policy document shifts focus away from waste disposal and moves it back up the production chain. To support the policy, regulation is already being used (Circular Economy Legislative Package) or in the pipeline (Single Use Plastics Directive). The policy document contains over 200 measures across various waste areas including Circular Economy, Municipal Waste, Consumer Protection and Citizen Engagement, Plastics and Packaging, Construction and Demolition, Textiles, Green Public Procurement and Waste Enforcement.

The overarching objectives of this action plan are to:

- Shift the focus away from waste disposal and treatment to ensure that materials and products remain in productive use for longer thereby preventing waste and supporting reuse through a policy framework that discourages the wasting of resources and rewards circularity;
- Make producers who manufacture and sell disposable goods for profit environmentally accountable for the products they place on the market;
- Ensure that measures support sustainable economic models (for example by supporting the use of recycled over virgin materials);
- Harness the reach and influence of all sectors including the voluntary sector, R&D, producers / manufacturers, regulatory bodies, civic society; and
- Support clear and robust institutional arrangements for the waste sector, including through a strengthened role for Local Authorities (LAs).

The plan identifies opportunities for the application of circular economy principles across a range of areas in Ireland including:

- Municipal waste;
- Consumer Protection;
- Food waste;
- Plastic and packaging waste;
- Construction and demolition waste;
- Textiles; and
- Procurement.

Department of the Environment, Climate and Communications (2022) Climate Action Plan 2023

The Climate Action Plan 2023 was published on the 21 December 2022 and represented the second annual update to the Climate Action Plan 2019. The Plan sets out the actions the Government intends to take to address climate breakdown across sectors such as electricity, transport, built environment, industry and agriculture.

The Plan provides that the Government will lead the transformation from waste management to circular economy practice through delivery of a new national policy. The implementation plan for actions by Government and other actors in relation to waste and the circular economy are as follows:

- Publish a Whole-of-Government Circular Economy Strategy and promote the Circular Economy;
- Establish a Circular Economy Innovation Scheme;
- Reduce demand for virgin raw materials and support re-use, by keeping material out of waste streams through streamlined end-of-waste and by-product decision-making processes and national end-of-waste decisions for specific construction and demolition waste streams;
- Continue to drive the rollout of CirculEire, the national programme for circular manufacturing and innovation;
- Develop a Food Waste Prevention Roadmap that sets out a series of actions to deliver the reductions necessary to halve our food waste by 2030 and promote our transition to a circular economy;

- Enhance food waste segregation, collection and treatment (anaerobic digestion and composting);
- Develop and implement a new Regional Waste Management Plans that will guide our transition to a circular economy;
- Develop new and expanded environmental levies to encourage reduced resource consumption and incentivise higher levels of re-use and recycling;
- Begin work on consumer information actions to inform consumer choice aimed at driving improvements in the environmental sustainability of the electronic communications sector;
- Implement Regulation (EU) No 517/2014 on F-Gases; and
- Separate collection obligations extended to include bio-waste by end of 2023.

B.5 Regional Policy

The Southern Region Waste Management Plan 2015 - 2021

For the purposes of waste management planning, Ireland is now divided into three regions: Southern, Eastern-Midlands, Connacht-Ulster. The Southern Region Includes Cork County Council.

The Southern Region Waste Management Plan 2015 - 2021 was launched in 2015. The strategic approach of the plan places a stronger emphasis on preventing wastes and material reuse activities. Three strategic targets have been set in the plan which include:

- 1% reduction per annum in the quantity of household waste generated per capita over the period of the plan;
- Achieve a recycling rate of 50% of managed municipal waste by 2020; and
- Reduce to 0% the direct disposal of unprocessed residual municipal waste to landfill in favour of higher value pre-treatment processes and indigenous recovery practices.

The plan looks to 2030 and includes a goal of reaching a recycling rate of 60%. Note that the Southern Region Waste Management Plan 2015 - 2021 is currently out of date – a National Waste Management Plan for a Circular Economy is currently being prepared to replace the existing Regional Waste Management Plans, including the Southern Region Waste Management Plan 2015 – 2021.

Cork County Development Plan 2022-2028

The Cork County Development Plan 2022-2028 (Cork County Council, 2022) sets out Cork County Council's policies and objectives for the development of the County over the Plan period.

The Council includes a number of waste prevention and management objectives as part of Chapter 15 Biodiversity and Environment. Objectives relevant to the Proposed Development include the following:

"Objective BE 15-14: Waste Prevention and Management:

a) Support the policy measures and actions outline in

- 'A Waste Action Plan for a Circular Economy Ireland's National Waste Policy 2020-2025', and

- Southern Region Waste Management Plan 2015 – 2021, or any successor plans

b) Support circular and climate resilient economy principles and associated strategic infrastructure, prioritising prevention, reuse, recycling and recovery, and to sustainably manage all types of waste by ensuring the provision of adequate waste recovery, recycling and disposal facilities for the county."

"Objective BE 15-17: Waste Prevention and Management:

a) ….

b) …

c) Construction and Environmental Management Plans (CEMPs)/ Construction and Demolition Management Plans shall be prepared for larger scale projects as set out in paragraph 15.12.24 and this requirement shall be assessed on a case-by-case basis as part of the development management process.

d) Support the implementation of the recommendations and policies of the National Hazardous Waste Management Plan 2014-2020."

Sections 15.12.23 to Section 15.12.25 of the Cork County Council Development Plan 2022-2028 also outline specific considerations for Construction and Demolition (C&D) waste.

RPS (2020) Construction and Demolition Waste Soil and Stone Recovery/Disposal Capacity Eastern Midlands Region / Connacht Ulster Region / Southern Region Waste Management Plans 2015 – 2021.

This report was undertaken on behalf of the Irish regional waste management offices to analyse the national waste capacity market for safe treatment of waste soils. A review was undertaken of soil waste generation and available capacity to accept soil waste in authorised facilities within the three waste regions.

The report identifies that the future authorised capacity available to recover soil and stones is an issue in each waste region in the context of likely strong construction activity. Possible options recommended include expanding capacities at existing sites and the use of Article 27 By-Product notifications.

B.6 Guidance

Environmental Protection Agency (EPA) (2021) Best Practice Guidelines for the Preparation of Resource Management Plans for Construction and Demolition Projects – 2021.

These guidelines supersede the 'Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Waste Projects' which were published by the Government in July 2006. The replacement guidelines reflect current waste legislation and policy including 'A Waste Action Plan for a Circular Economy Ireland's National Waste Policy 2020-2025' published in September 2020. Since the publication of the 2006 guidelines, waste management legislation and policy have evolved towards prioritising waste prevention and life-cycle thinking as follows:

- An increased emphasis on waste prevention, in line with the waste hierarchy, through established principles such as designing out waste and the use of green procurement.
- The guidelines have also been prepared to promote more circular design and construction principles in line with the EU Circular Economy Action Plan under the EU Green Deal. The circular economy model tries to avoid using unnecessary resources in the first place and keep resources 'in flow' by means of effective and smart reuse and recycling strategies reducing the use of virgin materials.

The guidelines provide a practical and informed mechanism to document the prevention and management of C&D wastes and resources from design to construction or demolition of a project. They provide clients, developers, designers, practitioners, contractors, sub-contractors and competent authorities with a common approach to preparing and determining Resource and Waste Management Plans (RWMP) for the construction and demolition sector in Ireland.

The guidelines address the best practice approach for the following phases of a project:

- Prior to Construction – including the stages of design, planning and procurement in advance of works on site; and
- During Construction – relating to the effective management of resources and wastes during construction or demolition operations.

European Commission (2016) EU Construction & Demolition Waste Management Protocol

This protocol was published by the European Commission in September 2016.

The overall aim of the protocol is to increase confidence in the C&D waste management process and the trust in the quality of C&D recycled materials. This will be achieved by:

a) Improved waste identification, source separation and collection;

b) Improved waste logistics;

c) Improved waste processing;

d) Quality management; and

e) Appropriate policy and framework conditions.

EPA (2019) Guidance on Soil and Stone By-products in the context of Article 27 of the European Communities (Waste Directive) Regulations 2011

Article 27 of the European Communities (Waste Directive) Regulations, 2011, as substituted by article 15 of the European Communities (Waste Directive) Regulations, 2020, S.I. No. 323 of 2020, states the following:

> *"27. (1) the Agency shall take appropriate measures to ensure that a substance or object resulting from a production process the primary aim of which is not the production of that substance or object is considered not to be waste, but to be a by-product if the following conditions are met:*
>
> *(a) further use of the substance or object is certain;*
>
> *(b) the substance or object can be used directly without any further processing other than normal industrial practice;*
>
> *(c) the substance or object is produced as an integral part of a production process; and*
>
> *(d) further use is lawful in that the substance or object fulfils all relevant product, environmental and health protection requirements for the specific use and will not lead to overall adverse environmental or human health impacts.*
>
> *(2) (a) Where a natural or legal person holds a substance or object in accordance with paragraph (1) which he or she believes is to be considered as a by-product, he or she shall notify the Agency and seek a determination on the matter from the Agency*
>
> *(b) He or she shall comply with relevant Agency guidance and submit information in a form and format as may be prescribed by the Agency in order to establish that the conditions in paragraph (1) are met.*

> *(c) Where there is no notice given to the Agency under subparagraph (a) in respect of a substance or object and the substance or object, as the case may be, is discarded or otherwise dealt with as if it were waste, the substance or object, as the case may be, shall be presumed to be waste until the contrary is proved.*
>
> *(3) The Agency—*
>
> *(a) may determine, in consultation with the relevant local authority and the natural or legal person concerned, whether a substance or object notified to it as a by-product in accordance with paragraph (2)(a) should be considered as a by-product or as a waste, and*
>
> *(b) shall notify the local authority and the natural or legal person concerned of the determination made.*
>
> *(c) may attach reporting conditions to a determination, pursuant to regulation 31a.*
>
> *(4) Nothing in this Regulation shall relieve a natural or legal person from his or her responsibilities under the Act of 1992 or the Act of 1996.*
>
> *(5) The Agency shall establish and maintain a register of by-products to record substances or objects notified to it as by-products under paragraph (2)(a).*
>
> *(6) Where the Agency makes a determination in accordance with paragraph (3) that a substance or object should be considered as waste and not as a by-product, the determination shall be final.*
>
> *(7) Where criteria have not been set at Union level, the Agency may establish detailed criteria on the application of the conditions laid down in paragraph 1 to specific substances or objects. The Agency shall notify the Commission of those detailed criteria in accordance with Directive (EU) 2015/153513 of the European Parliament and of the Council where so required by that Directive."*

Economic operators, who hold a substance, which they believe to be a by-product under Article 27, must notify the Environmental Protection Agency. Conditions (1) (a) to (1)(d) must be satisfied for an Article 27 notification to be successful.

The EPA has produced guidance on the notification process. The purpose of the guidance is to inform economic operators how to prevent waste soil and stone by classifying it as a by-product in accordance with the legislation and the EPA's regulatory approach to determinations on soil and stone by-products. This guidance document covers soil and stone only.

The guidance is aimed at local authorities, developers, the construction sector, the waste management sector and consultants.

Its environmental objective is that, by making certain excess uncontaminated soil and stone is beneficially used with no overall adverse impacts on the environment or human health, a material producer will ensure that the material is regarded as a by-product rather than a waste.

Environmental Protection Agency (2020) Draft End of Waste Guidance Part 1 and Part 2

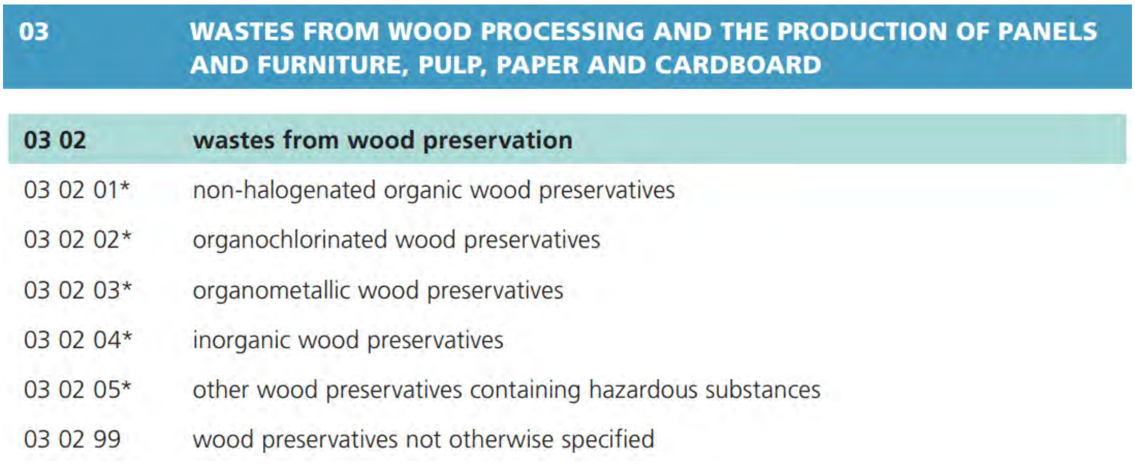
The EPA has published guidance on the 'end-of-waste' concept under Article 28 of the European Communities (Waste Directive) Regulations, 2011. Part 1 of the guidance describes the context and benefits, and introduces the end-of-waste test, under Article 28, to potential applicants. Part 2 provides guidance for applicants on how to address the requirements of the end-of-waste test.

FÁS and CIF (2002) Construction and Demolition Waste Management – A Handbook for Contractors & Site Managers

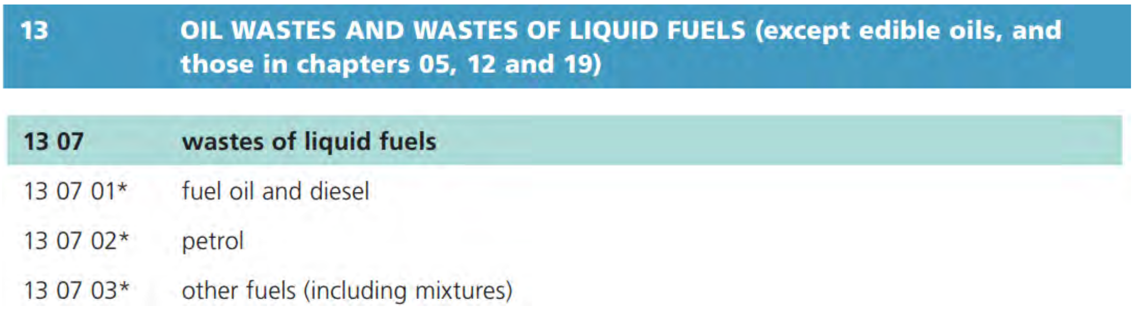
This handbook was produced in conjunction with Fás and the CIF in 2002. It provides advice for contractors and site managers on how to manage construction and demolition waste to make financial savings in purchasing material and disposal costs in a sustainable manner.

Appendix C

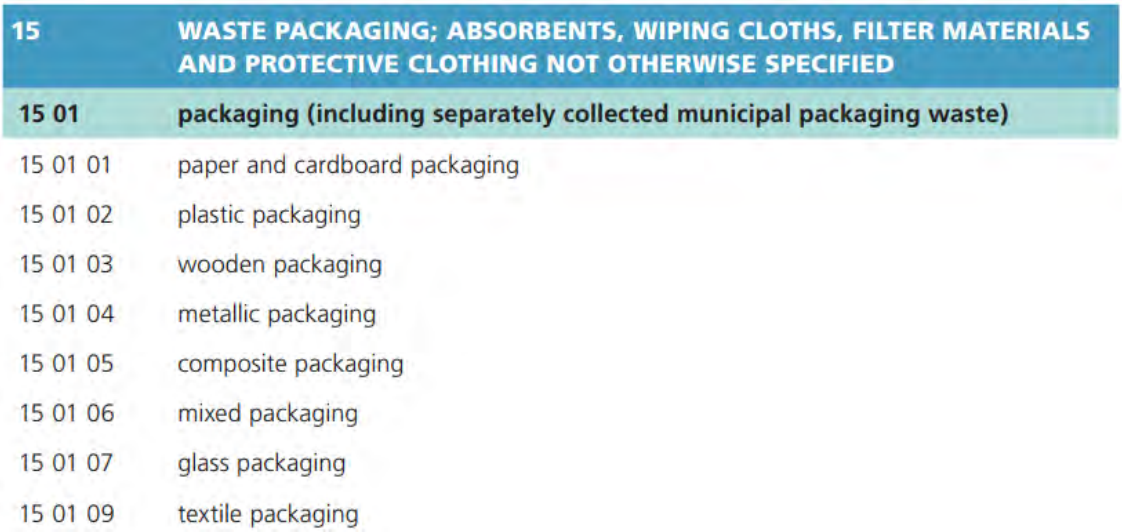
EPA – List of Waste Codes for Construction and Demolition Wastes



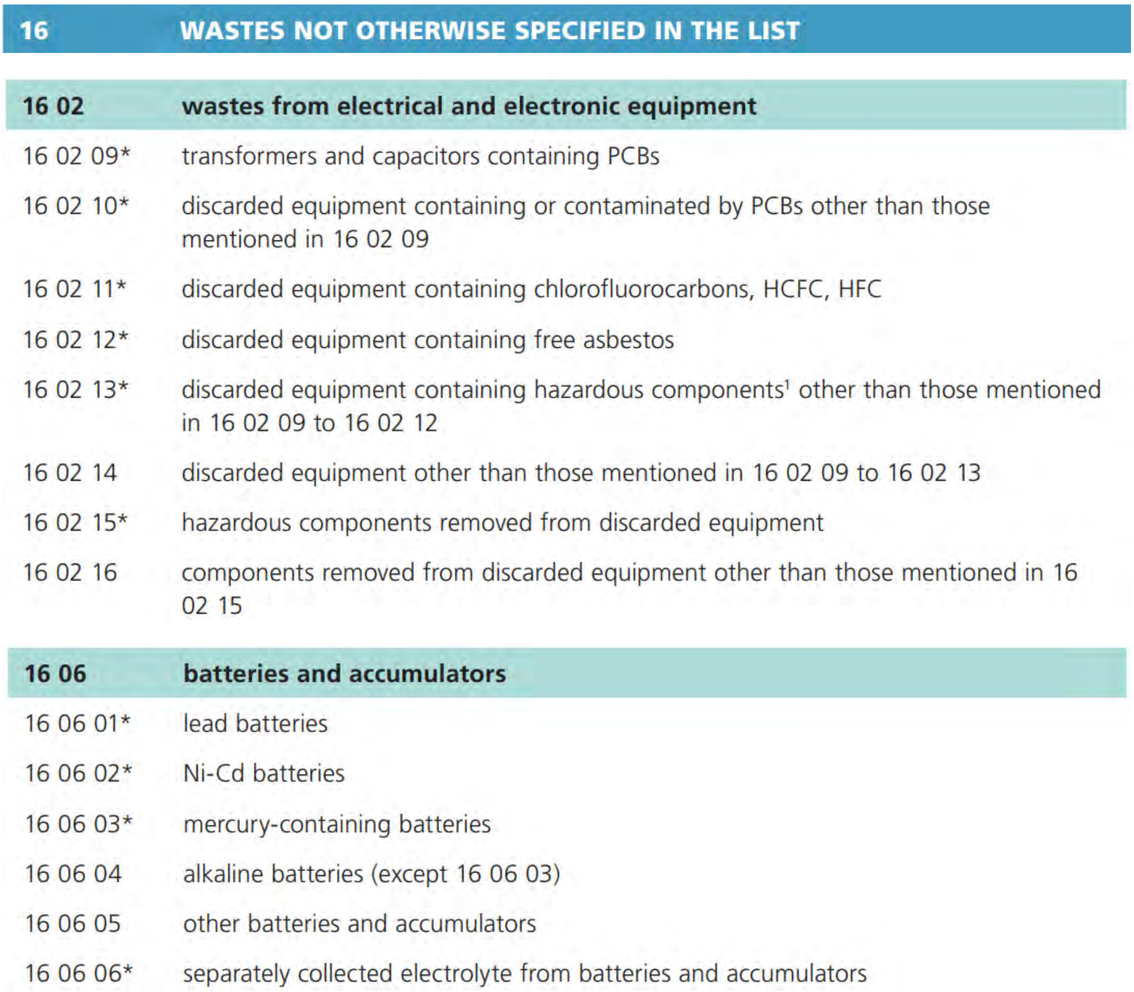
03	WASTES FROM WOOD PROCESSING AND THE PRODUCTION OF PANELS AND FURNITURE, PULP, PAPER AND CARDBOARD
03 02	**wastes from wood preservation**
03 02 01*	non-halogenated organic wood preservatives
03 02 02*	organochlorinated wood preservatives
03 02 03*	organometallic wood preservatives
03 02 04*	inorganic wood preservatives
03 02 05*	other wood preservatives containing hazardous substances
03 02 99	wood preservatives not otherwise specified



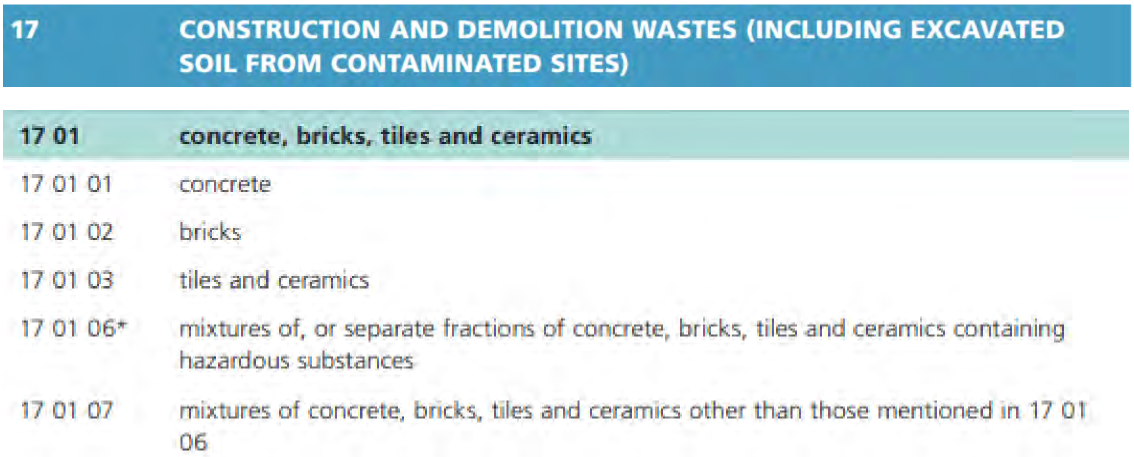
13	OIL WASTES AND WASTES OF LIQUID FUELS (except edible oils, and those in chapters 05, 12 and 19)
13 07	**wastes of liquid fuels**
13 07 01*	fuel oil and diesel
13 07 02*	petrol
13 07 03*	other fuels (including mixtures)



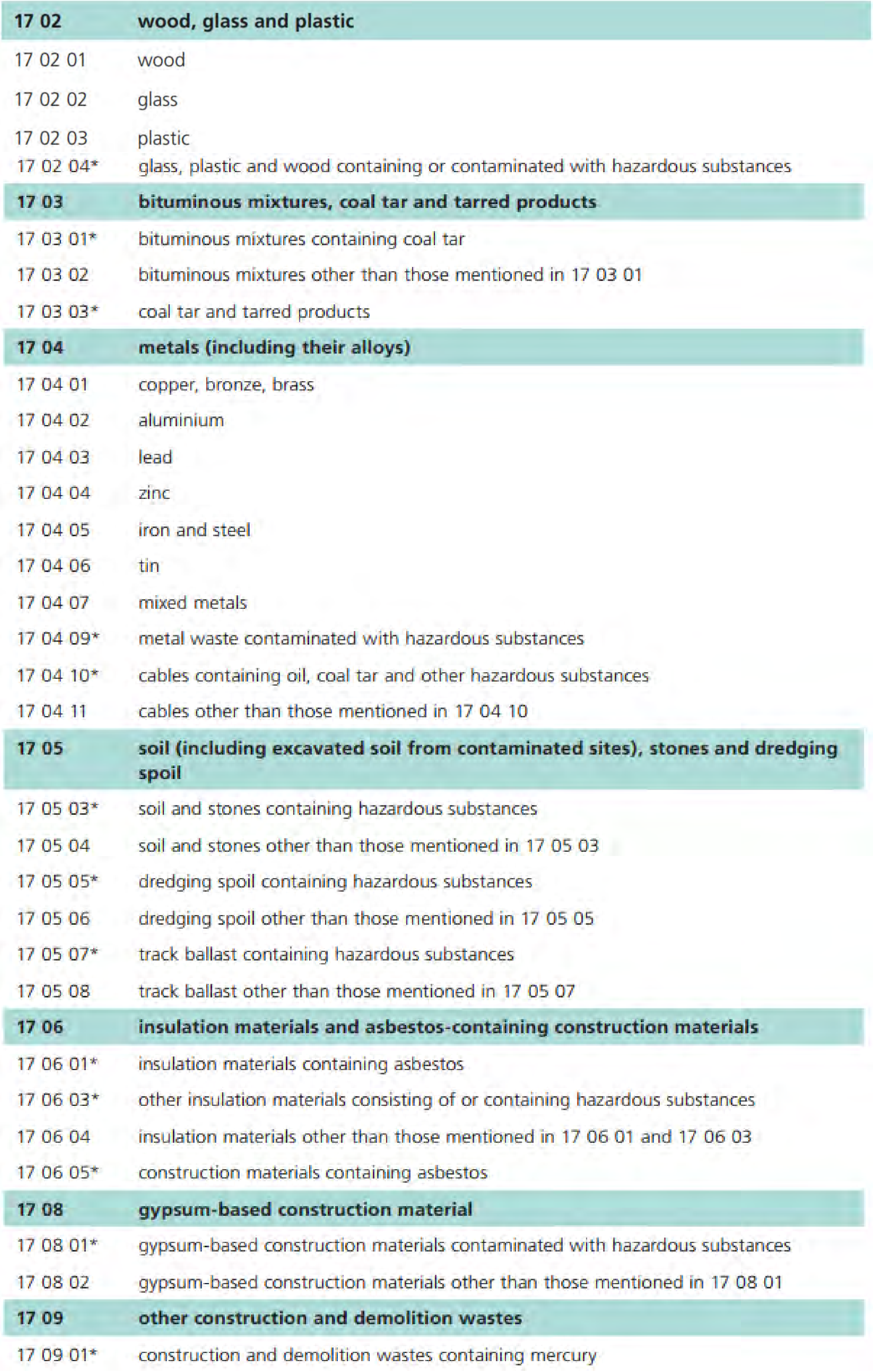
15	WASTE PACKAGING; ABSORBENTS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED
15 01	**packaging (including separately collected municipal packaging waste)**
15 01 01	paper and cardboard packaging
15 01 02	plastic packaging
15 01 03	wooden packaging
15 01 04	metallic packaging
15 01 05	composite packaging
15 01 06	mixed packaging
15 01 07	glass packaging
15 01 09	textile packaging



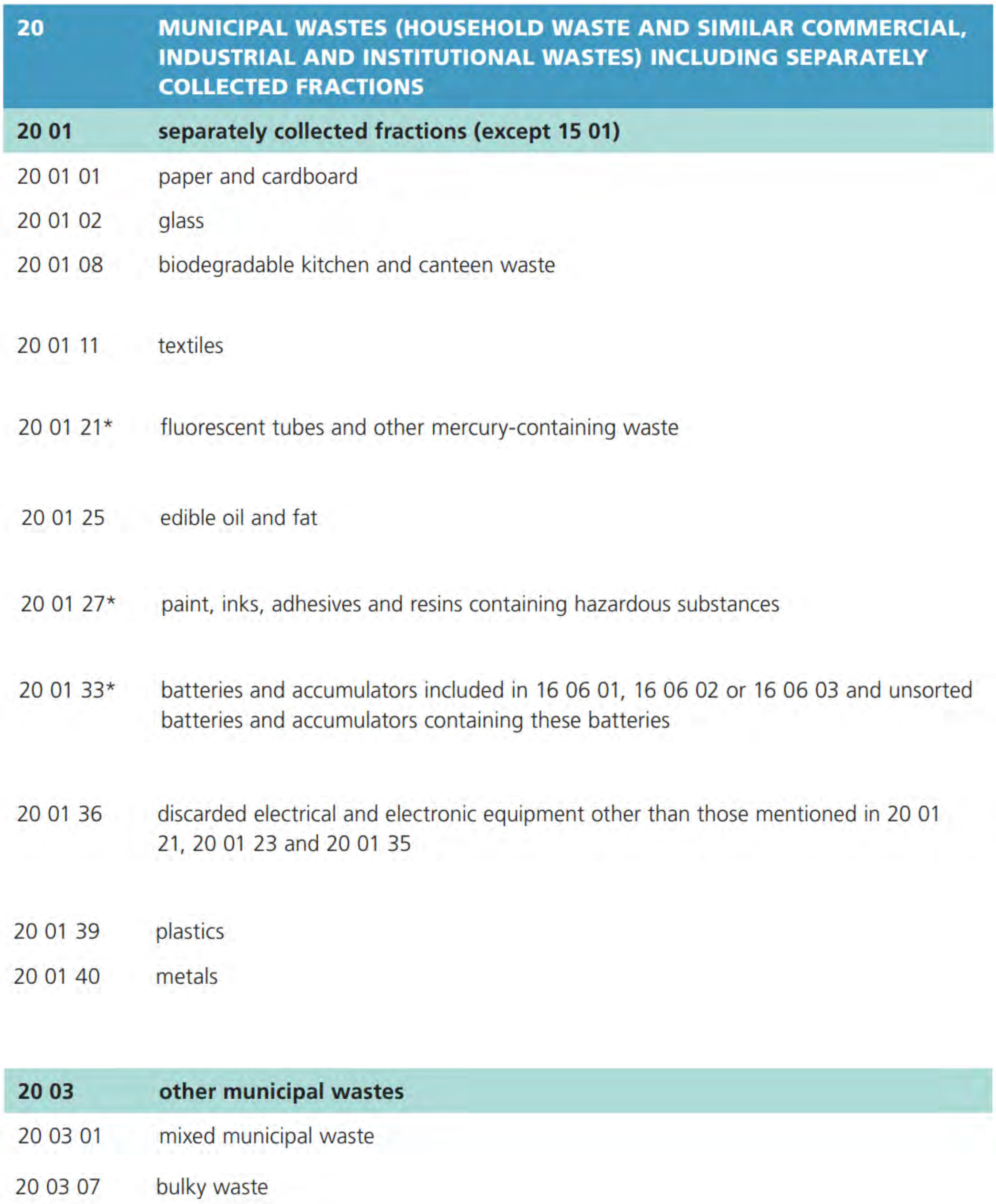
16	WASTES NOT OTHERWISE SPECIFIED IN THE LIST
16 02	**wastes from electrical and electronic equipment**
16 02 09*	transformers and capacitors containing PCBs
16 02 10*	discarded equipment containing or contaminated by PCBs other than those mentioned in 16 02 09
16 02 11*	discarded equipment containing chlorofluorocarbons, HCFC, HFC
16 02 12*	discarded equipment containing free asbestos
16 02 13*	discarded equipment containing hazardous components[1] other than those mentioned in 16 02 09 to 16 02 12
16 02 14	discarded equipment other than those mentioned in 16 02 09 to 16 02 13
16 02 15*	hazardous components removed from discarded equipment
16 02 16	components removed from discarded equipment other than those mentioned in 16 02 15
16 06	**batteries and accumulators**
16 06 01*	lead batteries
16 06 02*	Ni-Cd batteries
16 06 03*	mercury-containing batteries
16 06 04	alkaline batteries (except 16 06 03)
16 06 05	other batteries and accumulators
16 06 06*	separately collected electrolyte from batteries and accumulators



17	CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)
17 01	**concrete, bricks, tiles and ceramics**
17 01 01	concrete
17 01 02	bricks
17 01 03	tiles and ceramics
17 01 06*	mixtures of, or separate fractions of concrete, bricks, tiles and ceramics containing hazardous substances
17 01 07	mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06



17 02	**wood, glass and plastic**
17 02 01	wood
17 02 02	glass
17 02 03	plastic
17 02 04*	glass, plastic and wood containing or contaminated with hazardous substances
17 03	**bituminous mixtures, coal tar and tarred products**
17 03 01*	bituminous mixtures containing coal tar
17 03 02	bituminous mixtures other than those mentioned in 17 03 01
17 03 03*	coal tar and tarred products
17 04	**metals (including their alloys)**
17 04 01	copper, bronze, brass
17 04 02	aluminium
17 04 03	lead
17 04 04	zinc
17 04 05	iron and steel
17 04 06	tin
17 04 07	mixed metals
17 04 09*	metal waste contaminated with hazardous substances
17 04 10*	cables containing oil, coal tar and other hazardous substances
17 04 11	cables other than those mentioned in 17 04 10
17 05	**soil (including excavated soil from contaminated sites), stones and dredging spoil**
17 05 03*	soil and stones containing hazardous substances
17 05 04	soil and stones other than those mentioned in 17 05 03
17 05 05*	dredging spoil containing hazardous substances
17 05 06	dredging spoil other than those mentioned in 17 05 05
17 05 07*	track ballast containing hazardous substances
17 05 08	track ballast other than those mentioned in 17 05 07
17 06	**insulation materials and asbestos-containing construction materials**
17 06 01*	insulation materials containing asbestos
17 06 03*	other insulation materials consisting of or containing hazardous substances
17 06 04	insulation materials other than those mentioned in 17 06 01 and 17 06 03
17 06 05*	construction materials containing asbestos
17 08	**gypsum-based construction material**
17 08 01*	gypsum-based construction materials contaminated with hazardous substances
17 08 02	gypsum-based construction materials other than those mentioned in 17 08 01
17 09	**other construction and demolition wastes**
17 09 01*	construction and demolition wastes containing mercury



20	**MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS**
20 01	**separately collected fractions (except 15 01)**
20 01 01	paper and cardboard
20 01 02	glass
20 01 08	biodegradable kitchen and canteen waste
20 01 11	textiles
20 01 21*	fluorescent tubes and other mercury-containing waste
20 01 25	edible oil and fat
20 01 27*	paint, inks, adhesives and resins containing hazardous substances
20 01 33*	batteries and accumulators included in 16 06 01, 16 06 02 or 16 06 03 and unsorted batteries and accumulators containing these batteries
20 01 36	discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35
20 01 39	plastics
20 01 40	metals
20 03	**other municipal wastes**
20 03 01	mixed municipal waste
20 03 07	bulky waste

Appendix D

Typical Content – Detailed Resource and Waste Management Plan

The detailed CRWMP and the requirements to be adopted by the contractor will include the following:

- A named Resource Manager (RM) of the CRWMP with responsibility for implementation at Construction Phase must be identified by the contractor;
- The CRWMP must be included in the site induction training;
- Toolbox talks and all other training on the CRWMP must be provided in line with EPA Guidance Section 5.4;
- There must be appropriate procedures for identifying suitably permitted waste collection operators and waste destination sites implemented – a resource for this task is included in Appendix F of the EPA Guidance;
- Resource efficient supply chains should be implemented as appropriate in line with EPA Guidance Section 5.5;
- There must be appropriate procedures for record keeping and reporting of all off-site export of resources implemented;
- There must be procedures for record keeping and reporting of all on site resource uses – this may include measures such as the use of an on-site a mobile crusher for producing aggregate from suitable residual concrete (subject to the appropriate waste consent) – in line with EPA Guidance Section 5.7;
- There must be appropriate procedures for audits and inspections of resource management practices in line with EPA Guidance Section 5.6;
- There must be appropriate procedures for engagement with the Local authority and other stakeholders in line with EPA Guidance Section 5.8;
- There must be a final report prepared summarising the outcomes of resource management processes adopted and the final inventory and cost for the project in line with EPA Guidance Section 5.8;
- Procedures for audits and inspections of resource management practices;
- There should be appropriate site signage on resource management put in place;
- There should be appropriate resource storage implemented on site (i.e., dedicated skips, hazardous materials storage, stockpile management, etc.). Note there are specific requirements on stockpiling more than 50kg of certain persistent organic pollutants (from a construction perspective these may include some chlorinated hydrocarbon contaminants in ground contamination, EPS/XPS insulation building material containing brominated flame retardant (HBCDD) or polychlorinated biphenyls from removal of electrical equipment) under Article 5 of EU Regulation (EU) 2019/1021; and
- There must be appropriate procedures for handling and export of resources in line with EPA Guidance Section 5.3.

Appendix E

Resource and Waste Inventory Template

LoW Code	Description	Volume Generated (tonnes)	Prevention (tonnes) (non-waste)	Reused (tonnes (non-waste)	Recycled (tonnes) (waste)	Recovered[6] (tonnes) (waste)	Disposed (tonnes) (waste)	Unit Cost Rate (€/tonne)	Total Cost (€)
17 01 01	Concrete								
17 01 02	Bricks								
17 01 03	Tiles and Ceramics								
17 02 01	Wood								
17 02 02	Glass								
17 02 03	Plastic								
17 03 02	Bituminous mixtures								
17 04 01	Copper, Bronze, Brass								
17 04 02	Aluminium								
17 04 03	Lead								
17 04 04	Zinc								
17 04 05	Iron and Steel								
17 04 06	Tin								
17 04 07	Mixed Metals								
17 04 11	Cables								
17 05 04	Soil and Stone								
17 06 04	Insulation Material								
17 08 02	Gypsum								
17 09 04	Mixed C&D Waste								
*17 01 06**	*Mixtures of, or separate fractions of concrete, bricks, tiles and ceramics containing hazardous substances*								
*17 02 04**	*Glass, plastic and wood containing or contaminated with hazardous substances*								
*17 03 01**	*Bituminous mixtures containing coal tar*								
*17 04 09**	*Metal waste contaminated with hazardous substances*								
*17 05 03**	*Soil and stones containing hazardous substances*								
*17 06 05**	*Construction materials containing asbestos*								
	Other resources (non-waste materials) (specify as needed)								
	Other Wastes (specify as needed)								

N25 Little Island Pedestrian and Cyclist Bridge
Environmental Impact Assessment Report

Chapter 16

Water

N25 Little Island Pedestrian and Cyclist Bridge
Environmental Impact Assessment Report

Appendix 16.1

Flood Risk Assessment

Contents

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Images

1. Introduction

Arup has been appointed by Cork County Council (CCC) to undertake a site-specific Flood Risk Assessment (FRA) which forms part of planning application for the proposed new N25 Little Island Pedestrian and Cyclist Bridge (i.e., the Proposed Development). The Proposed Development is located approximately 10km to the east of Cork City. The FRA has been undertaken in accordance with 'The Planning System and Flood Risk Management' Guidelines for Planning Authorities published in November 2009, jointly by the Office of Public Works (OPW) and the then Department of Environment, Heritage, and Local Government (DEHLG) and Circular PL 2/2014, hereafter referred to as 'the Guidelines'. The purpose of the study is to identify and quantify the risk of flooding to the Proposed Development and elsewhere, and identify any measures, if required, to mitigate the risk.

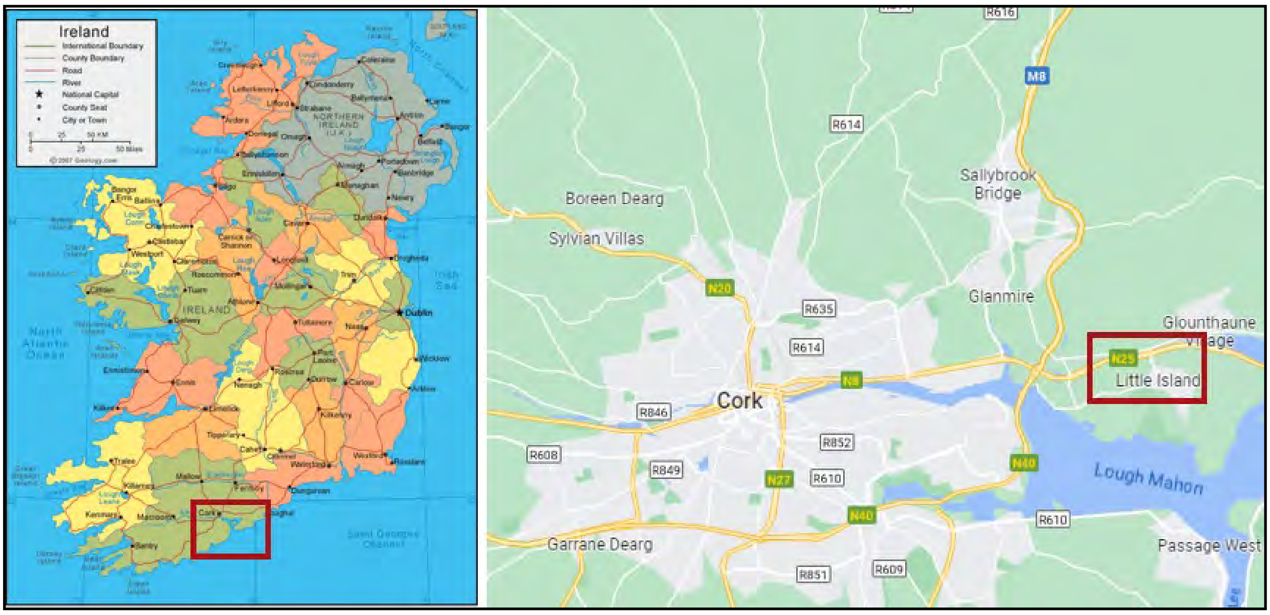


Image 1.1: Approximate Site Location

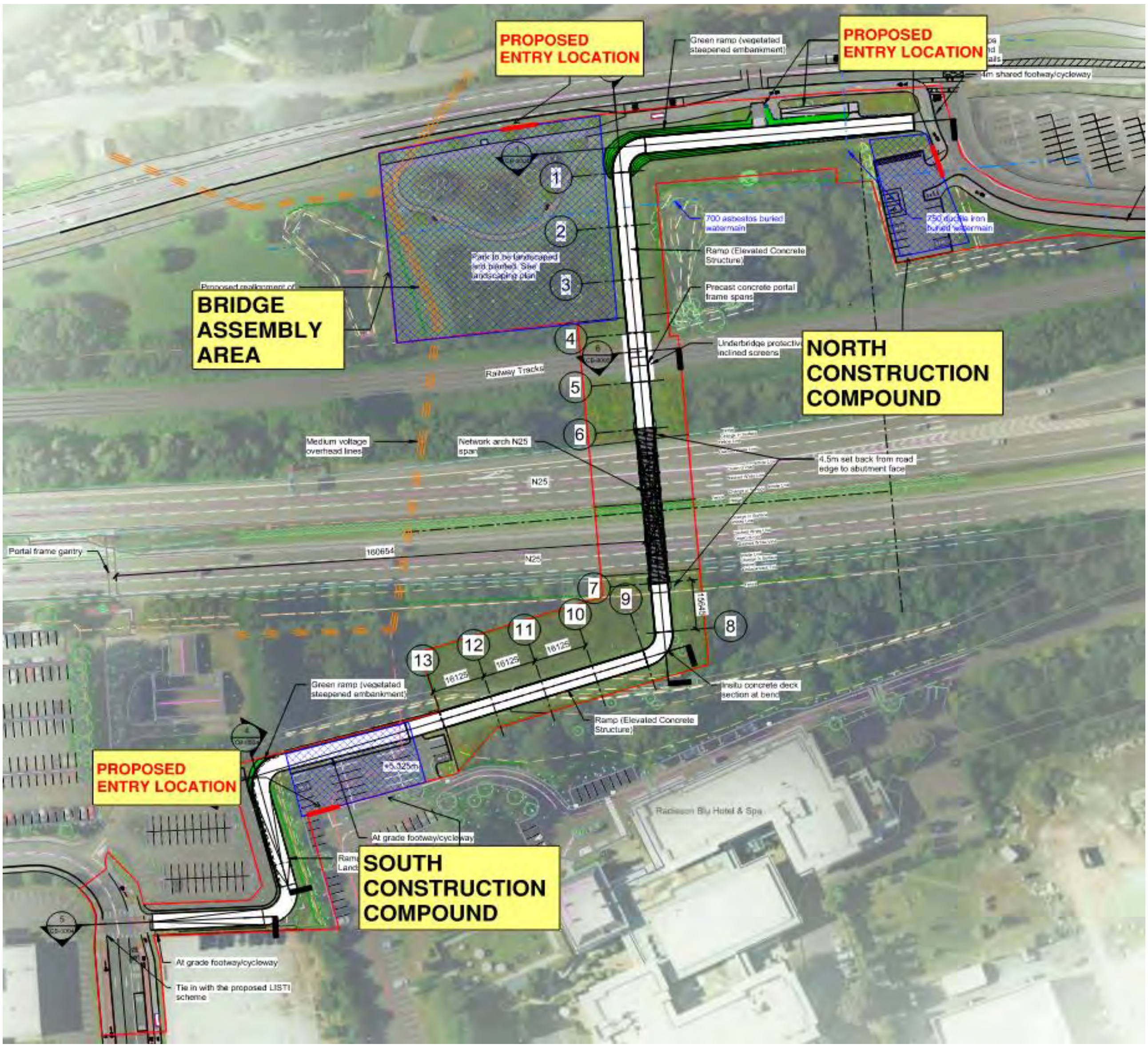


Image 1.2: Extract of Proposed Development site layout, illustrating proposed construction compounds and bridge assembly compound.

1.1 Proposed Development Overview

The Proposed Development will consist of a new pedestrian and cyclist bridge that encompasses a segregated footway and cycleway that will be 5m wide (3m two-way cycleway and 2m footway), connecting the Little Island Train Station and the Dunkettle to Carrigtwohill pedestrian and cycle route with the Radisson Blu Hotel, Eastgate Business Park and the wider surrounds of Little Island. The proposed structure consists of a single span (approximately 49m) steel network arch structure over the N25, a 2 x 15m span precast segmental portal frame structure over the Irish Rail line, and access ramps to the north and south sides. The bridge will have a minimum vertical clearance of 5.7m over the road and 5.3m over the railway line and a maximum slope of 1:22 on the approach ramps, as shown in **Image 1.3**.

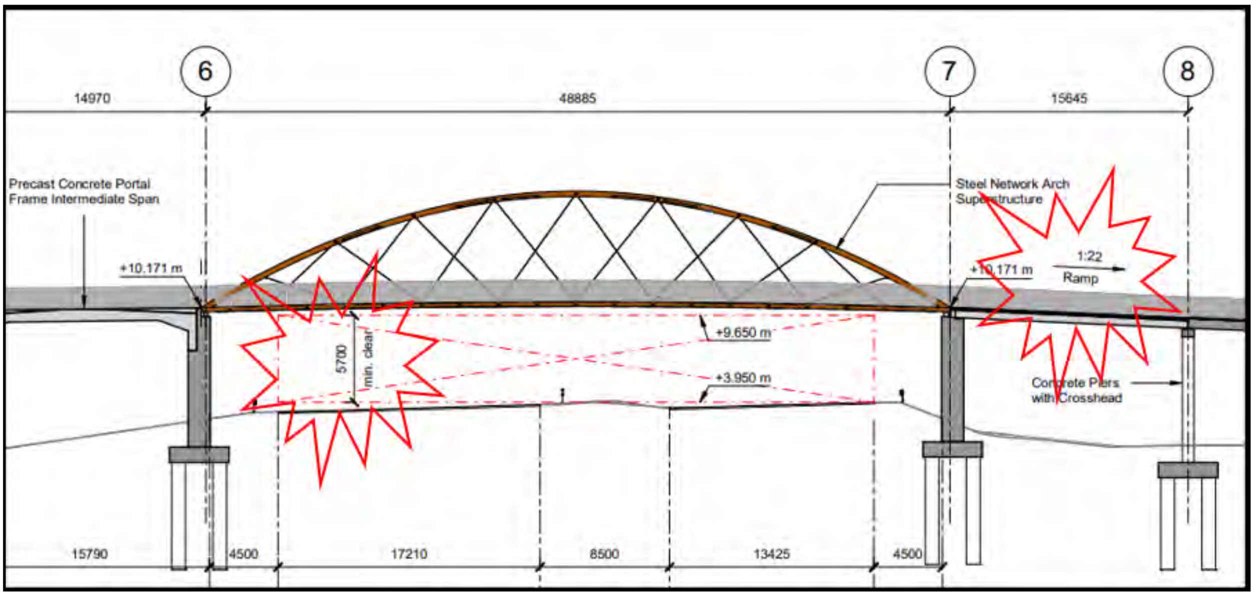


Image 1.3: Cross section of Bridge over the road showing vertical clearance and maximum slope.

1.2 Scope of the Study

The scope of the study includes the following:

- Review of all relevant information and data from:
    - South Western Catchment Flood Risk Assessment and Management Study (CFRAMS);
    - The Office of Public Works (OPW) Preliminary Flood Risk Assessment Mapping (PFRA);
    - The Irish Coastal Protection Strategy Study (ICPSS);
    - Historic flooding information for the area and / or any relevant studies; and
    - Available topographical information for the site.
- Review of the risk of coastal, fluvial, pluvial and groundwater flooding; and
- Preparation of a flood risk assessment report.

1.3 Summary of Data Used

In preparing this report, the following data was collated and reviewed:

- Flood history of the site from OPW National Flood Hazard Mapping website (www.floodmaps.ie);
- CFRAM mapping produced by OPW (www.floodinfo.ie);
- Guidelines for Planning Authorities on ‘The Planning System and Flood Risk Management’ published in November 2009, jointly by the OPW and the then DEHLG;
- Preliminary Flood Risk Assessment (PFRA) mapping produced by the OPW (www.cfram.ie/pfra);
- Site geological and hydrogeological data from the Geological Survey of Ireland website (www.gsi.ie); and
- Aerial photography and mapping from Google Maps.

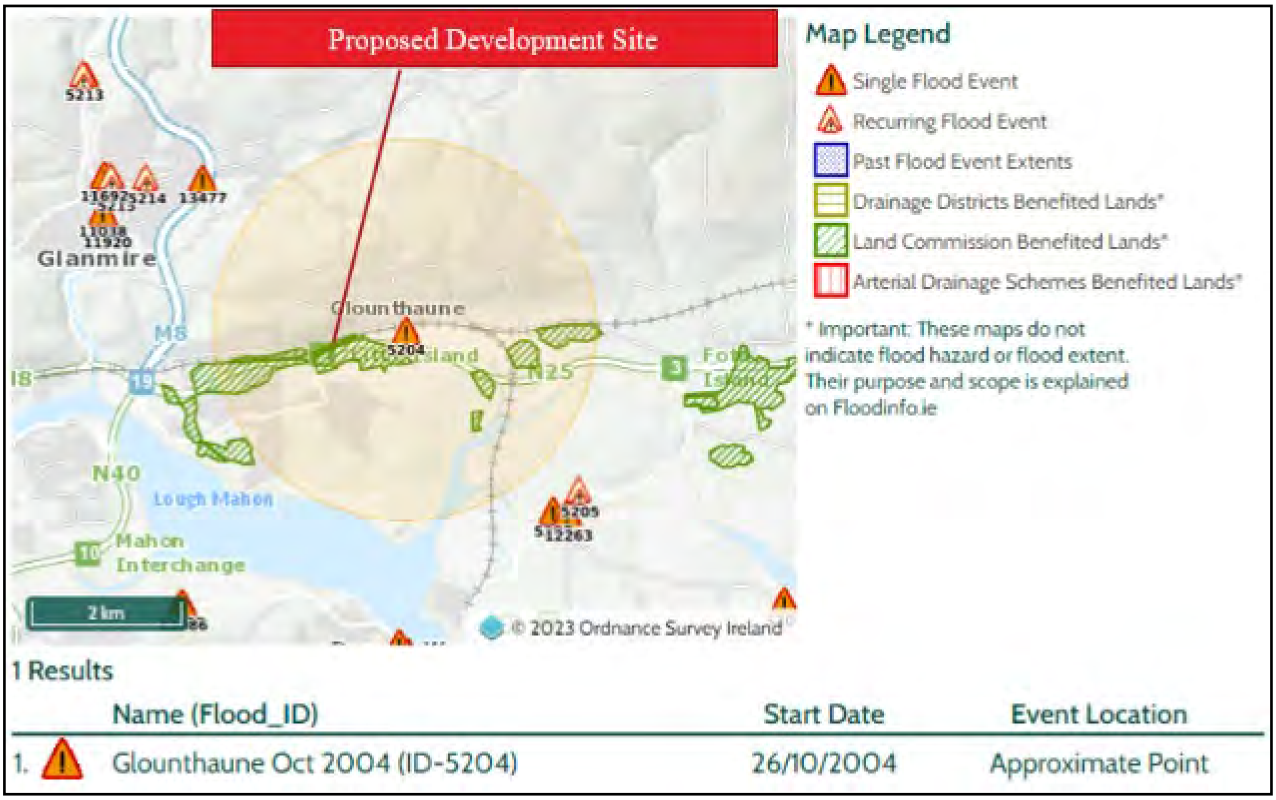
Note that all Ordnance Datum (OD) levels referred to in this report are to Malin Head.

2. Stage 1 – Flood Risk Identification

In this stage, all flooding and surface water issues that might affect the site are assessed to confirm if the site is at risk of flooding from all known sources.

2.1 Historic Flooding at the Site

Records of historic fluvial flooding near the Proposed Development site were reviewed from the OPW National Flood Hazard Mapping website (www.floodinfo.ie). An extract from the website is included in **Image 2.1**. The map shows no historic record of flooding at the site. The flooding incident shown on the map (within circle) at Wexford Street on 26th October 2004 (approximately 2km) was due to coastal / estuarine waters. It should be noted that an absence of a historic record of flooding at the site of interest may not mean that the site is not at risk of flooding.



* Important: These maps do not indicate flood hazard or flood extent. Their purpose and scope is explained on Floodinfo.ie

1 Results

	Name (Flood_ID)	Start Date	Event Location
1.	Glounthaune Oct 2004 (ID-5204)	26/10/2004	Approximate Point

Image 2.1: Historical Flooding at Proposed Development Location (source: www.floodinfo.ie)

2.2 Fluvial Flooding

Fluvial flooding occurs when rivers and streams break their banks and water flows out onto the adjacent low-lying areas (the natural floodplains).

Image 2.2 shows the CFRAM flood maps for the 0.1%, 1% and 10% AEP fluvial floods. It can be seen from the flood extents that the Proposed Development is located outside of the flood extents and is therefore at low risk of fluvial flooding.

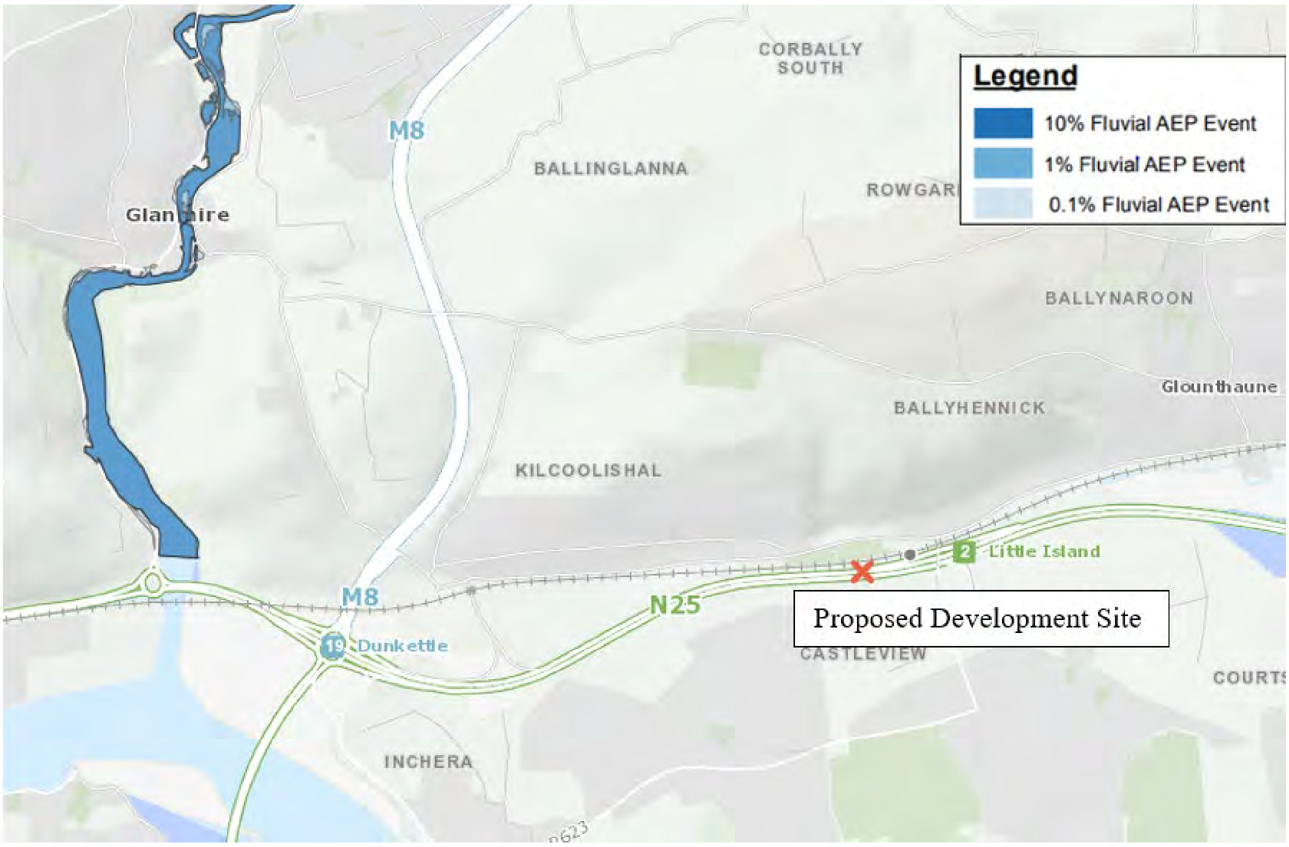


Image 2.2: Extract from South Western CFRAMS fluvial flood extents, current scenario (source: www.floodinfo.ie)

The only other surface water body that appears to interface with the Proposed Development site is the Kilcoolishal Stream that drains the marshy area north of the N25 and south of the railway line, before discharging to Cork Harbour via Eastgate Business Park (culverted). There is neither a historical record nor any flood maps that indicate flooding to the Proposed Development site because of this stream.

2.3 Coastal Flooding

An extract from the South Western CFRAM Study coastal flood extents is presented in **Image 2.3**. The predicted extent for the 1 in 10-, 200- and 1000-year fluvial flood events are shown. The Proposed Development location lies within the 0.5% AEP coastal floodplain (within Flood Zone A) on the northern access ramp. and is therefore at risk of coastal flooding.

The Cork County Development Plan Mapper 2022-2028 (CCC, 2022) also identifies a flood risk to the south of the N25. However, the Proposed Development location lies outside of the 0.5% AEP coastal floodplain (within Flood Zone C) on the southern access ramp. Hence, the southern access ramp is under low risk. Refer to **Image 2.4**.

It is noted that tidal flooding encroaches the Proposed Development site from the east to the west after inundating Harper's Island first.

Image 2.3: Extract from South Western CFRAMS coastal flood extents, current scenario (0.5% AEP)

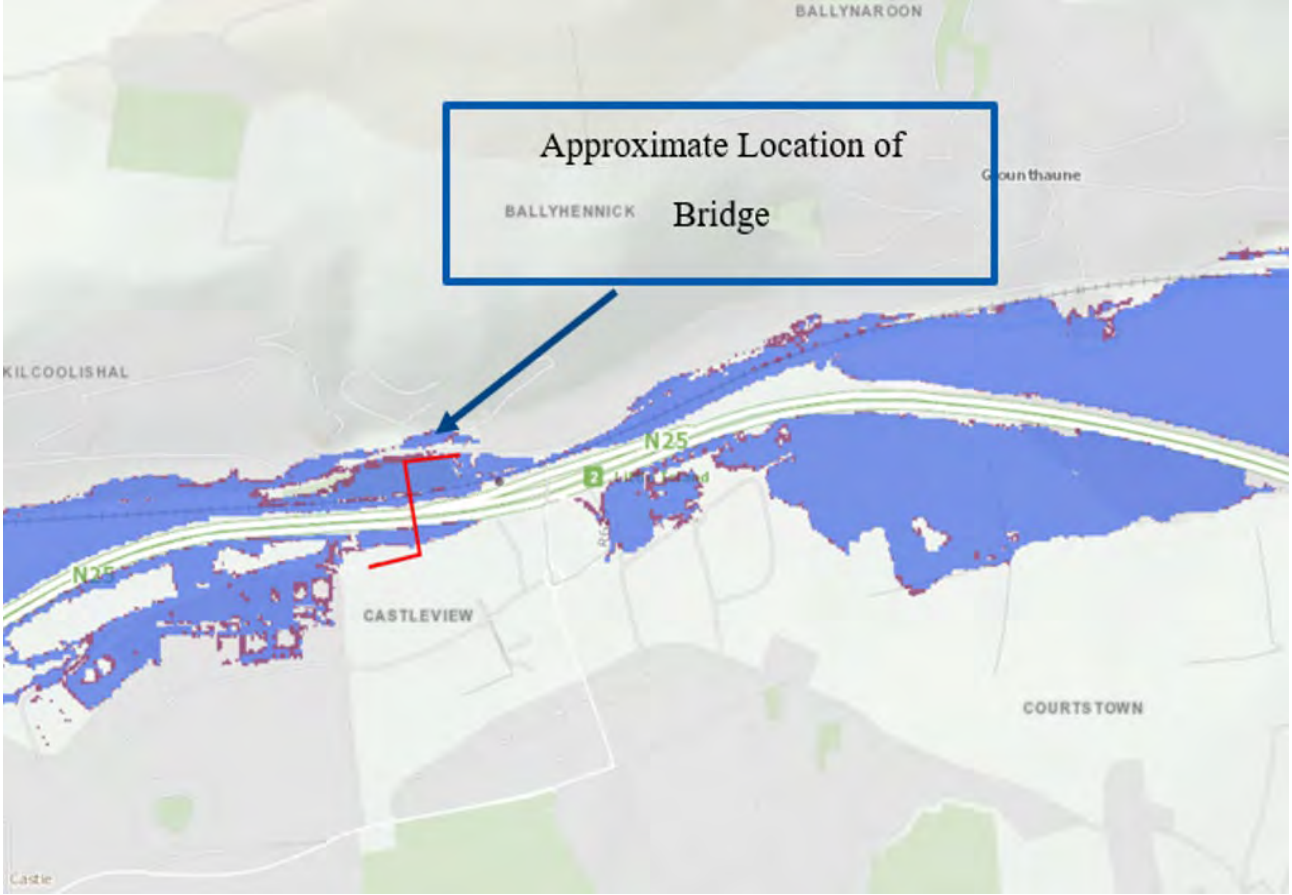


Image 2.4: CCDP 2022 Coastal flood extents, (0.5% AEP)

2.4 Pluvial Flooding

Pluvial flooding occurs when extreme rainfall overwhelms drainage systems or soil infiltration capacity, causing excess rainwater to pond above ground at low points in the topography.

To assess the risk of pluvial flooding to the Proposed Development, Preliminary Flood Risk Assessment (PFRA) flood maps produced by the OPW were reviewed and are presented in **Image 2.5**. The PFRA map indicates that the site is at low risk of pluvial flooding. However, these maps are preliminary and are only indicative. The risk level may change if the drainage system is overwhelmed or blocked.

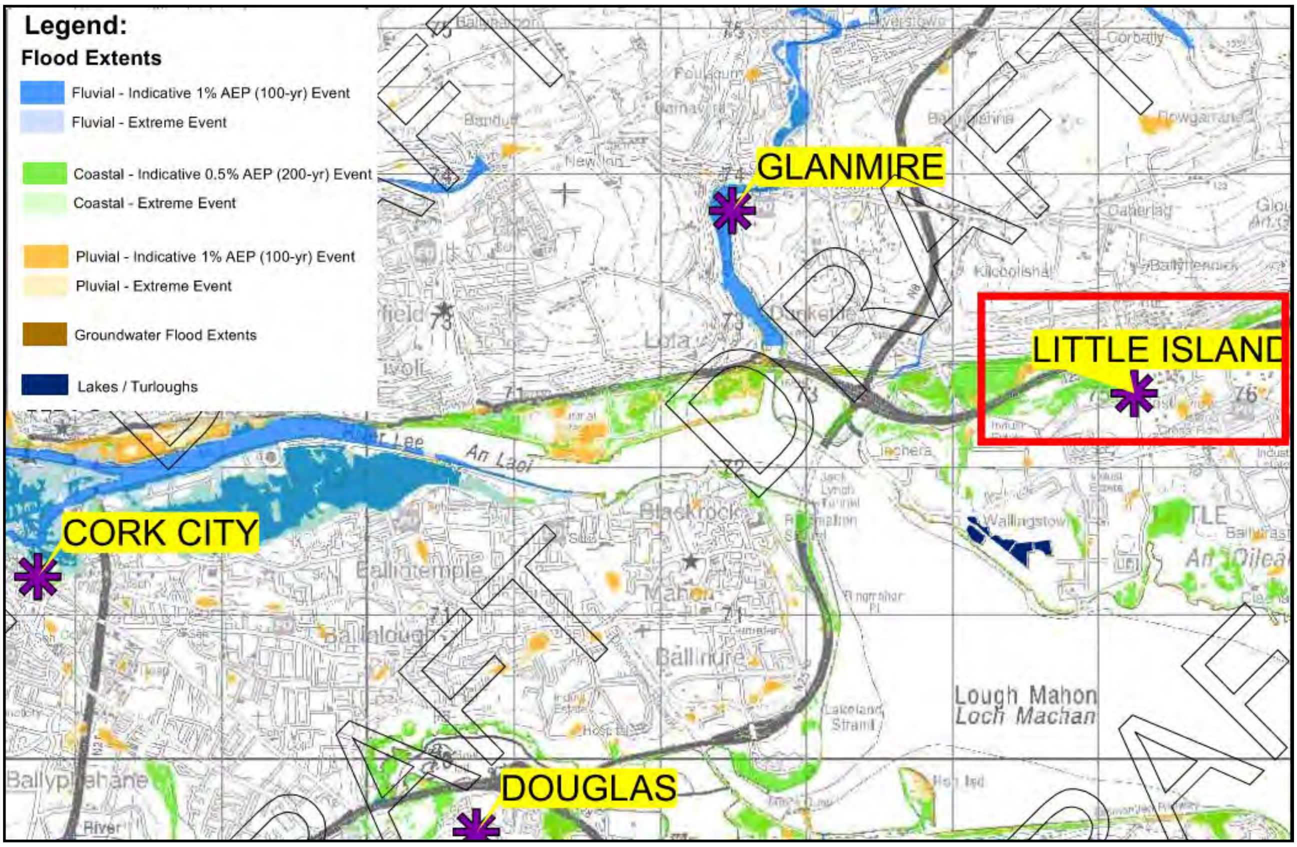


Image 2.5: Preliminary Pluvial Flood Risk Mapping of under study area-Little Island

2.5 Groundwater Flooding

Groundwater flooding can occur during lengthy periods of heavy rainfall, typically during late winter / early spring when the groundwater table is already high. If the groundwater level rises above ground level, it can pond at local low points and cause periods of flooding.

The risk of groundwater flooding at the site has been assessed using the Geological Survey Ireland (GSI) Groundwater Flooding Probability Maps. Assessment of the GSI flood maps indicates that the Proposed Development will be safe from the 0.1%, 1% and 10% AEP groundwater floods. Refer to **Image 2.6**. According to the map, flood risk from groundwater at the Proposed Development site is low.

In the absence of historic flooding, the risk from groundwater flooding is likely to be low. It is however recommended that ground water level at the site is monitored to allow better assessment of groundwater flood risk including during the Construction Phase.

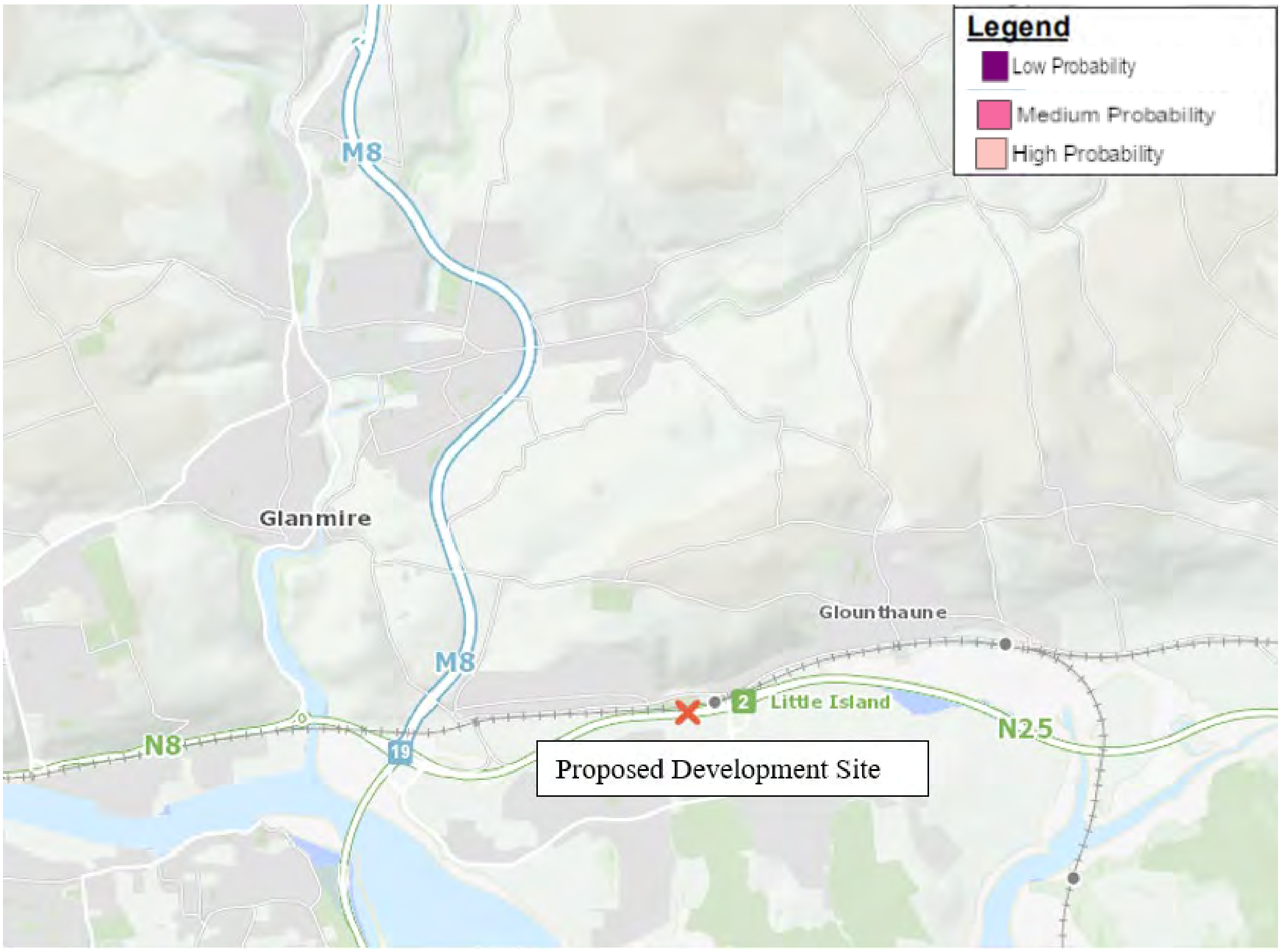


Image 2.6: Groundwater Flood Risk Map (source: www.floodinfo.ie)

2.6 Conclusion of Stage 1 FRA

An assessment of the potential flood risk to the site has been carried out. The conclusions from the assessment are as follows:

- There is no record of historical flooding within 500m radius of the Proposed Development site;
- The southern part of the Proposed Development site is located outside of the predicted 1 in 1000-year fluvial floodplain (within Flood Zone C). Fluvial flood risk of the Proposed Development site is therefore deemed to be low;
- The northern part of the Proposed Development site is located within the predicted 1 in 200-year coastal floodplain (within Flood Zone A). The Proposed Development site is therefore at risk of coastal flooding at this location;
- The risk of pluvial flooding to the site is low. However, the risk of flooding from surface runoff may affect the site if the drainage system is overwhelmed or blocked; and
- The risk of groundwater flooding to the site is considered low. However, monitoring of groundwater levels at the site as part of the site investigations may be required.

Therefore, it is concluded that it is necessary to progress to Stage II FRA to examine further flooding from the coastal source.

3. Stage 2 – Initial Flood Risk Assessment

A Stage 2 FRA (initial flood risk assessment) was undertaken to:

- Confirm the sources of flooding; and
- Appraise the adequacy of existing information as identified under Stage 1 FRA.

A Source-Pathway-Receptor model was developed to assess the risks from the various sources of flooding. The model provides the likelihood of flooding happening from the specified source and its consequence depending on the vulnerability classification of the Proposed Development.

3.1 Source-Pathway-Receptor Model

A Source-Pathway-Receptor model was developed to summarise all possible sources of flooding, the pathway, and receptor for the Proposed Development site. The analysis provided estimates of the probability and magnitude of the sources, the performance and response of pathways and the consequences to the receptors because of the Proposed Development, as listed in **Table 3.1**.

Table 3.1: Source - Pathway – Receptor Model [1]

Source	Pathway	Receptor	Likelihood	Consequence	Risk
Fluvial	Overbank Flow	People / Property	Remote (1)	Minimal (1)	Low (1)
Coastal	Sea Level Rise	People / Property	Likely (4)	Minimal (1)	Medium (4)
Surface water (Pluvial)	Blockage / Overflow	People / Property	unlikely (2)	Minimal (1)	Low (2)
Groundwater	Rising Water Level	People / Property	Remote (1)	Minimal (1)	Low (1)
Human / Mechanical Error	Operational Failure	People / Property	Remote (1)	Minimal (1)	Low (1)

Table 3.1 indicates that the Proposed Development site is at a low risk of flooding from fluvial and groundwater sources. However, the risk of flooding from coastal source is considered medium. The

---

[1] Basis of Scores:

- Likelihood:
  Remote (1): less the 0.1% AEP
  Unlikely (2): 0.1% AEP
  Possible (3): 1% AEP Fluvial or 0.5% Coastal
  Likely (4):10% AEP
- Consequence:
  Minimal (1): inconvenience
  Medium (2): damage to property
  High (3): damage to property and injury
  Major (4): Loss of life and damage to property
- Risk: Low (<=3), Medium (b/n 4 and 6), High (>=8), Very High > (12)

information sources identified in Section 1.3 are considered adequate for the purpose of this FRA and hence, no additional information is required to complete the study. Therefore, the Stage 2: Initial Flood Risk Assessment was completed to confirm the sources of flooding, to determine what further assessments might be required to address the flood risk issues, to propose mitigation measures and to determine residual risks, if any, to the Proposed Development.

3.2 Assessment of Coastal Flood Risk

The maximum water level at the nearest node upstream (approximately 2km) of the existing bridge for the 0.5% AEP coastal flood event level is 2.86m OD. While this is far north from the Proposed Development site, the water levels are considered conservative for use at the site.

The lowest point on the footway / cycle way ramp on the northern side of the Proposed Development is at 2.526m OD (refer to **Image 3.1**). This will result in the submergence of the northern ramp to an approximate depth of 334mm at the entry. The lowest point at southern ramp is at 3.40m OD which is higher than the 0.5% AEP flood level. The southern ramp is at a considerable distance west of the Kilcoolishal Stream, within the grounds of the Eastgate Business Park, and is culverted for most of its length before draining to Cork Harbour. Hence, there is a low risk of flooding.

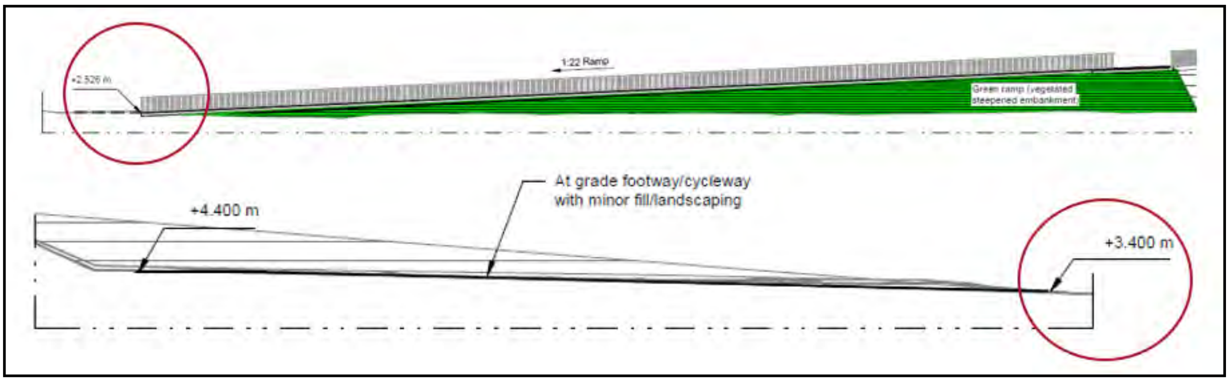


Image 3.1: Northern and Southern Approach Ramps

As the shown in **Figure 2.3**, that the northern ramp of the bridge lies in Flood Zone A where the probability of flooding from the sea is highest (greater than 0.5% or 1 in 200 for coastal flooding). Therefore, a Justification test is required to ensure suitability of the Proposed Development.

3.3 Development Management Justification Test

As the Proposed Development is a pedestrian and cyclist bridge, the vulnerability class is considered "less vulnerable" as it does not represent critical infrastructure. However, the Proposed Development is required to satisfy the Justification test requirements, in accordance with Guidelines, as a section of it is in Flood Zone A. **Table 3.2** presents the assessment and results of the Justification Test as applied to the Proposed Development.

Table 3.2: Justification Test

No.	Criteria	Response	Criteria Satisfied
1	The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines.	The Proposed Development is located within an 'Industry' and 'Green Infrastructure' zone as per the Cork County Development Plan (2022-2028). This development achieves both zoning objectives. The proposed bridge is designed to be seamlessly incorporated and enhance the green corridor.	Yes
2	The proposal has been subject to an appropriate flood risk assessment that demonstrates:		

No.	Criteria	Response	Criteria Satisfied
2(i)	The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk.	The FRA completely demonstrated that the Proposed Development does not increase the risk of flooding elsewhere as the source of flooding is coastal and the water level rise due to the submergence of a small section of the bridge will not impact on the surrounding flood level.	Yes
2(ii)	The development proposal includes measures to minimise flood risk to people, property, the economy, and the environment as far as reasonably possible.	The Proposed Development take only a very small section of the coastal floodplain area and the embankments with the sides grassed. Therefore, no risk identified that justify a mitigation.	Yes
2(iii)	The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access; and	The maximum flood depth in flooded areas can reach up to 3.66m OD. Whereas the lowest access point on the northern ramp is 2.528m OD, access to the bridge from the southern side ensure that access and egress to the bridge is not impacted. The Proposed Development will also integrate with the local surface water drainage system and hence does not impact on flood risk. Moreover, the bridge will not be open for the public, except for emergency personnel, during flood events. .	Yes
2(iv)	The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.	The Proposed Development will facilitate sustainable urban growth through the provision of upgraded cultural heritage and public realm spaces. This is in line with the Cork County Development Plan objectives which states *"To Plan for and support the sustainable long-term development of County Cork as an integrated network of vibrant socially and economically successful urban settlements and rural communities, metropolitan and town greenbelts and open countryside, supporting and contributing to the economic development of the County and of the Southern Region."*. The development is in keeping with the landscape and visuals of the river landscape.	Yes

3.4 Conclusion of Stage 2 FRA

The preceding assessment indicated that the norther section of the Proposed Development site is in Flood Zone A from coastal source. The Justification test completed indicated that it satisfies all the criteria and hence, the Proposed Development is appropriate at the proposed location. It is concluded that the flood risk does not need to be mitigated any further, and hence, a Stage 3 FRA was not required.

4. Conclusion and Recommendations

A site-specific FRA was completed as required in the Guidelines for the Proposed Development site. A section of the northern ramp of the Proposed Development is located within Flood Zone A from coastal flooding. As the development is “less vulnerable” a Justification Test was required to be completed. This test indicated that all the justification criteria are met without the need for mitigation measures.

The risk of flooding from other sources is considered low. However, with respect to the pluvial flooding, it is recommended that the approach ramps are positioned without blocking surface water drainage pathways. It is also recommended that surface drainage systems are in accordance with the CIRIA SUDS Manual (C753) or equivalent guideline.

It is concluded the flood risk to the site from all sources can be managed without increasing flood risk elsewhere and therefore, the Proposed Development complies with DoEHLD / OPW guidance.

5. References

Cork County Council (CCC) (2022). Cork County Development Plan 2022-2028.

Geological Survey of Ireland (GSI) (2018). Groundwater Vulnerability Mapping. Available at: www.gsi.ie

Office of Public Works (OPW) (2018). Preliminary Flood Risk Assessment Mapping. Available at: https://www.floodinfo.ie/about_frm/pfra/ [Accessed: May 2023]

OPW (2009). The planning System and Flood Risk Management Guidelines for Planning Authorities.

OPW (2020). Irish Coastal Protection Strategy Study (ICPSS). Available at: https://www.gov.ie/en/publication/eed0fb-irish-coastal-protection-strategy-study-icpss/ [Accessed: May 2023]

OPW (2023). National Flood Hazard Mapping Web Site. http:/www.floodmaps.ie/ [Accessed: May 2023]

Circular PL 2/2014, 13 August 2014. Environment, Community and Local Government.

N25 Little Island Pedestrian and Cyclist Bridge
Environmental Impact Assessment Report

Chapter 17

Land, Soils, Geology and Hydrogeology

N25 Little Island Pedestrian and Cyclist Bridge
Environmental Impact Assessment Report

Appendix 17.1
Site Walkover

Introduction

The following is a summary of the observations by the Land, Soils, Geology and Hydrogeology environmental impact assessment team following a site walkover of the Proposed Development. The walkover occurred on the 17th February 2022. The site walkover was undertaken in accessible portions of the site (see **Figure 1**), including:

- North of the N25 carriageway;
- Railway line; and
- South of the N25 carriageway.

Not all observations have been included in the summary for conciseness. Typically, only observations that could not have been determined from the desk study and that are relevant to Land, Soils, Geology and Hydrology have been included. The omission of an observation of a feature does not negate the feature's importance in terms of the Land, Soils, Geology and Hydrogeology environmental impact assessment.

The observations are described in **Table 1**.

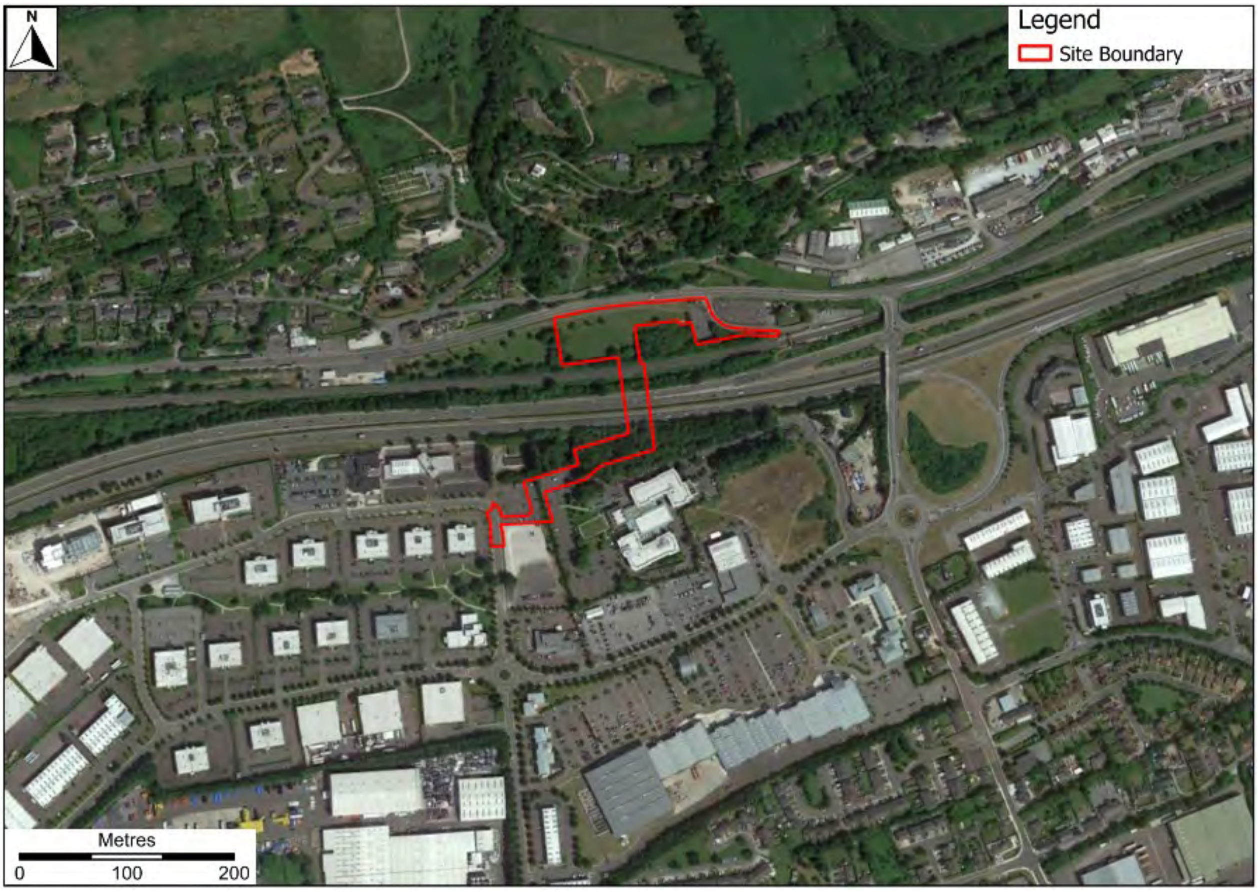


Figure 1: Site boundary of the Proposed Development.

Table 1: Key observations from the site walkover of the Proposed Development on 17/02/2022

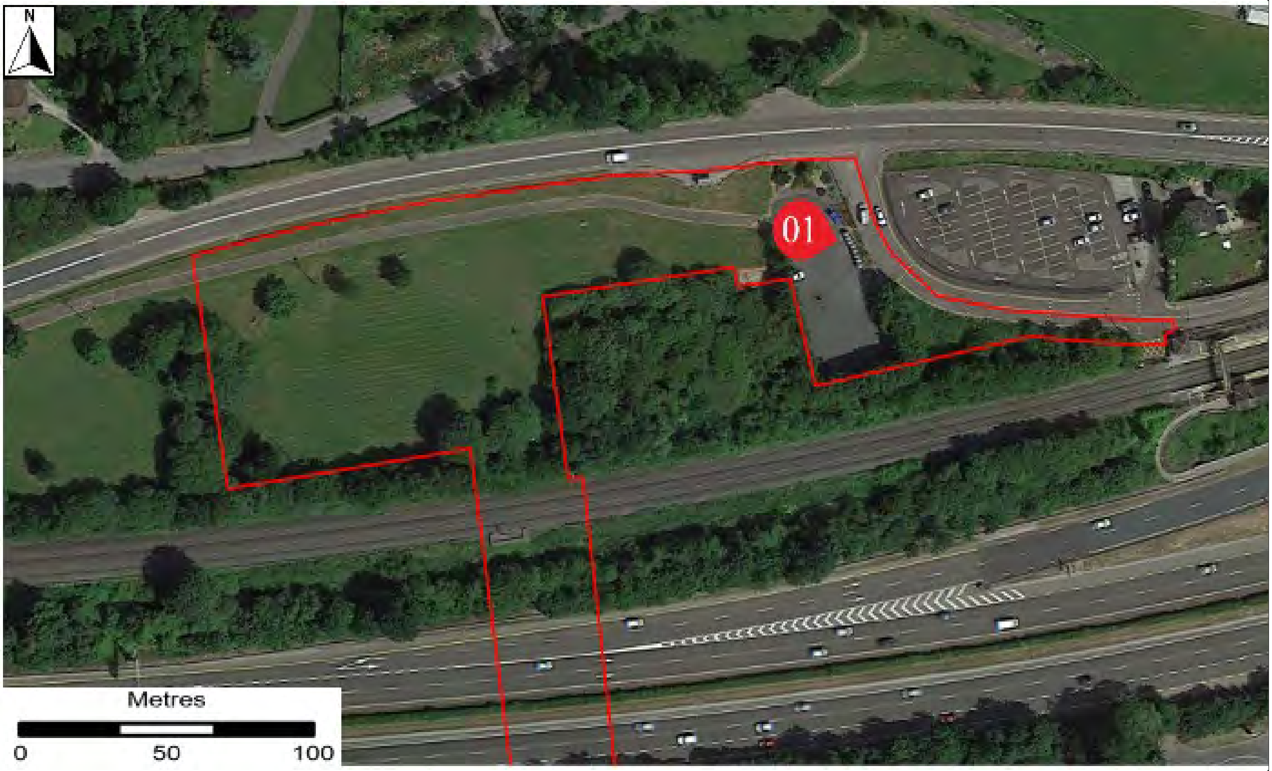
Photo ID	Caption	Date taken	Coordinates (ITM)
Figure_01	Hard standing area in north eastern portion of the site.	17/02/2022	575433, 572929
			
 			

Photo ID	Caption	Date taken	Coordinates (ITM)
Figure_02	Subsurface services located to the west of the Proposed Development.	17/02/2022	575243, 572900

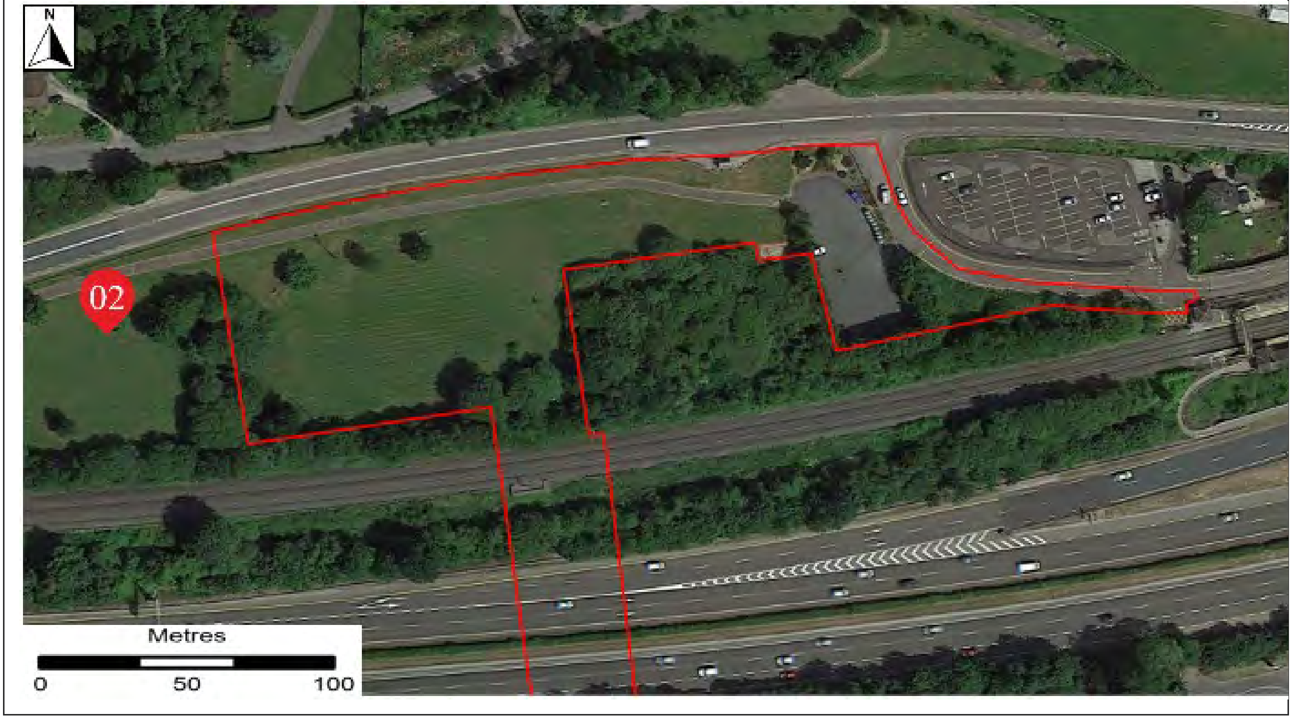


Photo ID	Caption	Date taken	Coordinates (ITM)
Figure_03	Overhead power lines along the northwest site boundary. Surface water ponding also encountered.	17/02/2022	575348, 572884

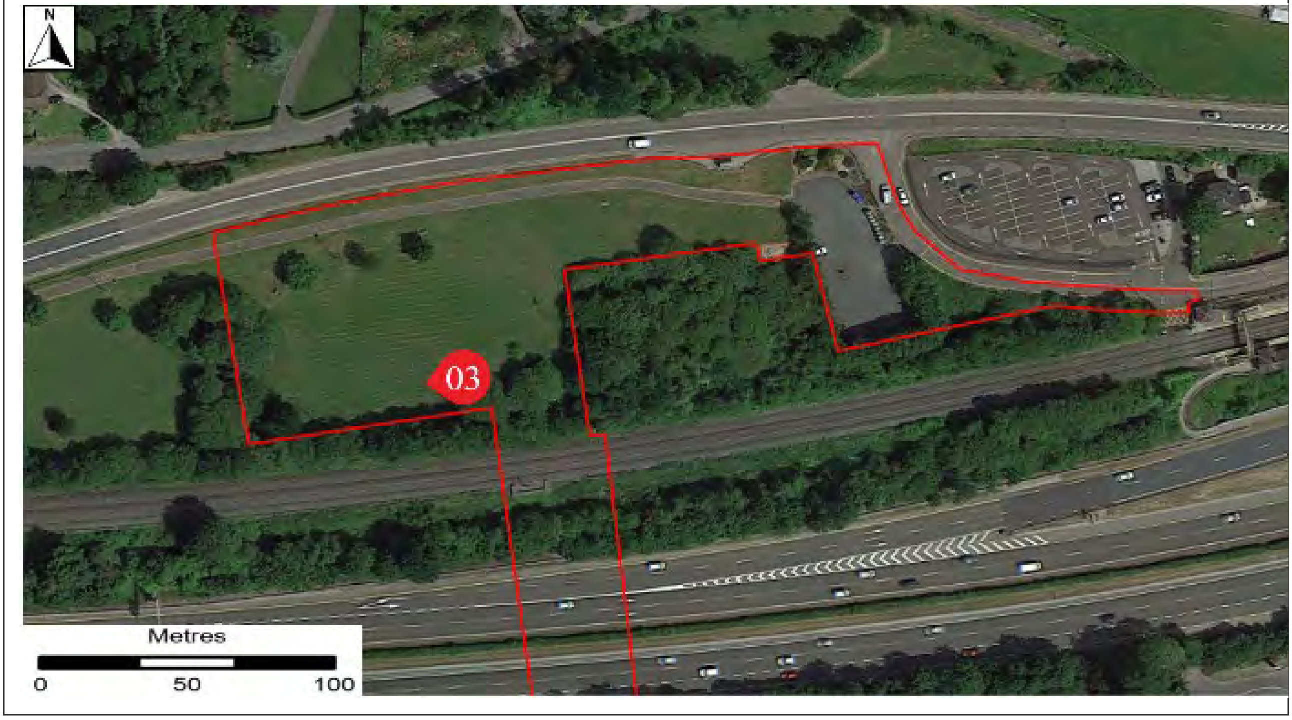


Photo ID	Caption	Date taken	Coordinates (ITM)
Figure_04	Railway line with several overhead power line crossings.	17/02/2022	575547, 572893

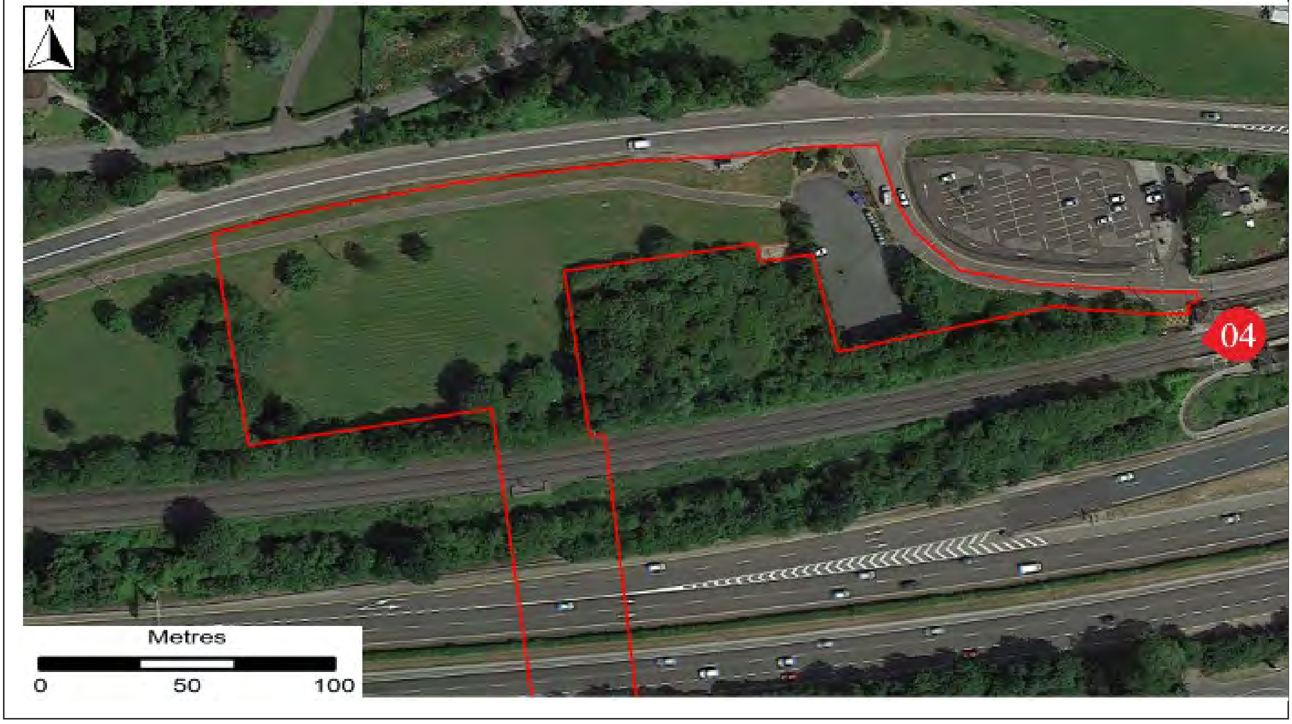


Photo ID	Caption	Date taken	Coordinates (ITM)
Figure_05	Level change between car parks south of the N25 carriageway.	17/02/2022	575244, 572720

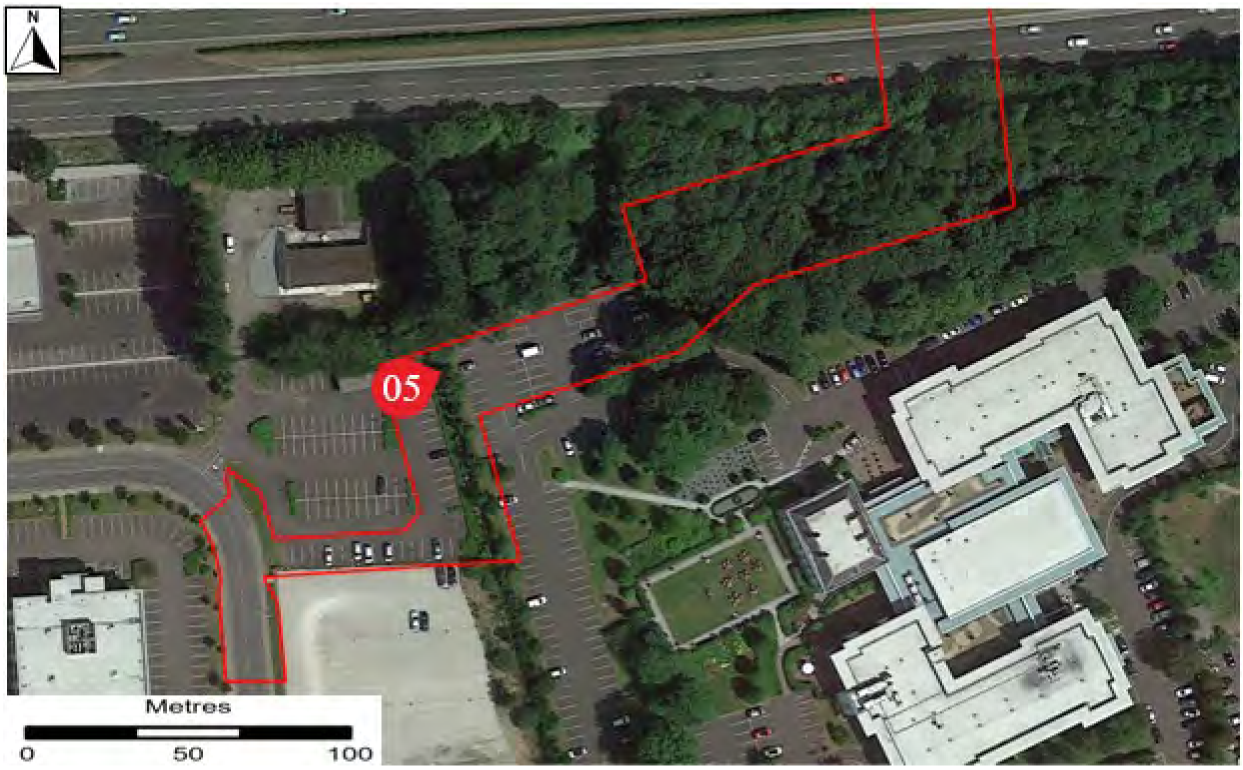


Photo ID	Caption	Date taken	Coordinates (ITM)
Figure_06	Settlement of hardstanding areas in southern section of the site.	17/02/2022	575260, 572730

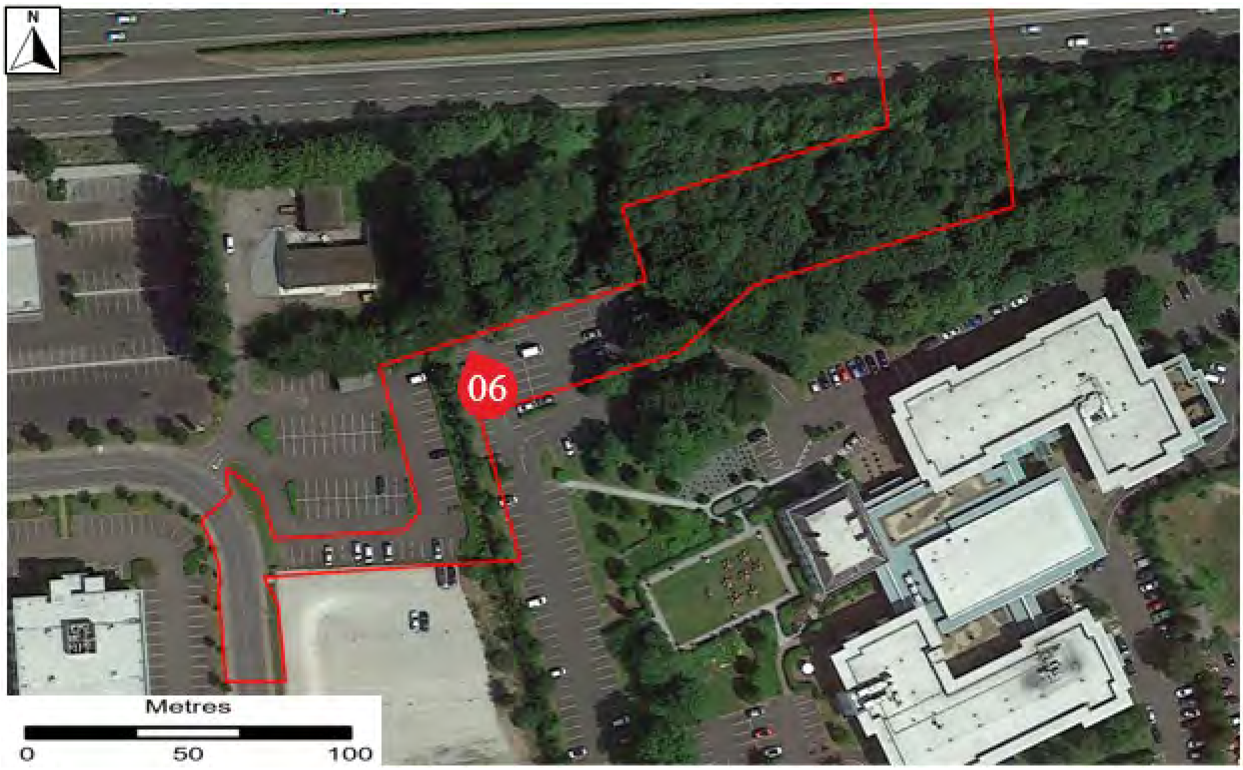
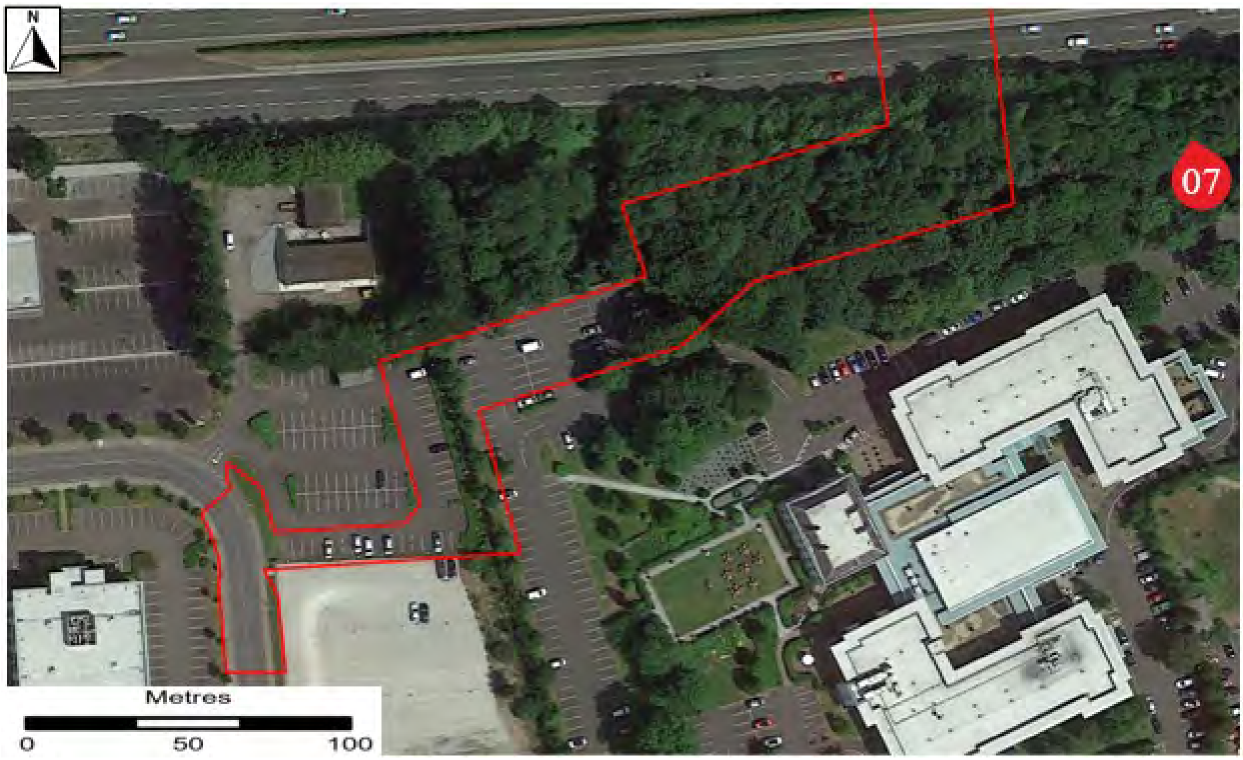


Photo ID	Caption	Date taken	Coordinates (ITM)
Figure_07	Open surface water drainage ditch to the south of the N25 carriageway.	17/02/2022	575440, 572762



N25 Little Island Pedestrian and Cyclist Bridge
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Appendix 17.2

Site Specific Ground Investigation

Our Ref: JMS/Rp/P22156 + attachments (*.pdf)

10th August, 2023

Arup
One Albert Quay,
Cork,
Ireland,
T12 X8N6
Ireland.

Re: Little Island/ N25 Pedestrian & Cycle Bridge, Ground Investigation, Factual Report.

Introduction

In August 2022, Priority Geotechnical (PGL) were requested by Arup acting on behalf of Cork County Council to undertake a ground investigation as part of the Little Island/ N25 Pedestrian & Cycle Bridge Project.

The site is located west of Little Island railway station, Co. Cork.

The proposed bridge alignment spans over the N25 dual carriage way and Cork-Cobh/ Midleton railway line, and is intended to connect the area of the Eastgate Road on Little Island to the greenfield area west of Little Island railway station.

The site consists of three distinct areas:

- North area: A publicly accessible grassed area to the north of the railway line which is generally flat with some dense wooded areas. There was formerly a tributary of the River Lee running across this area, separating Little Island from the mainland, which has since been infilled. A number of key services traverse this site and will require the Contractor to liaise with the relevant service providers;

- The N25: a National Road consisting of a dual carriageway in this location which is maintained under a TII Motorway Maintenance and Renewals Contract (MMaRC). Any works carried out including traffic management or site visits shall be coordinated by the Employer in conjunction with the MMaRC Contractor/any other Contractors working within the area such as at the Dunkettle Interchange/An Garda Síochána; and
- South area: An urban area to the south of the N25 consisting of carparks and an Irish Water Pumping station. The Radisson hotel and its car park sit approximately 2m higher than the car park to its west and the adjacent pumping station.

Works will consist of cable percussion and rotary boreholes, as well as trial pitting and dynamic probing. Only rotary boreholes will be carried out on the verge and/ or hard shoulder of the dual carriageway.

Objectives

The proposed development at the site is the construction of a pedestrian and cycle bridge connecting the Eastgate Road area of Little Island in the south to the Little Island railway station in the north. Several alignment options are under consideration, all of which span from the grassed area west of Little Island railway station and north of the railway line, over the railway line and dual carriageway, to Little Island.

The ground investigation that is the subject of this specification is intended to inform the assessment of alignment options at preliminary design of the proposed bridge.

Scope

The original scope of the ground investigation, which was specified by Arup, comprised of:

- 06Nr. cable percussion boreholes to 25m with rotary core follow-on to 30m;
- 05Nr. rotary open holes boreholes to 30m (with coring if rock encountered before 30m BGL);
- 06Nr. trial pits to 4.5m BGL;
- 09Nr. dynamic probes super heavy;
- Associated in-situ testing (SPTs and plate load tests);

- 03Nr. groundwater installations and associated groundwater sampling, testing and monitoring;
- Geotechnical and geo-environmental sampling and laboratory testing; and
- Factual report.

The quantities of works was changed during the period of works. The final site works as completed is outlined, herein. This geotechnical data report presents the fieldworks records with regard to the ground investigation for the Little Island/ N25 Pedestrian & Cycle Bridge Project. The report should be read in conjunction with the accompanying exploratory records, the photographic records and the laboratory test data.

Site Works

This investigation was carried out in accordance with Eurocode 7- Geotechnical Design Part 2, ground investigation and testing (BS EN 1997-2: 2007) and the relevant British Standards (BS 5930 (2015) Code of Practice for Site Investigation and BS 1377, Method of Tests for Soil for Civil Engineering Purposes, *in situ* Tests Parts 1 to 9).

The direct intrusive fieldworks were undertaken between the 19th August, 2022 and the 29th June, 2023 under the supervision of PGL, Engineering Geologist(s). Details of the plant and equipment used are detailed on the relevant exploratory records, accompanying this report.

Cable Percussion Boreholes

Seven (07) cable percussion boreholes were drilled to depths 2.70m below existing ground level (bgl) to 12.50m bgl using PGL's Dando 2000 Rig and 200mm diameter casing. Borehole BH02 were relocated after terminating on shallow obstructions. The exploratory logs are accompanying this factual report.

Location	Final Depth (m bgl)	Date Start (dd/mm/yyyy)
BH01	10.1	05/01/2023
BH02	6.0	10/01/2023
BH02A	7.0	11/01/2023
BH03	12.5	21/12/2022
BH08	5.8	18/01/2023
BH09	2.7	20/01/2023
BH10	11.0	12/01/2023

Location	Depth Top (m bgl)	Depth Base (m bgl)	Duration (hh:mm)	Tool
BH01	1.80	1.90	01:00	Chisel
	2.90	3.00	01:00	Chisel
	8.80	9.00	01:00	Chisel
	10.00	10.10	01:00	Chisel
BH02	2.80	3.00	01:00	Chisel
	3.90	4.00	01:00	Chisel
	5.95	6.00	01:00	Chisel
BH02A	2.70	2.80	00:30	Chisel
	4.90	5.00	01:00	Chisel
	6.60	6.70	01:00	Chisel
	7.00	7.00	01:00	Chisel
BH03	0.85	0.90	00:30	Chisel
	9.80	9.95	00:30	Chisel
	10.60	10.70	01:00	Chisel
	11.40	11.60	01:00	Chisel
	12.50	12.50	01:00	Chisel
BH08	1.80	1.90	01:00	Chisel
	3.80	4.00	01:00	Chisel
	5.80	5.80	01:00	Chisel
BH09	1.30	1.50	01:00	Chisel
	2.50	2.60	00:30	Chisel
	2.70	2.70	01:00	Chisel
BH10	5.50	5.70	01:00	Chisel
	5.90	6.00	00:30	Chisel
	7.80	7.90	00:30	Chisel
	8.90	9.00	01:00	Chisel
	10.80	11.00	01:00	Chisel

Rotary Boreholes

Subsequently, eight (08) rotary boreholes (06Nr. follow on boreholes) were advanced to depths 30.0m bgl to 31.2m bgl using PGL's Soilmech PSM Rig and 131mm diameter casing. The exploratory logs are accompanying this factual report.

Location	Final Depth (m bgl)	Date Start (dd/mm/yyyy)
RC01	30.0	19/05/2023
RC02	30.0	18/05/2023
RC03	30.0	17/05/2023
RC05	31.2	22/09/2022
RC08	30.0	30/05/2023

Location	Final Depth (m bgl)	Date Start (dd/mm/yyyy)
RC09	30.0	25/05/2023
RC10	30.0	16/05/2023
RC11	30.0	19/08/2022

Trial Pits

Five (05) trial pits were excavated to depths 1.10m bgl to 2.50m bgl using 10t and 14t tracked excavators. The exploratory logs and photographic records accompany this factual report.

Location	Final Depth (m bgl	Date Start (dd/mm/yyyy)
TP01	2.50	12/12/2022
TP02	1.70	12/12/2022
TP03	1.20	12/12/2022
TP04	1.10	29/06/2023
TP05	2.30	29/06/2023

Sampling

A total of eighty five (85) bulk disturbed samples (B), four (04) small disturbed samples (D) and ten (10) environmental samples (ENV) and water samples were recovered from the exploratory holes in accordance with Geotechnical Investigation and Sampling – Sampling Methods and Groundwater Measurements (EN ISO 22475-1:2006).

In-Situ Testing

Standard Penetration Tests (SPT)

A total of one hundred and seventy four (174) standard penetration tests, were carried out in the cable percussion and rotary boreholes using the 60° solid cone (CPT) in place of the standard split barrel sampler. The data was presented on the relevant logs accompanying this factual report.

Dynamic Probes

PGL's Competitor dynamic probing rig was to undertake dynamic probing (DP(H); 50kg drop weight, 500mm drop height) in general accordance with Geotechnical Investigation and Testing, Part 2, Dynamic probing, BS EN ISO 22476-2:2005. The blows per 100mm ($N_{100\ H}$) were recorded to refusal being 25blows without progress over 100mm. Eight (08) number dynamic probes progressed to refusal at depths 7.00m bgl to 8.80m bgl. The exploratory records accompany this report and are discussed herein.

Location	Final Depth (m bgl	Date Start (dd/mm/yyyy)
DP01	8.7	06/03/2023
DP02	8.8	06/03/2023
DP03	8.5	06/03/2023
DP04	8.7	06/01/2023
DP05	8.4	06/03/2023
DP06	8.6	06/03/2023
DP07	7.6	06/03/2023
DP08	7.0	06/03/2023

Plate Loading Tests

Two (02) number plate loading tests were undertaken using 450mm diameter plate in accordance with EC7 Geotechnical design Pt. 2, ground investigation and testing, EN 1997-2:2001 (E), Cl. 4.11, Plate loading test (Annex K) using a 14t tracked excavator for reaction, to determine *in situ* CBR values. The results accompanying this factual report.

Survey and Drawings

The 'as built' exploration locations were surveyed to the Ordinance Survey Irish Transverse Mercator system of co-ordinates (ITM) and elevations to Malin Head datum and shown on the relevant exploratory logs and the Exploratory Location Plans (P22156-SI-A, P22156-SI-01) accompanying this report.

Location	Easting	Northing	Ground Level (mOD)	Final Depth (m bgl)	Date Start (dd/mm/yyyy)
BH01	575249.07	572898.53	2.50	10.10	05/01/2023
BH02	575307.97	572871.09	1.94	6.00	10/01/2023
BH02A	575310.67	572871.09	1.94	7.00	11/01/2023
BH03	575194.04	572870.07	2.73	12.50	21/12/2022
BH08	575294.87	572742.55	5.38	5.80	18/01/2023
BH09	575212.19	572709.15	3.44	2.70	20/01/2023
BH10	575358.66	572891.18	1.63	11.00	12/01/2023
DP01	575389.64	572938.41	2.96	8.70	06/03/2023
DP02	575379.16	572936.48	2.98	8.80	06/03/2023
DP03	575352.80	572935.25	2.98	8.50	06/03/2023
DP04	575313.03	572929.02	2.87	8.70	06/01/2023
DP05	575310.04	572918.09	2.58	8.40	06/03/2023
DP06	575286.02	572923.27	2.84	8.60	06/03/2023
DP07	575231.27	572909.46	2.73	7.60	06/03/2023
DP08	575213.94	572904.40	2.91	7.00	06/03/2023
RC01	575249.08	572898.53	2.50	30.00	19/05/2023

Location	Easting	Northing	Ground Level (mOD)	Final Depth (m bgl)	Date Start (dd/mm/yyyy)
RC02	575310.67	572871.09	1.94	30.00	18/05/2023
RC03	575194.00	572870.07	2.73	30.00	17/05/2023
RC05	575300.07	572824.57	3.42	31.20	22/09/2022
RC08	575294.87	572742.55	5.38	30.00	30/05/2023
RC09	575212.19	572709.15	3.44	30.00	25/05/2023
RC10	575358.66	572891.18	1.63	30.00	16/05/2023
RC11	575308.77	572788.87	3.92	30.00	19/08/2022
TP01	575392.76	572937.34	2.94	2.50	12/12/2022
TP02	575318.98	572928.37	2.91	1.70	12/12/2022
TP03	575181.54	572888.69	3.16	1.20	12/12/2022
TP04	575256.58	572732.37	4.92	1.10	29/06/2023
TP05	575235.79	572716.09	3.80	2.30	29/06/2023

Laboratory Testing

Laboratory testing was scheduled by Arup and carried out by PGL in accordance with BS1377 (1990), Methods of test for soils for civil engineering purposes. Chemical testing was carried out by Eurofins-Chemtest Ltd. (UK) on behalf of PGL. The laboratory data accompanies this report.

Type	Quantity, Nr.	Remarks
Natural moisture content	21	16% to 56%
Particle size distribution	43	09Nr. hydrometer analysis on fine soils
Atterberg limits	11	Liquid Limit, LL 32% to 61%
		Plastic Limit, PL 20% to 36%
		Plasticity Index, PI 12 to 29
Shear box	01	BH02A 5.00m bgl
Suite D	06	See attached results
Loss on ignition	02	3.3% and 3.8%
Organic Matter	02	<0.40% and 1.4%
Environmental, Suite E	12	See attached results
Environmental, Suite F	03	

Please note that all samples shall be retained for a period no longer than 28 days from the date of this report. Thereafter all remaining samples shall be appropriately disposed of unless a written instruction to the contrary is received by PGL prior to the date of this reporting and within the 28 day period outlined above. Laboratory testing will result in a reduction of sample quantity and in some cased the use of the full sample mass. Samples already tested may not be suitable or available for further testing.

Published Geology

A search of the Geological Survey data base and 1:100,000 mapping (Sheet 25) indicated the site is defined by six major lithological units within the Cork syncline. To the north of the study area lies the Cuskinny member (KNcu) made up of flaser and linsen bedded Sandstone. The Ballysteen formation is mapped as dark muddy Limestone and Shale. Waulsortian Limestones (WA) described as massive, unbedded Lime-mudstones.

These are followed by the Cork Red Marble Formation, made up of red brecciated calcilutite Limestone, the Little Island Formation (LI), described as massive and crinoidal fine Limestone followed by the Clashavodig (CV) formation, described as Oolitic, peloidal, cherty fine Limestone.

North south trending faults are mapped in the area offsetting the geological units. Outcropping bedrock is mapped to the north of the study area. Teagasc subsoil mapping indicates the site is underlain by Made Ground deposits, estuarine deposits and Glacial till. The national groundwater vulnerability mapping indicates the area is of moderate to high vulnerability.

Ground and Groundwater Conditions

The full details of the ground conditions encountered are provided for on the exploratory records accompanying this report. The records provide descriptions, in accordance with BS 5930 (2015) and Eurocode 7, Geotechnical Investigation and Testing, Identification and classification of soils, Part 1, Identification and description (EN ISO 14688-1: 2002),– Identification and Classification of Soil, Part 2: Classification Principles (EN ISO 14688-2:2004) and Identification and Classification of Rock, Part 1: Identification & Description (EN ISO 14689-1:2004) of the materials encountered, *in situ* testing and details of the samples taken, together with any observations made during the ground investigation.

Groundwater levels may be subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions, tidal variations etc. Low volume groundwater flow may be cut-off by borehole casing as it progresses in stiff glacial deposits. The duration trial pit excavations remain open may not be sufficient to allow for low volume flow to present. The groundwater regime should be assessed from standpipe well installations, where available.

Groundwater was encountered during the period of works at depths 1.70m bgl to 21.00m bgl.

SUMMARY OF GROUNDWATER

Location	Depth Strike (m bgl)	Remarks	Standpipe (Y/N)
BH01	-	None encountered	N
BH02	-	None encountered	N
BH02A	-	None encountered	N
BH03	-	None encountered	N
BH08	-	See shift log	N
BH09	-	None encountered	N
BH10	-	See shift log	N
RC01	4.00	See shift data	N
RC02	12.00	See shift log	N
RC03	12.00	See shift log	Y
RC05	10.10	See shift data	N
RC08	21.00	See shift data	N
RC09	17.00	See shift data	Y
RC10	-	See shift log	Y
RC11	8.80	See shift data	N
TP01	1.70	Seepage flow rate	N
TP01	1.90	Trickle flow rate	N
TP02	-	None encountered	N
TP03	-	None encountered	N
TP04	-	None encountered	N
TP05	-	None encountered	N

Three (03) 50mm dia. HPDE standpipes were constructed to allow for groundwater monitoring. The details are summarised below.

SUMMARY OF STANDPIPE CONSTRUCTION

Location	Depth Top (m bgl)	Depth Base (m bgl)	Diameter (mm)	Pipe Type
RC03	0.0	15.0	50	PLAIN
	15.0	20.0	50	SLOTTED
RC09	0.0	25.0	50	PLAIN
	25.0	30.0	50	SLOTTED
RC10	0.0	8.0	50	PLAIN
	8.0	12.0	50	SLOTTED

Groundwater levels were taken from boreholes on a of return site visit. The readings are presented below.

SUMMARY OF GROUNDWATER LEVELS

Location	Depth (m bgl)	Depth (m bgl)
	10/07/2023	**10/08/2023**
RC03	2.00	0.8
RC09	2.55	2.53
RC10	0.87	1.76

Exploratory locations were backfilled with their arisings gravel, lean-mix and tar. Backfill details are displayed graphically on the accompanying logs and summarised below.

SUMMARY OF BACKFILL

∴ GRAVEL Backfill to installation/ borehole

☰ uPVC slotted pipe

▩ ARISINGS Backfill

▧ BENTONITE Backfill to installation/ borehole

Should you have any queries in relation to the data collected and presented herein, please do not hesitate to contact our office.

Yours sincerely,
For **Priority Geotechnical,**

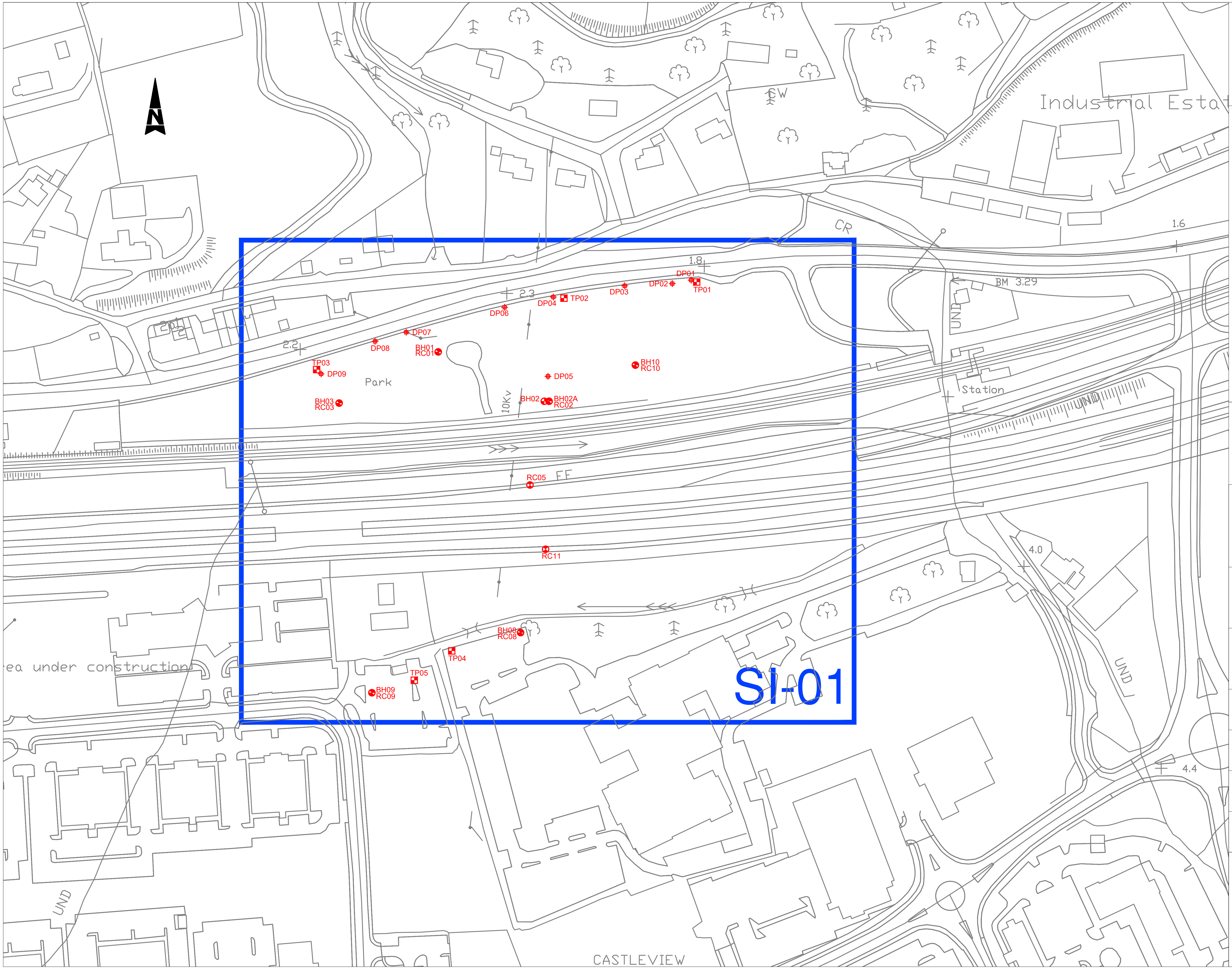
J McSweeney

James McSweeney BSc
Engineering Geologist

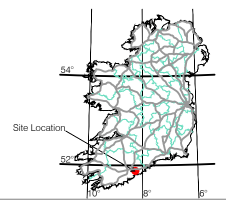
No responsibility can be held by PGL for ground conditions between exploratory locations. The exploratory logs provide for ground profiles and configuration of strata relevant to the investigation depths achieved during the fieldworks. Caution shall be taken when extrapolating between such exploratory locations. No liability is accepted for ground conditions extraneous to the exploratory locations.

No account has been taken of potential subsidence or ground movement due to mineral extraction, mining works or karstification below or in proximity to the site, unless specifically addressed.

This report has been prepared for Employer and their Representative as outline, herein. The information should not be used without their prior written permission. PGL accepts no responsibility or liability for this document being used other than for the purposes for which it was intended.



Priority Geotechnical Site



JOB NAME:

N25 Pedestrian &
Cycle Bridge

Sheet Title:

EXPLORATORY LOCATION
LAYOUT

JOB NUMBER:

P22156

DRAWING NUMBER:

P22156-SI-A

DRAWN BY:

Gary Curtin

DATE:

24/08/2022

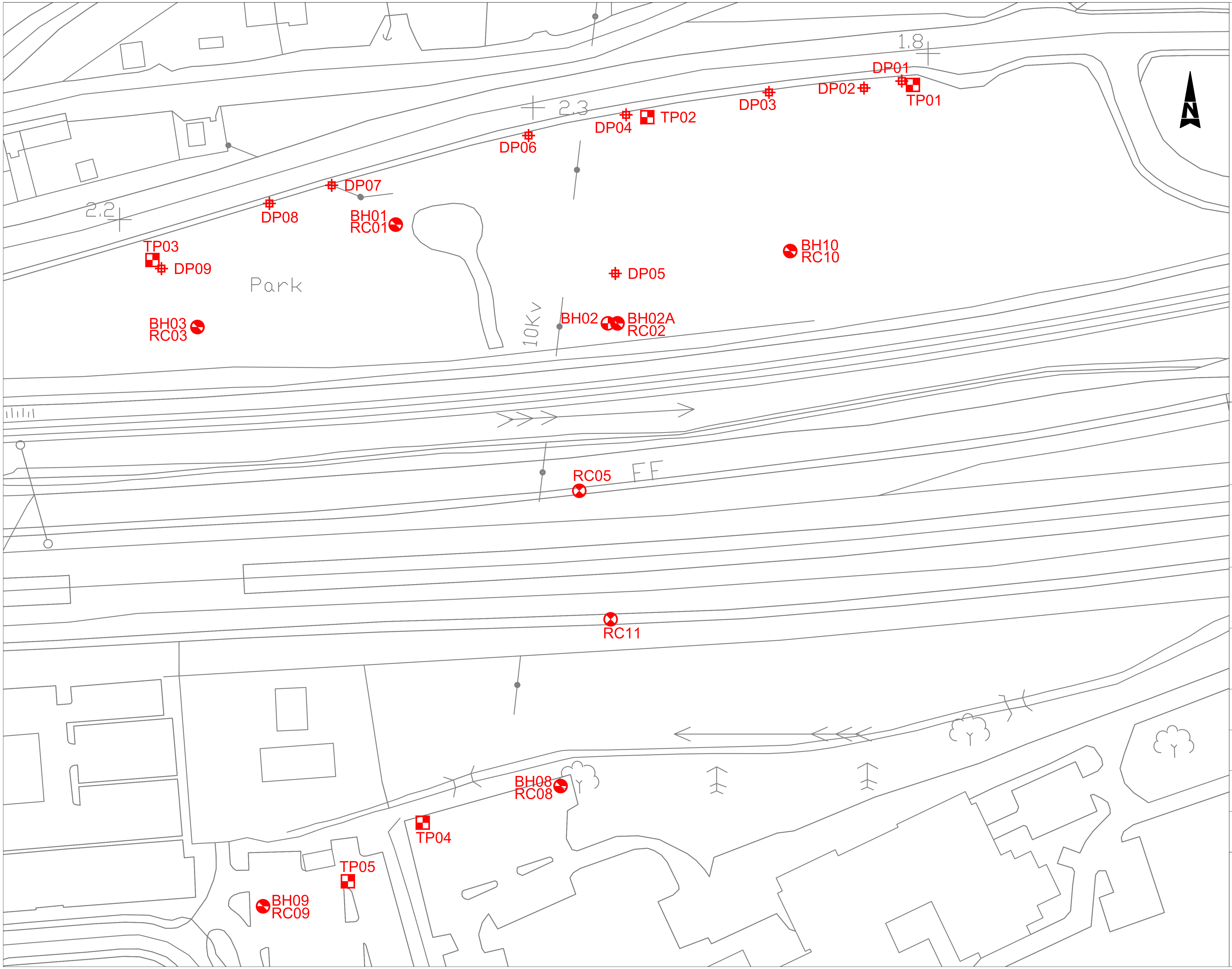
SCALE:	APPROVED:
1:2000 ON A3	GH

REVISION:

D01

KEY:

BH00	Denotes Borehole location
RC00	Denotes Rotary Core location
TP00	Denotes Trial Pit location
DP00	Denotes Dynamic Probe location



JOB NAME:

N25 Pedestrian &
Cycle Bridge

Sheet Title:

EXPLORATION LOCATION
PLAN

JOB NUMBER:

P22156

DRAWING NUMBER:

P22156-SI-01

DRAWN BY:

Gary Curtin

DATE:

24/08/2022

SCALE:	APPROVED:
1:500 ON A3	GH

REVISION:

D01

KEY TO SYMBOLS ON EXPLORATORY HOLE RECORDS

GENERAL

m	Meter
mm	Millimetres
BGL	Below existing ground level
mOD	Level to OD Malin
TP	Trial Pit
ST	Slit Trench
CP	Cable Percussion Borehole
RC	Rotary Cored Borehole
IP	Inspection Pit
FP	Foundation Pit
DP	Dynamic Probe
Geobore S	Geobore S Borehole

SAMPLES

B	Bulk disturbed sample
D	Small disturbed sample
U	Undisturbed sample
WS	Dynamic sample/ window sample
ENV	Environmental sample
SPLTLS	Split spoon sample
CBR	California Bearing Ratio mould sample

RECOVERY AND ROCK QUALITY

TCR %	Total Core Recovery (% of Core Run)
SCR %	Solid Core Recovery (length of core having at least one full diameter as % of core run) RQD
RQD %	Rock Quality Designation (length of solid core greater than 100mm as % of core run)
FI	Fracture Index
NI	Non intact
AVG	Average distance between fractures
MAX	Maximum distance between fractures
MIN	Minimum distance between fractures

GROUNDWATER

Strike	▼
Level after standing	▽

IN-SITU TESTING

N	Standard Penetration Test - Blows required to drive 300mm after seating drive
C	Standard Penetration Test - 60Cone
S	Standard Penetration Test – Split Spoon

Soil and rock descriptions are based on the guidance in BS5930:2015, The Code of Practice for Site Investigation

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Drilled By	KC	**Borehole No.**	**BH01**
Logged By	MM		Sheet 1 of 2

Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords**	575249E - 572899N	**Hole Type** CP
Location	Little Island, Co. Cork		**Level**	2.50 m OD	**Scale** 1:50
Client	Cork County Council		**Date**	05/01/2023 - 09/01/2023	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00 - 1.20	B					(MADE GROUND) Dark brown, sandy very silty GRAVEL with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub angular. Cobbles are 63mm to 100mm, angular to sub angular.
		1.20 - 2.20 1.20	B SPT (C)	N=29 (5,5/6,7,8,8)	1.20	1.30		Medium dense, dark brown, sandy very silty GRAVEL with high cobble content. Sand is fine to coarse. Gravel is fine, angular to sub angular.
		2.20 - 3.20 2.20	B SPT (C)	N=32 (5,5/7,7,9,9)	2.20	0.30		Dense, dark brown, sandy silty GRAVEL with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular.
					3.00	-0.50		Firm to stiff, grey brown, slightly sandy slightly gravelly SILT. Sand is fine to coarse. Sand is fine to coarse. Gravel is fine, angular to sub angular.
		3.20 - 4.20 3.20	B SPT (C)	N=18 (5,4/4,5,4,5)				
		4.20 - 5.20 4.20	B SPT (C)	N=21 (4,4/5,5,5,6)				
		5.20 - 6.20 5.20	B SPT (C)	N=16 (3,3/4,4,4,4)				
		6.20 - 7.20 6.20	B SPT (C)	N=18 (4,5/5,5,4,4)				
					7.00	-4.50		Medium dense, dark grey, slightly sandy silty GRAVEL with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub angular to sub rounded. Cobbles are 63mm to 100mm, sub angular to sub rounded.
		7.20 - 8.20 7.20	B SPT (C)	N=19 (3,4/4,5,5,5)				
		8.20 - 9.20 8.20	B SPT (C)	N=19 (5,6/6,5,4,4)	8.20	-5.70		Medium dense, dark grey, slightly silty slightly sandy GRAVEL with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub angular to sub rounded. Cobbles are 63mm to 150mm, angular to sub rounded.

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
10.10	200	200

Equipment Dando 2000

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool
1.80	1.90	01:00	Chisel
2.90	3.00	01:00	Chisel
8.80	9.00	01:00	Chisel
10.00	10.10	01:00	Chisel

Remarks

Borehole terminated at 10.10m bgl, refusal.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	05/01/2023 08:00	0.00	Start of shift
Dry	05/01/2023 18:00	4.20	End of shift
Dry	06/01/2023 08:00	4.20	Start of shift
Dry	06/01/2023 18:00	9.20	End of shift
Dry	09/01/2023 08:00	9.20	Start of shift

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Drilled By	KC	**Borehole No.**	**BH01**
Logged By	MM	Sheet 2 of 2	
Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.**	P22156
Co-ords	575249E - 572899N	**Hole Type**	CP
Location	Little Island, Co. Cork		
Level	2.50 m OD	**Scale**	1:50
Client	Cork County Council		
Date	05/01/2023 - 09/01/2023		

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
▨		9.20 - 10.10	B		9.20	-6.70	▨	Medium dense, dark grey, slightly silty slightly sandy GRAVEL with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub angular to sub rounded. Cobbles are 63mm to 150mm, angular to sub rounded.
		9.20	SPT (C)	N=24 (7,7/6,5,6,7)				
		10.10	SPT (C)	50 (25 for 0mm/50 for 0mm)	10.10	-7.60	▨	Medium dense, brown, slightly silty very sandy GRAVEL. Gravel is fine to coarse, sub angular to sub rounded. Sand is coarse.
								End of Borehole at 10.100m

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
10.10	200	200

Equipment Dando 2000

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool
1.80	1.90	01:00	Chisel
2.90	3.00	01:00	Chisel
8.80	9.00	01:00	Chisel
10.00	10.10	01:00	Chisel

Remarks

Borehole terminated at 10.10m bgl, refusal.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	05/01/2023 08:00	0.00	Start of shift
Dry	05/01/2023 18:00	4.20	End of shift
Dry	06/01/2023 08:00	4.20	Start of shift
Dry	06/01/2023 18:00	9.20	End of shift
Dry	09/01/2023 08:00	9.20	Start of shift

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Drilled By	KM	Borehole No.	**RC01**
Logged By	N/A	Sheet 1 of 4	

Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords**	575249E - 572899N	**Hole Type** RO
Location	Little Island, Co. Cork		**Level**	2.50 m OD	**Scale** 1:50
Client	Cork County Council		**Date**	19/05/2023 - 24/05/2023	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
								Open hole boring: Driller described: (TOPSOIL) underlain by CLAY.
					1.50	1.00		Open hole boring: Driller described: Gravelly CLAY.
					3.00	-0.50		Open hole boring: Driller described: Dense, sandy GRAVEL.

1
2
3
4
5
6
7
8
9

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
4.00	2.00	20		See shift data.

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	76	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Rotary open borehole terminated at 30.0m bgl, required depth.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	19/05/2023 08:00	0.00	Start of shift
4.50	19/05/2023 18:00	15.00	End of shift
2.00	24/05/2023 08:00	15.00	Start of shift
3.50	24/05/2023 18:00	30.00	End of borehole.

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Drilled By	KM	**Borehole No.**	**RC01**
Logged By	N/A		Sheet 2 of 4

Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.**	P22156
Co-ords	575249E - 572899N	**Hole Type**	RO
Location	Little Island, Co. Cork		
Level	2.50 m OD	**Scale**	1:50
Client	Cork County Council		
Date	19/05/2023 - 24/05/2023		

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
								Open hole boring: Driller described: Dense, sandy GRAVEL.
		12.00	SPT (C)	N=39 (8,10/8,9,10,12)				
		13.50	SPT (C)	N=40 (9,9/8,10,11,11)				*13.50m - 30.00m: Driller noted 'blowing Sands'.*
		15.00	SPT (C)	N=53 (8,12/12,12,14,15)				
		18.00	SPT (C)	N=42 (11,9/10,8,12,12)				

10
11
12
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Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
4.00	2.00	20		See shift data.

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	76	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Rotary open borehole terminated at 30.0m bgl, required depth.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	19/05/2023 08:00	0.00	Start of shift
4.50	19/05/2023 18:00	15.00	End of shift
2.00	24/05/2023 08:00	15.00	Start of shift
3.50	24/05/2023 18:00	30.00	End of borehole.

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Drilled By	KM	**Borehole No.**	**RC01**
Logged By	N/A		Sheet 3 of 4
Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.**	P22156
Co-ords	575249E - 572899N	**Hole Type**	RO
Location	Little Island, Co. Cork	**Scale**	1:50
Level	2.50 m OD		
Client	Cork County Council	**Date**	19/05/2023 - 24/05/2023

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description	
▨							▨	Open hole boring: Driller described: Dense, sandy GRAVEL.	
									19
		19.50	SPT (C)	N=55 (12,12/13,14,15,13)					
									20
		21.00	SPT (C)	N=45 (10,8/12,9,10,14)					21
									22
									23
		24.00	SPT (C)	44 (14,15/44 for 150mm)					24
									25
		25.50	SPT (C)	66 (12,16/66 for 225mm)					
									26
									27

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
4.00	2.00	20		See shift data.

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	76	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Rotary open borehole terminated at 30.0m bgl, required depth.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	19/05/2023 08:00	0.00	Start of shift
4.50	19/05/2023 18:00	15.00	End of shift
2.00	24/05/2023 08:00	15.00	Start of shift
3.50	24/05/2023 18:00	30.00	End of borehole.

Drilled By	KM	Borehole No.	**RC01**
Logged By	N/A	Sheet 4 of 4	

Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords**	575249E - 572899N	**Hole Type** RO
Location	Little Island, Co. Cork		**Level**	2.50 m OD	**Scale** 1:50
Client	Cork County Council		**Date**	19/05/2023 - 24/05/2023	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
▨								Open hole boring: Driller described: Dense, sandy GRAVEL.
		30.00	SPT (C)	25 (19,22/25 for 75mm)	30.00	-27.50		End of Borehole at 30.000m

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Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
4.00	2.00	20		See shift data.

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	76	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Rotary open borehole terminated at 30.0m bgl, required depth.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	19/05/2023 08:00	0.00	Start of shift
4.50	19/05/2023 18:00	15.00	End of shift
2.00	24/05/2023 08:00	15.00	Start of shift
3.50	24/05/2023 18:00	30.00	End of borehole.

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Drilled By	KC	**Borehole No.**	**BH02**
Logged By	MM		Sheet 1 of 1
Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.**	P22156
Co-ords	575308E - 572871N	**Hole Type**	CP
Location	Little Island, Co. Cork	**Scale**	1:50
Level	1.94 m OD		
Client	Cork County Council	**Date**	10/01/2023 - 11/01/2023

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00 - 1.00	B					Firm to stiff, dark brown, slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub angular.
		1.00 - 2.00 1.00	B SPT (C)	N=11 (2,2/3,3,2,3)				
		2.00 - 3.00 2.00	B SPT (C)	N=19 (4,4/5,5,4,5)				
		3.00 - 4.00 3.00	B SPT (C)	N=25 (5,5/5,6,7,7)	3.00	-1.06		Dense, dark brown, sandy very silty GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular to sub angular.
		4.00 - 5.00 4.00	B SPT (C)	N=48 (8,11/14,12,11,11)	4.00	-2.06		Dense, dark brown, sandy very silty GRAVEL with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub angular. Cobbles are 63mm to 100mm, sub angular to sub rounded.
		5.00 - 6.00 5.00	B SPT (C)	N=34 (7,7/8,8,9,9)				
		6.00	SPT (C)	50 (25 for 0mm/50 for 0mm)	6.00	-4.06		End of Borehole at 6.000m

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
6.00	200	200

Equipment Dando 2000

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool
2.80	3.00	01:00	Chisel
3.90	4.00	01:00	Chisel
5.95	6.00	01:00	Chisel

Remarks

Borehole terminated at 6.0m bgl, refusal.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	10/01/2023 08:00	0.00	Start of shift
Dry	10/01/2023 18:00	5.00	End of shift
Dry	11/01/2023 08:00	5.00	Start of shift
Dry	11/01/2023 18:00	7.00	End of borehole

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Drilled By	KC
Logged By	MM
Borehole No.	**BH02A**
	Sheet 1 of 1
Project Name	N25 LI Pedestrian & Cycle Bridge
Project No.	P22156
Co-ords	575311E - 572871N
Hole Type	CP
Location	Little Island, Co. Cork
Level	1.94 m OD
Scale	1:50
Client	Cork County Council
Date	11/01/2023 - 12/01/2023

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
		0.00 - 1.00	B					(MADE GROUND) Dark brown, silty GRAVEL with foul smell , organic matter. Gravel is fine to coarse, angular to sub angular.
		1.00 - 2.00 1.00	B SPT (C)	N=8 (1,1/2,2,2,2)	1.00	0.94		Firm, dark brown, slightly sandy gravelly SILT. Sand is fine to coarse. Gravel is fine, angular to sub angular.
		2.00 - 3.00 2.00	B SPT (C)	N=22 (4,4/3,3,7,9)	2.00	-0.06		Stiff, dark brown, slightly sandy gravelly SILT with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub angular. Cobbles are 63mm to 100mm, sub angular to sub rounded.
		3.00 - 4.00 3.00	B SPT (C)	N=20 (3,3/4,5,5,6)	3.00	-1.06		Medium dense, dark brown, silty sandy GRAVEL with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub rounded. Cobbles are 63mm to 150mm, sub angular to sub rounded.
		4.00 - 5.00 4.00	B SPT (C)	N=33 (7,7/7,8,9,9)				
		5.00 - 6.00 5.00	B SPT (C)	N=40 (7,9/9,11,11,9)	5.00	-3.06		Dense, dark brown, slightly silty slightly sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, sub angular to sub rounded.
		6.00 - 7.00 6.00	B SPT (C)	N=49 (7,7/12,12,14,11)				*6.00m - 7.00m: Driller noted Boulder content.*
		7.00	SPT (C)	50 (25 for 0mm/50 for 0mm)	7.00	-5.06		End of Borehole at 7.000m

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
7.00	200	200

Equipment Dando 2000

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool
2.70	2.80	00:30	Chisel
4.90	5.00	01:00	Chisel
6.60	6.70	01:00	Chisel
7.00	7.00	01:00	Chisel

Remarks

Borehole terminated at 7.0m bgl, refusal.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	11/01/2023 08:00	0.00	Start of shift
Dry	11/01/2023 18:00	5.00	End of shift
Dry	12/01/2023 08:00	5.00	Start of shift
Dry	12/01/2023 18:00	7.00	End of borehole

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Drilled By	KM	**Borehole No.**	**RC02**
Logged By			Sheet 1 of 4
Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.**	P22156
Co-ords	575311E - 572871N	**Hole Type**	RO
Location	Little Island, Co. Cork	**Level**	1.94 m OD
Scale	1:50		
Client	Cork County Council	**Date**	18/05/2023 - 19/05/2023

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
								Open hole boring: Driller described: (TOPSOIL) CLAY.
					1.50	0.44		Open hole boring: Driller described: CLAY.
					3.00	-1.06		Open hole boring: Driller described: Black, CLAY.
					4.50	-2.56		Open hole boring: Driller described: Black grey, CLAY.

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
12.00	4.00	20		See shift log

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	131	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Rotary open borehole terminated at 30.00m bgl, refusal.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	18/05/2023 08:00	0.00	Start of shift
5.00	18/05/2023 18:00	19.50	End of shift
5.00	19/05/2023 08:00	19.50	Start of shift
2.00	19/05/2023 18:00	30.00	End of borehole

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Drilled By	KM	
Logged By		
Borehole No.	**RC02**	Sheet 2 of 4

Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords**	575311E - 572871N	**Hole Type** RO
Location	Little Island, Co. Cork		**Level**	1.94 m OD	**Scale** 1:50
Client	Cork County Council		**Date**	18/05/2023 - 19/05/2023	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
								Open hole boring: Driller described: Black grey, CLAY.
	▽				12.00	-10.06		Open hole boring: Driller described: Black grey, gravelly CLAY.
		13.50	SPT (C)	N=33 (8,6/8,7,9,9)	13.50	-11.56		Open hole boring: Driller described: Dense, GRAVEL.
		15.00	SPT (C)	N=35 (10,9/7,8,10,10)	15.00	-13.06		Open hole boring: Driller described: Dense, sandy GRAVEL.
		16.50	SPT (C)	N=44 (12,13/10,12,12,10)				
		18.00	SPT (C)	N=52 (8,8/13,13,12,14)				

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Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
12.00	4.00	20		See shift log

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	131	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Rotary open borehole terminated at 30.00m bgl, refusal.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	18/05/2023 08:00	0.00	Start of shift
5.00	18/05/2023 18:00	19.50	End of shift
5.00	19/05/2023 08:00	19.50	Start of shift
2.00	19/05/2023 18:00	30.00	End of borehole

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Drilled By	KM	**Borehole No.**	**RC02**
Logged By			Sheet 3 of 4
Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.**	P22156
Co-ords	575311E - 572871N	**Hole Type**	RO
Location	Little Island, Co. Cork	**Level**	1.94 m OD
Scale	1:50		
Client	Cork County Council	**Date**	18/05/2023 - 19/05/2023

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description	
								Open hole boring: Driller described: Dense, sandy GRAVEL.	
									19
		19.50	SPT (C)	N=55 (7,11/11,14,15,15)	19.50	-17.56		Open hole boring: Driller described: Dense GRAVEL.	
									20
		21.00	SPT (C)	44 (12,16/44 for 150mm)					21
									22
		22.50	SPT (C)	43 (9,9/43 for 150mm)					
									23
		24.00	SPT (C)	25 (12,17/25 for 75mm)					24
									25
		25.50	SPT (C)	0 (19,25/0 for 0mm)					
									26
		27.00	SPT (C)	42 (16,12/42 for 150mm)					27

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
12.00	4.00	20		See shift log

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	131	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Rotary open borehole terminated at 30.00m bgl, refusal.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	18/05/2023 08:00	0.00	Start of shift
5.00	18/05/2023 18:00	19.50	End of shift
5.00	19/05/2023 08:00	19.50	Start of shift
2.00	19/05/2023 18:00	30.00	End of borehole

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Drilled By	KM
Logged By	
Borehole No.	**RC02**
	Sheet 4 of 4

Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords**	575311E - 572871N	**Hole Type** RO
Location	Little Island, Co. Cork		**Level**	1.94 m OD	**Scale** 1:50
Client	Cork County Council		**Date**	18/05/2023 - 19/05/2023	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description	
		Depth (m bgl)	Type	Results					
								Open hole boring: Driller described: Dense GRAVEL.	28
		28.50	SPT (C)	25 (18,19/25 for 75mm)					
									29
		30.00	SPT (C)	47 (17,18/47 for 150mm)	30.00	-28.06		End of Borehole at 30.000m	30
									31
									32
									33
									34
									35
									36

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
12.00	4.00	20		See shift log

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	131	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Rotary open borehole terminated at 30.00m bgl, refusal.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	18/05/2023 08:00	0.00	Start of shift
5.00	18/05/2023 18:00	19.50	End of shift
5.00	19/05/2023 08:00	19.50	Start of shift
2.00	19/05/2023 18:00	30.00	End of borehole

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Drilled By	PC & KC	**Borehole No.**	**BH03**
Logged By			Sheet 1 of 2
Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.**	P22156
Co-ords	575194E - 572870N	**Hole Type**	CP
Location	Little Island, Co. Cork	**Level**	2.73 m OD
Scale	1:50		
Client	Cork County Council	**Date**	21/12/2022 - 04/01/2023

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description	
		Depth (m bgl)	Type	Results					
▨		0.00 - 1.00	B				▨	(TOPSOIL) Brown, slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub angular to sub rounded. Cobbles are 63mm to 200mm, sub angular to sub rounded.	
		1.00 - 2.00 1.00	B SPT (C)	N=12 (2,3/3,2,3,4)	1.00	1.73	▨	Firm, brown, slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub angular to sub rounded.	1
		2.00 - 3.00 2.00	B SPT (C)	N=14 (2,2/3,3,4,4)	2.00	0.73	▨	Medium dense, sandy very clayey GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, sub-angular.	2
		3.00 - 4.00 3.00	B SPT (C)	N=15 (3,3/4,4,3,4)	3.00	-0.27	▨	Firm, grey, slightly gravelly slightly sandy CLAY. Sand is fie to coarse. Gravel is fine to coarse, sub-angular.	3
		4.00 - 5.00 4.00	B SPT (C)	N=14 (3,3/3,3,4,4)					4
		5.00 - 6.00 5.00	B SPT (C)	N=15 (4,4/3,4,4,4)	5.00	-2.27	▨	Firm to stiff, grey, slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse.	5
		6.00 - 7.00 6.00	B SPT (C)	N=16 (4,5/4,4,4,4)					6
		7.00 - 8.00 7.00	B SPT (C)	N=17 (4,4/5,4,4,4)					7
		8.00 - 9.00 8.00	B SPT (C)	N=16 (3,3/4,4,4,4)					8
		9.00 - 10.00 9.00	B SPT (C)	N=24 (5,5/6,6,5,7)	9.00	-6.27			9

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
12.50	131	131

Equipment Dando 2000

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool
0.85	0.90	00:30	Chisel
9.80	9.95	00:30	Chisel
10.60	10.70	01:00	Chisel
11.40	11.60	01:00	Chisel
12.50	12.50	01:00	Chisel

Remarks

Borehole terminated at 12.50m bgl, refusal.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	21/12/2022 08:00	0.00	Start of shift.
Dry	21/12/2022 18:00	6.50	End of shift.
Dry	22/12/2022 08:00	6.50	Start of shift.
Dry	22/12/2022 18:00	10.50	End of shift.
Dry	04/01/2023 08:00	9.00	Start of shift

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Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords**	575194E - 572870N	**Hole Type** CP
Location	Little Island, Co. Cork		**Level**	2.73 m OD	**Scale** 1:50
Client	Cork County Council		**Date**	21/12/2022 - 04/01/2023	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description	
		Depth (m bgl)	Type	Results					
▨							☒	Stiff, slightly sandy SILT. Sand is fine to coarse.	
▨		10.00 - 11.00 10.00	B SPT (C)	N=25 (6,6/7,6,6,6)	10.00	-7.27	⁘	Medium dense to dense, GRAVEL with boulder content.	10
▨		11.00 - 12.00 11.00	B SPT (C)	N=48 (7,7/19,11,9,9)			⁘		11
▨		12.00	SPT (C)	N=76 (8,8/12,18,22,24)			⁘		12
		12.50	SPT (C)	50 (25 for 0mm/50 for 0mm)	12.50	-9.77		End of Borehole at 12.500m	
									13
									14
									15
									16
									17
									18

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
12.50	131	131

Equipment Dando 2000

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool
0.85	0.90	00:30	Chisel
9.80	9.95	00:30	Chisel
10.60	10.70	01:00	Chisel
11.40	11.60	01:00	Chisel
12.50	12.50	01:00	Chisel

Remarks

Borehole terminated at 12.50m bgl, refusal.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	21/12/2022 08:00	0.00	Start of shift.
Dry	21/12/2022 18:00	6.50	End of shift.
Dry	22/12/2022 08:00	6.50	Start of shift.
Dry	22/12/2022 18:00	10.50	End of shift.
Dry	04/01/2023 08:00	9.00	Start of shift

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Drilled By	KM/JM	**Borehole No.**	**RC03**
Logged By			Sheet 1 of 4
Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.**	P22156
Co-ords	575194E - 572870N	**Hole Type**	RO
Location	Little Island, Co. Cork	**Level**	2.73 m OD
Scale	1:50		
Client	Cork County Council	**Date**	17/05/2023 - 18/05/2023

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
								Open hole boring: Driller described: (TOPSOIL) CLAY.
					1.50	1.23		Open hole boring: Driller described: Black, CLAY.
					3.00	-0.27		Open hole boring: Driller described: Black, CLAY.
	▼							

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Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
12.00	6.00	15		See shift log

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	76	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Rotary open borehole terminated at 30.00m bgl, required depth. 50mm standpipe installed.
Response zone from 15.0m to 20.0m bgl.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	17/05/2023 08:00	0.00	Start of shift
	17/05/2023 18:00	18.00	End of shift
4.0	18/05/2023 08:00	18.00	Start of shift
4.5	18/05/2023 18:00	30.00	End of rotary open borehole

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Drilled By	KM/JM	Borehole No.	**RC03**
Logged By			Sheet 2 of 4
Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.**	P22156
Co-ords	575194E - 572870N	**Hole Type**	RO
Location	Little Island, Co. Cork		
Level	2.73 m OD	**Scale**	1:50
Client	Cork County Council		
Date	17/05/2023 - 18/05/2023		

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
								Open hole boring: Driller described: Black, CLAY.
					10.50	-7.77		Open hole boring: Driller described: Stiff, black, gravelly CLAY.
	▽							
		13.50	SPT (C)	N=41 (7,7/10,10,11,10)				
		15.00	SPT (C)	N=43 (6,6/10,9,12,12)	15.00	-12.27		Open hole boring: Driller described: Dense, sandy GRAVEL.
		16.50	SPT (C)	N=55 (10,9/12,13,15,15)				
		18.00	SPT (C)	N=49 (10,10/13,10,14,12)	18.00	-15.27		Open hole boring: Driller described: Dense, sandy

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Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
12.00	6.00	15		See shift log

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	76	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Rotary open borehole terminated at 30.00m bgl, required depth. 50mm standpipe installed. Response zone from 15.0m to 20.0m bgl.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	17/05/2023 08:00	0.00	Start of shift
	17/05/2023 18:00	18.00	End of shift
4.0	18/05/2023 08:00	18.00	Start of shift
4.5	18/05/2023 18:00	30.00	End of rotary open borehole

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Drilled By	KM/JM	**Borehole No.**	**RC03**
Logged By		Sheet 3 of 4	
Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.**	P22156
Co-ords	575194E - 572870N	**Hole Type**	RO
Location	Little Island, Co. Cork		
Level	2.73 m OD	**Scale**	1:50
Client	Cork County Council		
Date	17/05/2023 - 18/05/2023		

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description	
								Open hole boring: Driller described: Dense, sandy GRAVEL.	
									19
		19.50	SPT (C)	25 (10,18/25 for 75mm)					
									20
									21
		21.00	SPT (C)	47 (18,19/47 for 150mm)					
									22
		22.50	SPT (C)	0 (24,25/0 for 0mm)					
									23
									24
		24.00	SPT (C)	47 (17,17/47 for 150mm)					
									25
		25.50	SPT (C)	0 (19,25/0 for 0mm)					
									26
									27
		27.00	SPT (C)	25 (17,18/25 for 75mm)					

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
12.00	6.00	15		See shift log

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	76	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Rotary open borehole terminated at 30.00m bgl, required depth. 50mm standpipe installed. Response zone from 15.0m to 20.0m bgl.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	17/05/2023 08:00	0.00	Start of shift
	17/05/2023 18:00	18.00	End of shift
4.0	18/05/2023 08:00	18.00	Start of shift
4.5	18/05/2023 18:00	30.00	End of rotary open borehole

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Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords**	575194E - 572870N	**Hole Type** RO
Location	Little Island, Co. Cork		**Level**	2.73 m OD	**Scale** 1:50
Client	Cork County Council		**Date**	17/05/2023 - 18/05/2023	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
								Open hole boring: Driller described: Dense, sandy GRAVEL.
		28.50	SPT (C)	44 (17,17/19,25,,)				
		30.00	SPT (C)	43 (16,16/18,25,,)	30.00	-27.27		End of Borehole at 30.000m

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Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
12.00	6.00	15		See shift log

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	76	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Rotary open borehole terminated at 30.00m bgl, required depth. 50mm standpipe installed.
Response zone from 15.0m to 20.0m bgl.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	17/05/2023 08:00	0.00	Start of shift
	17/05/2023 18:00	18.00	End of shift
4.0	18/05/2023 08:00	18.00	Start of shift
4.5	18/05/2023 18:00	30.00	End of rotary open borehole

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Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords** 575300E - 572825N	**Hole Type** RO
Location	Little Island, Co. Cork		**Level** 3.42 m OD	**Scale** 1:50
Client	Cork County Council		**Date** 22/09/2022 - 22/09/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00 - 1.20	B					Open hole boring. Driller described: Bituminous material underlain by road base.
		0.70	SPT (C)	25 (42 for 75mm/25 for 0mm)	0.70	2.72		Open hole boring. (MADE GROUND) Brown, clayey GRAVEL. Gravel is fine, angular to sub rounded.
		1.20 - 2.70	B					
		2.50	SPT (C)	N=84 (8,14/19,20,21,24)				
		2.70 - 4.20	B					
		3.20	SPT (C)	N=33 (3,4/5,7,9,12)	3.20	0.22		Open hole boring. Stiff, grey, CLAY
		4.20 - 5.70	B					
		5.70 - 7.20	B					
		5.70	SPT (C)	N=29 (3,6/7,7,7,8)				
		7.20 - 8.70	B					
		7.20	SPT (C)	N=32 (4,5/8,7,8,9)				
		8.70	B		8.70	-5.28		Open hole boring. Stiff, grey, slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to
		8.70	SPT (C)	N=35 (3,3/6,9,10,10)				

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
10.10				See shift data

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
31.20	131	131

Equipment Soilmec PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Borehole terminated at 31.20m bgl

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	22/09/2022 08:00	0.00	Start of shift
10.10	22/09/2022 18:00	31.20	End borehole

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Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords**	575300E - 572825N	**Hole Type** RO
Location	Little Island, Co. Cork		**Level**	3.42 m OD	**Scale** 1:50
Client	Cork County Council		**Date**	22/09/2022 - 22/09/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
	▼							Open hole boring. Stiff, grey, slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium, angular to sub angular.
		10.20 10.20	B SPT (C)	N=62 (4,5/8,16,18,20)	10.20	-6.78		Open hole boring. Dense, red brown, sandy GRAVEL. Sand is fine to coarse. Gravel is fine to medium, angular to sub rounded.
		11.70 11.70	B SPT (C)	N=58 (5,7/9,13,18,18)				
		13.20 13.20	B SPT (C)	N=53 (4,9/10,12,15,16)				
		14.70 14.70	B SPT (C)	N=55 (6,11/11,13,14,17)				
		16.20 16.20	B SPT (C)	N=44 (5,8/8,10,12,14)	16.20	-12.78		Open hole boring. Dense, purple grey, gravelly SAND. Gravel is fine to medium, sub angular to sub rounded. Sand is fine to coarse.
		17.70 17.70	B SPT (C)	N=43 (6,7/8,8,13,14)				

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
10.10				See shift data

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
31.20	131	131

Equipment Soilmec PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Borehole terminated at 31.20m bgl

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	22/09/2022 08:00	0.00	Start of shift
10.10	22/09/2022 18:00	31.20	End borehole

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Drilled By	AK	**Borehole No.**	**RC05**
Logged By			Sheet 3 of 4

Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.**	P22156	**Co-ords**	575300E - 572825N
Hole Type	RO				
Location	Little Island, Co. Cork	**Level**	3.42 m OD	**Scale**	1:50
Client	Cork County Council	**Date**	22/09/2022 - 22/09/2022		

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
								Open hole boring. Dense, purple grey, gravelly SAND. Gravel is fine to medium, sub angular to sub rounded. Sand is fine to coarse.
		19.20 19.20	B SPT (C)	N=59 (5,9/13,13,16,17)	19.20	-15.78		Open hole boring. Dense, brown, SAND.
		20.70 20.70	B SPT (C)	N=37 (4,5/7,8,10,12)				
					21.20	-17.78		Open hole boring. Driller described: Medium dense to dense, sandy GRAVEL.
		22.20 22.20	B SPT (C)	N=21 (1,2/4,5,6,6)				
		23.70 23.70	B SPT (C)	N=20 (2,3/3,5,5,7)				
		25.20 25.20	B SPT (C)	N=13 (2,2/2,3,4,4)				
		26.70 26.70	B SPT (C)	N=14 (3,3/3,3,4,4)				

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Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
10.10				See shift data

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
31.20	131	131

Equipment Soilmec PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Borehole terminated at 31.20m bgl

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	22/09/2022 08:00	0.00	Start of shift
10.10	22/09/2022 18:00	31.20	End borehole

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	Logged By		

Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords**	575300E - 572825N	**Hole Type** RO
Location	Little Island, Co. Cork		**Level**	3.42 m OD	**Scale** 1:50
Client	Cork County Council		**Date**	22/09/2022 - 22/09/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description	
		Depth (m bgl)	Type	Results					
▨		28.20 28.20	B SPT()	N=17 (2,3/3,4,4,6)			⁘	Open hole boring. Driller described: Medium dense to dense, sandy GRAVEL.	28
▨		29.70 29.70	B SPT (C)	N=16 (1,4/4,3,4,5)			⁘		29 30
▨					31.20	-27.78	⁘		31
								End of Borehole at 31.200m	32 33 34 35 36

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
10.10				See shift data

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
31.20	131	131

Equipment Soilmec PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Borehole terminated at 31.20m bgl

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	22/09/2022 08:00	0.00	Start of shift
10.10	22/09/2022 18:00	31.20	End borehole

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Drilled By KC	Borehole No. **BH08**	
Logged By AT	Sheet 1 of 1	

Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords**	575295E - 572743N	**Hole Type** CP
Location	Little Island, Co. Cork		**Level**	5.38 m OD	**Scale** 1:50
Client	Cork County Council		**Date**	18/01/2023 - 19/01/2023	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
▨		0.00 - 1.20	B				▨	Bituminous surfacing.
▨					0.20	5.18	▨	(MADE GROUND) Grey brown, slightly silty sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular to sub rounded.
▨		1.20 - 2.20 1.20	B SPT (C)	N=38 (7,7/9,9,11,9)	1.20	4.18	▨	(MADE GROUND) Dense, grey brown, silty sandy GRAVEL with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub angular to rounded. Cobbles are fine to medium ,sub rounded, 63mm to 110mm, Sandstone/Siltstone lithology.
▨		2.20 - 3.20 2.20	B SPT (C)	N=32 (7,9/9,8,7,8)	2.20	3.18	▨	(MADE GROUND) Dense, brown, silty very sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, sub angular to rounded. Cobbles are fine to medium, sub angular to sub rounded, 63mm to 110mm, Sandstone/Mudstone and Limestone lithology.
▨		3.20 - 4.20 3.20	B SPT (C)	N=40 (9,11/9,11,11,9)	3.20	2.17	▨	(MADE GROUND) Dense, brown, silty very sandy GRAVEL with high to medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub angular to rounded. Cobbles are fine to coarse, sub angular to sub rounded, 63mm to 150mm, Siltstone lithology.
▨		4.20 - 5.20 4.20	B SPT (C)	N=44 (7,7/12,11,9,12)			▨	
▨		5.20	SPT (C)	N=47 (8,8/7,7,14,19)	5.20	0.18	▨	Driller described: Stiff, CLAY with boulder content.
					5.80	-0.42		End of Borehole at 5.800m

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				See shift log

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
5.80	200	200

Equipment Dando 2000

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool
1.80	1.90	01:00	Chisel
3.80	4.00	01:00	Chisel
5.80	5.80	01:00	Chisel

Remarks

Borehole terminated at 5.80m bgl, refusal.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	18/01/2023 08:00	0.00	Start of shift
Dry	18/01/2023 18:00	2.20	End of shift
Dry	19/01/2023 08:00	2.20	Start of shift
Dry	19/01/2023 18:00	5.80	End of borehole.

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Drilled By	KM	**Borehole No.**	**RC08**
Logged By	N/A		Sheet 1 of 4
Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.**	P22156
Co-ords	575295E - 572743N	**Hole Type**	RO
Location	Little Island, Co. Cork		
Level	5.38 m OD	**Scale**	1:50
Client	Cork County Council		
Date	30/05/2023 - 30/05/2023		

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
								Open hole boring: Driller described: (MADE GROUND)
					3.00	2.38		Open hole boring: Driller described: Clayey GRAVEL.
					7.40	-2.02		Open hole boring: Driller described: Stiff, brown, CLAY.
	▼	7.50	SPT (C)	N=19 (4,5/5,4,4,6)				
		9.00	SPT (C)	N=24 (4,3/5,6,6,7)	9.00	-3.62		

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
21.00	7.50	20		See shift data.

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	131	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Rotary open borehole terminated at 30.00m bgl, required depth.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	30/05/2023 08:00	0.00	Start of shift
7.50	30/05/2023 18:00	30.00	End of borehole

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Drilled By	KM	Borehole No.	**RC08**
Logged By	N/A		Sheet 2 of 4

Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords**	575295E - 572743N	**Hole Type** RO
Location	Little Island, Co. Cork		**Level**	5.38 m OD	**Scale** 1:50
Client	Cork County Council		**Date**	30/05/2023 - 30/05/2023	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
								Open hole boring: Driller described: Stiff, brown to black, CLAY.
		10.50	SPT (C)	N=23 (5,5/6,6,4,7)	10.50	-5.12		Open hole boring: Driller described: Stiff, black, SILT.
		12.00	SPT (C)	N=24 (3,3/5,5,7,7)				
		13.50	SPT (C)	N=20 (3,4/4,5,5,6)				
		15.00	SPT (C)	N=33 (6,6/7,7,9,10)				
		16.50	SPT (C)	N=30 (7,7/8,6,8,8)				
		18.00	SPT (C)	N=37 (5,5/9,10,9,9)				

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Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
21.00	7.50	20		See shift data.

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	131	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Rotary open borehole terminated at 30.00m bgl, required depth.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	30/05/2023 08:00	0.00	Start of shift
7.50	30/05/2023 18:00	30.00	End of borehole

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Drilled By	KM	**Borehole No.**	**RC08**
Logged By	N/A	Sheet 3 of 4	

Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.**	P22156
Co-ords	575295E - 572743N	**Hole Type**	RO
Location	Little Island, Co. Cork	**Level**	5.38 m OD
Scale	1:50		
Client	Cork County Council	**Date**	30/05/2023 - 30/05/2023

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		Depth (m bgl)	**Type**	**Results**				
							× × × ×	Open hole boring: Driller described: Stiff, black, SILT.
		19.50	SPT (C)	N=46 (8,8/9,12,12,13)				
	▽	21.00	SPT (C)	N=49 (9,10/11,10,14,14)	21.00	-15.62	⁘	Open hole boring: Driller described: Dense, sandy GRAVEL.
		22.50	SPT (C)	42 (12,17/42 for 150mm)				
		24.00	SPT (C)	25 (12,19/25 for 75mm)				
		25.50	SPT (C)	44 (16,16/44 for 150mm)				
		25.80	SPT (C)	25 (11,18/25 for 75mm)				
		27.00	SPT (C)	47 (10,14/47 for 150mm)				

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
21.00	7.50	20		See shift data.

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	131	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Rotary open borehole terminated at 30.00m bgl, required depth.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	30/05/2023 08:00	0.00	Start of shift
7.50	30/05/2023 18:00	30.00	End of borehole

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Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords**	575295E - 572743N	**Hole Type** RO
Location	Little Island, Co. Cork		**Level**	5.38 m OD	**Scale** 1:50
Client	Cork County Council		**Date**	30/05/2023 - 30/05/2023	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
▨							░	Open hole boring: Driller described: Dense, sandy GRAVEL.
		30.00	SPT (C)	25 (10,19/25 for 75mm)	30.00	-24.62		End of Borehole at 30.000m

28
29
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32
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Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
21.00	7.50	20		See shift data.

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	131	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Rotary open borehole terminated at 30.00m bgl, required depth.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	30/05/2023 08:00	0.00	Start of shift
7.50	30/05/2023 18:00	30.00	End of borehole

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Drilled By	KC	Borehole No.	**BH09**
Logged By	MM	Sheet 1 of 1	

Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.**	P22156
Co-ords	575212E - 572709N	**Hole Type**	CP
Location	Little Island, Co. Cork	**Scale**	1:50
Level	3.44 m OD		
Client	Cork County Council		
Date	20/01/2023 - 20/01/2023		

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		Depth (m bgl)	**Type**	**Results**				
▨		0.00 - 1.20	B				▨	(MADE GROUND) Dark brown, slightly silty sandy GRAVEL with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub angular.
▨		1.20 - 2.20 1.20	B SPT (C)	N=67 (8,8/11,18,18,20)	1.20	2.24	▨	(MADE GROUND) Dense, dark brown, slightly silty sandy GRAVEL with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub angular. Cobbles are 63mm to 150mm, sub angular to sub rounded. Driller notes presence of very large boulders.
▨		2.20 - 2.70 2.20	B SPT (C)	N=35 (6,7/9,9,8,9)				
		2.70	SPT (C)	50 (25 for 0mm/50 for 0mm)	2.70	0.74		End of Borehole at 2.700m

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
2.70	200	200

Equipment Dando 2000

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool
1.30	1.50	01:00	Chisel
2.50	2.60	00:30	Chisel
2.70	2.70	01:00	Chisel

Remarks

Borehole terminated at 2.70m bgl, refusal.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	20/01/2023 08:00	0.00	Start of shift
Dry	20/01/2023 18:00	2.70	End of borehole

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Drilled By	KM	**Borehole No.**	**RC09**
Logged By	N/A		Sheet 1 of 4
Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.**	P22156
Co-ords	575212E - 572709N	**Hole Type**	RO
Location	Little Island, Co. Cork	**Level**	3.44 m OD
Scale	1:50		
Client	Cork County Council	**Date**	25/05/2023 - 29/05/2023

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
								Open hole boring: Driller described: (MADE GROUND)
					1.50	1.94		Open hole boring: Driller described: Clayey GRAVEL.
					3.00	0.44		Open hole boring: Driller described: CLAY.
					4.20	-0.76		Open hole boring: Driller described: Stiff, black, SILT.
		6.00	SPT (C)	N=22 (4,5/5,6,5,6)				
	▼							
		7.50	SPT (C)	N=21 (4,4/5,5,6,5)				
		9.00	SPT (C)	N=21 (4,4/5,5,6,5)				

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
17.00	7.00	20		See shift data.

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	131	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Rotary open borehole terminated at 30.00m bgl, required depth. 50mm standpipe installed.
Response zone from 25.0m to 30.0m bgl.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	25/05/2023 08:00	0.00	Start of shift
7.50	25/05/2023 18:00	18.00	End of shift
6.00	29/05/2023 08:00	18.00	Start of shift
7.40	29/05/2023 18:00	30.00	End of borehole

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Drilled By	KM
Logged By	N/A
Borehole No.	**RC09**
	Sheet 2 of 4
Project Name	N25 LI Pedestrian & Cycle Bridge
Project No.	P22156
Co-ords	575212E - 572709N
Hole Type	RO
Location	Little Island, Co. Cork
Level	3.44 m OD
Scale	1:50
Client	Cork County Council
Date	25/05/2023 - 29/05/2023

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Stratum Description
							Open hole boring: Driller described: Stiff, black, SILT.
		10.50	SPT (C)	N=27 (3,3/7,7,6,7)			
		12.00	SPT (C)	N=32 (5,5/8,8,7,9)			
		13.50	SPT (C)	N=29 (8,8/6,6,8,9)			
		15.00	SPT (C)	N=38 (5,9/9,10,9,10)			
		16.50	SPT (C)	N=38 (5,5/7,9,10,12)			
	▽				17.00	-13.56	Open hole boring: Driller described: Dense, sandy GRAVEL. *17.00m - 22.50m: Driller noted 'blowing sands'.*
		18.00	SPT (C)	N=45 (9,8/10,10,12,13)			

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
17.00	7.00	20		See shift data.

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	131	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Rotary open borehole terminated at 30.00m bgl, required depth. 50mm standpipe installed. Response zone from 25.0m to 30.0m bgl.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	25/05/2023 08:00	0.00	Start of shift
7.50	25/05/2023 18:00	18.00	End of shift
6.00	29/05/2023 08:00	18.00	Start of shift
7.40	29/05/2023 18:00	30.00	End of borehole

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Drilled By	KM	**Borehole No.**	**RC09**
Logged By	N/A		Sheet 3 of 4

Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.**	P22156	**Co-ords**	575212E - 572709N	**Hole Type**	RO
Location	Little Island, Co. Cork			**Level**	3.44 m OD	**Scale**	1:50
Client	Cork County Council			**Date**	25/05/2023 - 29/05/2023		

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description	
								Open hole boring: Driller described: Dense, sandy GRAVEL.	
									19
		19.50	SPT (C)	N=46 (8,10/10,12,12,12)					
									20
		21.00	SPT (C)	N=57 (6,9/11,10,17,19)					21
									22
		22.50	SPT (C)	25 (17,22/25 for 75mm)					
									23
		24.00	SPT (C)	25 (18,20/25 for 75mm)					24
									25
		25.50	SPT (C)	50 (22,25/50 for 0mm)					
									26
		27.00	SPT (C)	49 (18,18/49 for 150mm)					27

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
17.00	7.00	20		See shift data.

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	131	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Rotary open borehole terminated at 30.00m bgl, required depth. 50mm standpipe installed. Response zone from 25.0m to 30.0m bgl.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	25/05/2023 08:00	0.00	Start of shift
7.50	25/05/2023 18:00	18.00	End of shift
6.00	29/05/2023 08:00	18.00	Start of shift
7.40	29/05/2023 18:00	30.00	End of borehole

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Drilled By KM	**Borehole No.** **RC09** Sheet 4 of 4	
Logged By N/A		

Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords**	575212E - 572709N	**Hole Type** RO
Location	Little Island, Co. Cork		**Level**	3.44 m OD	**Scale** 1:50
Client	Cork County Council		**Date**	25/05/2023 - 29/05/2023	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
								Open hole boring: Driller described: Dense, sandy GRAVEL.
		28.50	SPT (C)	25 (16,24/25 for 75mm)				
		30.00	SPT (C)	25 (14,21/25 for 150mm)	30.00	-26.56		End of Borehole at 30.000m

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
17.00	7.00	20		See shift data.

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	131	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Rotary open borehole terminated at 30.00m bgl, required depth. 50mm standpipe installed. Response zone from 25.0m to 30.0m bgl.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	25/05/2023 08:00	0.00	Start of shift
7.50	25/05/2023 18:00	18.00	End of shift
6.00	29/05/2023 08:00	18.00	Start of shift
7.40	29/05/2023 18:00	30.00	End of borehole

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Drilled By	KC/VC	**Logged By**	AT	Borehole No.	**BH10** Sheet 1 of 2
Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.**	P22156	**Hole Type**	CP
Co-ords	575359E - 572891N				
Location	Little Island, Co. Cork	**Level**	1.63 m OD	**Scale**	1:50
Client	Cork County Council	**Date**	12/01/2023 - 17/01/2023		

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
▨		0.00 - 1.20	B				▨	(MADE GROUND) Silty sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse.
▨		1.20 - 2.20 1.20	B SPT (C)	N=10 (2,2/2,2,3,3)	1.20	0.43	▨	Firm, grey, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine, angular to sub angular.
▨		2.20 - 3.20 2.20	B SPT (C)	N=10 (2,2/2,2,3,3)	2.20	-0.57	▨	Firm to stiff, grey, slightly gravelly slightly sandy SILT. Sand is fine to coarse. Gravel is fine to coarse.
▨		3.20 - 4.20 3.20	B SPT (C)	N=16 (4,4/4,5,4,3)			▨	
▨		4.20 - 5.20 4.20	B SPT (C)	N=20 (4,4/5,5,7,3)			▨	
▨		5.20 - 6.20 5.20	B SPT (C)	N=50 (8,8/11,11,14,14)	5.20	-3.57	▨	Stiff, grey black brown orange, slightly sandy SILT with rootlets.
▨		6.20 - 7.20 6.20	B SPT (C)	N=35 (7,7/9,9,9,8)	6.20	-4.57	▨	Dense, brown purple, sandy very silty GRAVEL with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub angular to sub rounded. Cobbles are fine to medium, sub rounded, 63mm to 100mm
▨		7.20 - 8.20 7.20	B SPT (C)	N=43 (8,7/9,11,12,11)	7.20	-5.57	▨	Dense, brown, silty very sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, sub angular to sub rounded. Sand is medium to coarse.
▨		8.00 - 9.00 8.20	B SPT (C)	N=34 (5,5/8,8,9,9)			▨	
		9.00 - 10.00 9.00	B SPT (C)	N=55 (8,9/11,12,15,17)				

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				See shift log

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
11.00	200	200

Equipment Dando 2000

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool
5.50	5.70	01:00	Chisel
5.90	6.00	00:30	Chisel
7.80	7.90	00:30	Chisel
8.90	9.00	01:00	Chisel
10.80	11.00	01:00	Chisel

Remarks

Borehole terminated at 11.0m bgl, refusal.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	12/01/2023 08:00	0.00	Start of shift
Dry	12/01/2023 18:00	1.20	End of shift
Dry	13/01/2023 08:00	1.20	Start of shift
Dry	13/01/2023 18:00	8.20	End of shift
Dry	17/01/2023 08:00	8.00	Start of shift

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Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords**	575359E - 572891N	**Hole Type** CP
Location	Little Island, Co. Cork		**Level**	1.63 m OD	**Scale** 1:50
Client	Cork County Council		**Date**	12/01/2023 - 17/01/2023	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description	
▨					9.20	-7.57	▨	Dense, brown, silty very sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, sub angular to sub rounded. Sand is medium to coarse. Dense, brown purple, slightly sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, sub angular to sub rounded.	
		10.00	SPT (C)	N=74 (15,15/13,18,19,24)					10
					11.00	-9.37		End of Borehole at 11.000m	11
									12
									13
									14
									15
									16
									17
									18

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				See shift log

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
11.00	200	200

Equipment Dando 2000

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool
5.50	5.70	01:00	Chisel
5.90	6.00	00:30	Chisel
7.80	7.90	00:30	Chisel
8.90	9.00	01:00	Chisel
10.80	11.00	01:00	Chisel

Remarks

Borehole terminated at 11.0m bgl, refusal.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	12/01/2023 08:00	0.00	Start of shift
Dry	12/01/2023 18:00	1.20	End of shift
Dry	13/01/2023 08:00	1.20	Start of shift
Dry	13/01/2023 18:00	8.20	End of shift
Dry	17/01/2023 08:00	8.00	Start of shift

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Drilled By	KM	**Borehole No.**	**RC10**
Logged By	N/A		Sheet 1 of 4
Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.**	P22156
Co-ords	575359E - 572891N	**Hole Type**	RO
Location	Little Island, Co. Cork	**Level**	1.63 m OD
Scale	1:50		
Client	Cork County Council	**Date**	16/05/2023 - 17/05/2023

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
								Open hole boring: Driller described: (TOPSOIL) CLAY.
					1.50	0.13		Open hole boring: Driller described: Black grey, CLAY.
	▼							
					7.50	-5.87		Open hole boring: Driller described: Black, clayey GRAVEL.
					9.00	-7.37		

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
	6.00	20		See shift log

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	131	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Rotary open borehole terminated at 30.00m bgl, refusal. 50mm standpipe installed. Response zone from 8.0m to 12.0m bgl.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	16/05/2023 08:00	0.00	Start of shift
3.80	16/05/2023 18:00	18.00	End of shift
2.00	17/05/2023 08:00	18.00	Start of shift
5.00	17/05/2023 18:00	30.00	End of borehole

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Drilled By	**Logged By**	Borehole No.
KM	N/A	**RC10** Sheet 2 of 4

Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords**	575359E - 572891N	**Hole Type** RO
Location	Little Island, Co. Cork		**Level**	1.63 m OD	**Scale** 1:50
Client	Cork County Council		**Date**	16/05/2023 - 17/05/2023	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
								Open hole boring: Driller described: Dense, sandy GRAVEL.
		12.00	SPT (C)	N=43 (8,10/11,8,12,12)				
		13.50	SPT (C)	N=39 (6,6/10,11,8,10)				
		15.00	SPT (C)	N=48 (8,8/12,10,13,13)				
		16.50	SPT (C)	N=42 (4,5/9,9,12,12)				
		18.00	SPT (C)	N=38 (7,7/8,6,10,14)	18.00	-16.37		Open hole boring: Driller described: Dense, sandy silty

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
	6.00	20		See shift log

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	131	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Rotary open borehole terminated at 30.00m bgl, refusal. 50mm standpipe installed. Response zone from 8.0m to 12.0m bgl.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	16/05/2023 08:00	0.00	Start of shift
3.80	16/05/2023 18:00	18.00	End of shift
2.00	17/05/2023 08:00	18.00	Start of shift
5.00	17/05/2023 18:00	30.00	End of borehole

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Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords**	575359E - 572891N	**Hole Type** RO
Location	Little Island, Co. Cork		**Level**	1.63 m OD	**Scale** 1:50
Client	Cork County Council		**Date**	16/05/2023 - 17/05/2023	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
								Open hole boring: Driller described: Dense, sandy silty GRAVEL.
		19.50	SPT (C)	N=42 (6,6/10,8,12,12)				
		21.00	SPT (C)	N=45 (10,9/10,12,13,10)				
		22.50	SPT (C)	N=51 (8,11/12,12,13,14)				
		24.00	SPT (C)	N=50 (10,10/14,12,9,15)				
		25.50	SPT (C)	45 (8,12/45 for 225mm)				
		27.00	SPT (C)	N=62 (10,12/8,17,18,19)				

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Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
	6.00	20		See shift log

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	131	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Rotary open borehole terminated at 30.00m bgl, refusal. 50mm standpipe installed. Response zone from 8.0m to 12.0m bgl.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	16/05/2023 08:00	0.00	Start of shift
3.80	16/05/2023 18:00	18.00	End of shift
2.00	17/05/2023 08:00	18.00	Start of shift
5.00	17/05/2023 18:00	30.00	End of borehole

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Drilled By	**Logged By**	Borehole No.
KM	N/A	**RC10**
		Sheet 4 of 4

Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.**	P22156
Co-ords	575359E - 572891N	**Hole Type**	RO
Location	Little Island, Co. Cork	**Level**	1.63 m OD
Scale	1:50		
Client	Cork County Council	**Date**	16/05/2023 - 17/05/2023

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
								Open hole boring: Driller described: Dense, sandy silty GRAVEL.
		28.50	SPT (C)	39 (9,16/39 for 150mm)				
		30.00	SPT (C)	45 (12,16/45 for 150mm)	30.00	-28.37		End of Borehole at 30.000m

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Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
	6.00	20		See shift log

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	131	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Rotary open borehole terminated at 30.00m bgl, refusal. 50mm standpipe installed. Response zone from 8.0m to 12.0m bgl.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	16/05/2023 08:00	0.00	Start of shift
3.80	16/05/2023 18:00	18.00	End of shift
2.00	17/05/2023 08:00	18.00	Start of shift
5.00	17/05/2023 18:00	30.00	End of borehole

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	Logged By N/A	Sheet 1 of 4	

Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords**	575309E - 572789N	**Hole Type** RO
Location	Little Island, Co. Cork		**Level**	3.92 m OD	**Scale** 1:50
Client	Cork County Council		**Date**	19/08/2022 - 19/08/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
								Open hole boring. Driller described: (MADE GROUND) Concrete and graded stone.
		1.00	SPT (C)	N=34 (5,7/7,8,10,9)	1.00	2.92		Open hole boring. Driller described: (MADE GROUND) Dense, sandy GRAVEL.
		2.00	SPT (C)	N=31 (4,5/6,6,9,10)				
		3.00	SPT (C)	N=28 (4,4/6,11,6,5)	3.00	0.92		Open hole boring. Driller described: Medium dense, GRAVEL.
		4.00	SPT (C)	N=39 (5,6/8,10,10,11)	4.00	-0.08		Open hole boring. Driller described: Stiff, gravelly CLAY.
		5.00	SPT (C)	50 (12,20/50 for 150mm)	5.00	-1.08		Open hole boring. Driller described: Soft, gravelly SILT. *5.00m: Driller described: Boulder. SPT refusal.*
		6.00	SPT (C)	N=7 (1,2/2,1,2,2)				
		7.00	SPT (C)	N=7 (1,2/1,1,3,2)				
	▼	8.50	SPT (C)	N=24 (4,5/7,6,5,6)	8.50	-4.58		Open hole boring. Driller described: Dense, GRAVEL. *8.50m: Locally 'Medium dense' deposits.*

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
8.80				See shift data.

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	131	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Borehole terminated at 30.00m bgl, required depth.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	19/08/2022 20:00	0.00	Start of shfit.
8.60	20/08/2022 05:00	30.00	End of borehole.

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Drilled By	AK
Logged By	N/A
Borehole No.	**RC11**
	Sheet 2 of 4

Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.**	P22156	**Co-ords**	575309E - 572789N
Hole Type	RO				
Location	Little Island, Co. Cork	**Level**	3.92 m OD	**Scale**	1:50
Client	Cork County Council	**Date**	19/08/2022 - 19/08/2022		

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description	
								Open hole boring. Driller described: Dense, GRAVEL.	
		10.00	SPT (C)	N=33 (4,7/7,8,9,9)					10
									11
		11.50	SPT (C)	N=33 (4,7/7,8,9,9)					
									12
		13.00	SPT (C)	N=35 (5,6/8,7,10,10)					13
									14
		14.50	SPT (C)	N=34 (6,6/7,7,9,11)					
									15
		16.00	SPT (C)	N=31 (5,6/8,8,8,7)					16
									17
		17.50	SPT (C)	N=32 (3,5/7,9,8,8)					
									18

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
8.80				See shift data.

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	131	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Borehole terminated at 30.00m bgl, required depth.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	19/08/2022 20:00	0.00	Start of shfit.
8.60	20/08/2022 05:00	30.00	End of borehole.

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Drilled By	Borehole No.
AK	**RC11**
Logged By	
N/A	Sheet 3 of 4

Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords**	575309E - 572789N	**Hole Type** RO
Location	Little Island, Co. Cork		**Level**	3.92 m OD	**Scale** 1:50
Client	Cork County Council		**Date**	19/08/2022 - 19/08/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description	
								Open hole boring. Driller described: Dense, GRAVEL.	
		19.00	SPT()	N=28 (4,4/5,6,8,9)					19
									20
					20.50	-16.58		Open hole boring. Driller described: Medium dense, SAND.	
									21
		22.00	SPT (C)	N=43 (6,8/10,11,10,12)				*22.00m: Locally 'Dense' deposits*	22
									23
		23.50	SPT (C)	N=21 (3,5/5,6,5,5)					
									24
		25.00	SPT (C)	N=19 (3,3/4,4,5,6)					25
									26
		26.50	SPT (C)	N=20 (3,3/5,6,5,4)					
									27

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
8.80				See shift data.

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	131	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Borehole terminated at 30.00m bgl, required depth.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	19/08/2022 20:00	0.00	Start of shfit.
8.60	20/08/2022 05:00	30.00	End of borehole.

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Project Name	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords**	575309E - 572789N	**Hole Type** RO
Location	Little Island, Co. Cork		**Level**	3.92 m OD	**Scale** 1:50
Client	Cork County Council		**Date**	19/08/2022 - 19/08/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
								Open hole boring. Driller described: Medium dense, SAND.
		28.00	SPT (C)	N=19 (3,3/3,5,6,5)				
		29.50	SPT (C)	N=17 (3,4/4,3,5,5)				
		30.00	SPT (C)	N=32 (4,6/8,8,7,9)	30.00	-26.08		End of Borehole at 30.000m

28
29
30
31
32
33
34
35
36

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
8.80				See shift data.

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
30.00	131	131

Equipment Soilmech PSM

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Borehole terminated at 30.00m bgl, required depth.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	19/08/2022 20:00	0.00	Start of shfit.
8.60	20/08/2022 05:00	30.00	End of borehole.

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Trial Pit No
TP01
Sheet 1 of 1

Project Name: N25 LI Pedestrian & Cycle Bridge

Project No. P22156

Co-ords: 575393E - 572937N

Level: 2.94m OD

Date 12/12/2022

Location: Little Island, Co. Cork

Dimensions (m): 4.50 1.00

Depth: 2.50m BGL

Scale 1:25

Client: Cork County Council

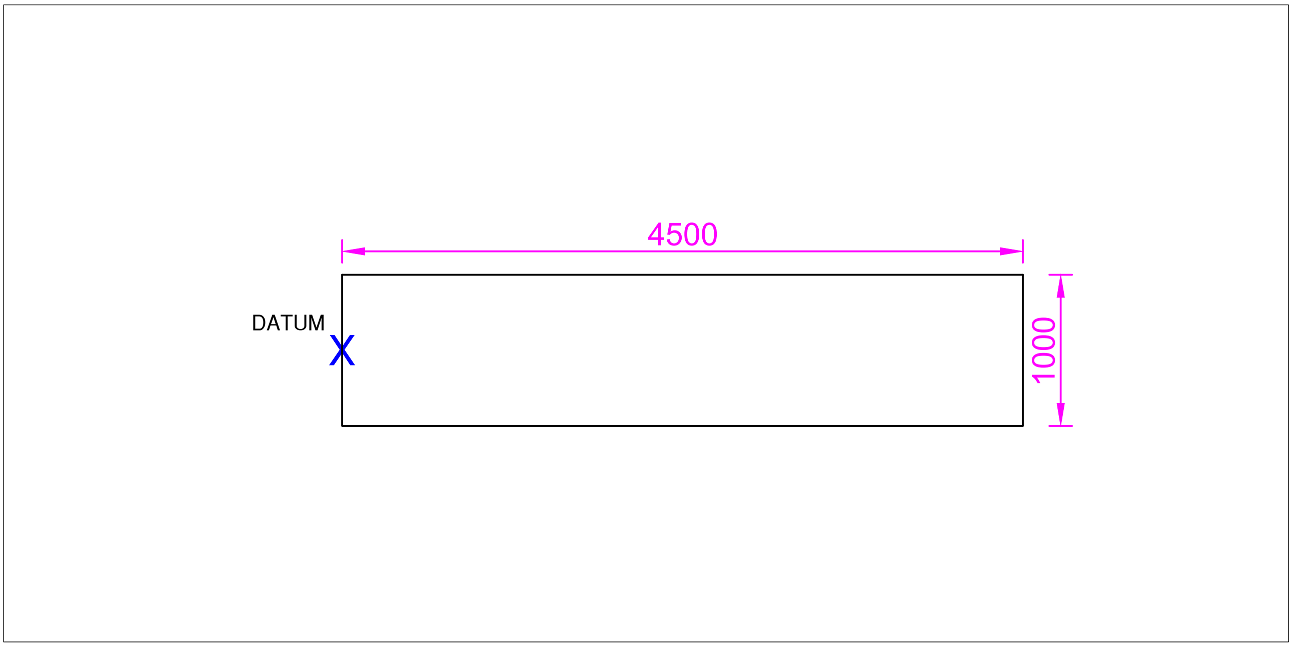
Logged SR

Water Strike & Backfill	**Samples & In Situ Testing**			**Depth (m)**	**Level (m OD)**	**Legend**	**Stratum Description**
	Depth (m)	**Type**	**Results**				
▨						▨	(TOPSOIL) Soft, red brown, slightly gravelly SILT.
▨				0.23	2.71	▨	(MADE GROUND) Brown, silty sandy GRAVEL with high cobble content, high boulder content, blocks, plastic and tape inclusions. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded.
▨	0.50 0.50 0.50	B ENV ES				▨	
▨				1.20	1.74	▨	(MADE GROUND) Grey to dark brown, organic odour, sandy very silty GRAVEL with high cobble content, high boulder content, timber, plastic steel inclusions.
▨	1.30 1.30 1.30	B ENV ES				▨	
▼						▨	
▼						▨	
				2.50	0.44		End of Pit at 2.500m

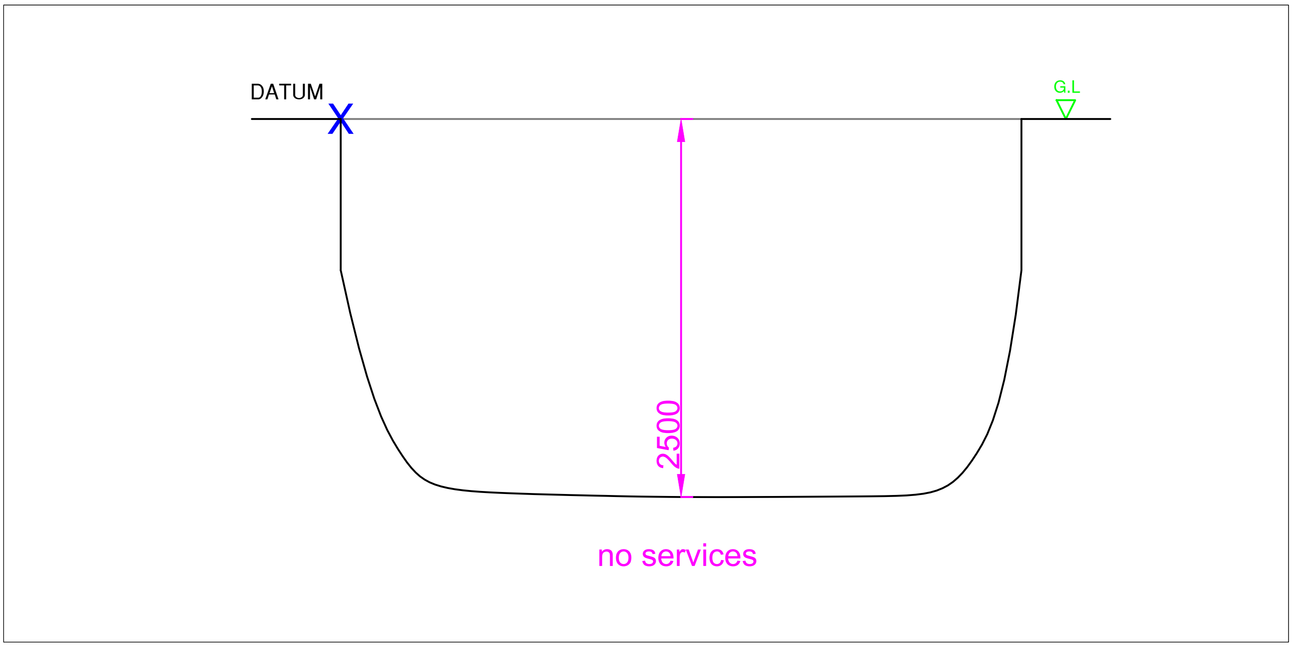
Stability: Moderate.
Plant: 14t tracked excavator.
Backfill: Arisings.

Groundwater: 1.70m: Seepage flow rate. 1.90m: Trickle flow rate.

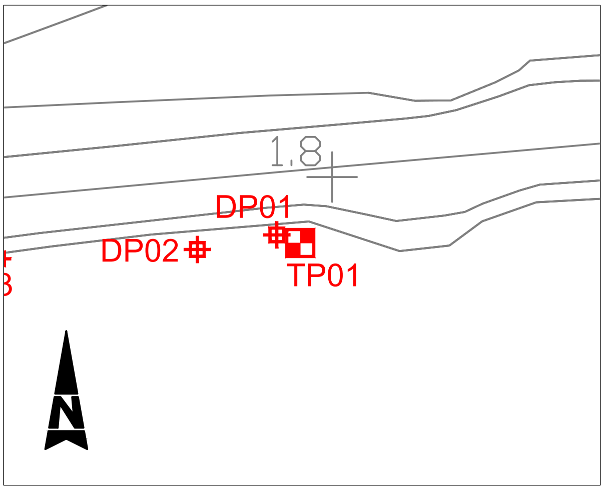
Remarks: TP01 terminated at 1.20m bgl, side wall collapse due to groundwater ingress. Plate load test carried out in pit at 0.50m bgl.



TRIAL PIT PLAN, 1:50 ON A4



TRIAL PIT SECTION, 1:50 ON A4



TRIAL PIT LOCATION PLAN, 1:1000 ON A4

DATUM COORDINATES:

EASTING:	575392.76
NORTHING:	572937.34
LEVEL:	2.94mAOD

KEY:

DATUM: X

TRIAL PIT DIMENSIONS:

LENGTH:	4.50m
WIDTH:	1.00m
DEPTH:	2.50m

STRATA SHOWN ON DETAILED LOG

DRAWN BY: G.C.		DATE: 14/12/2022
LOGGED BY: R.S.		DATE: 12/12/2022
SCALE: AS STATED	APPROVED: GH	REVISION: D01

TRIAL PIT NUMBER:

TP01

JOB NAME:

N25 Pedestrian & Cycle Bridge

JOB NUMBER:

P22156

DRAWING NUMBER:

P22156-TP01

JOB REF: P22156
JOB Name: N25 LI Pedestrian & Cycle Bridge

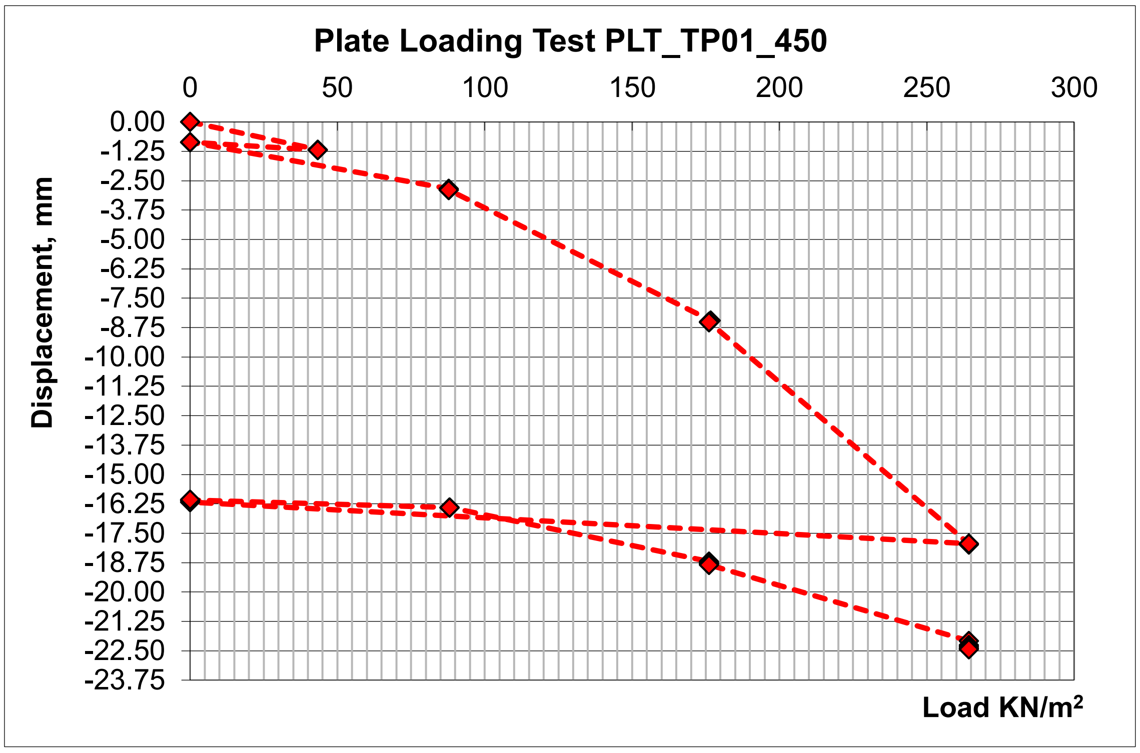
Plate Bearing Test PLT TP01
Test Number 1
Depth 0.5m m bgl
Bedding Material Sand
Date 12/12/2022
Ground Conditions (Made Ground) Silty sandy GRAVEL with high cobble content.
Seating Load 0.75t/ 25kPa
Plate Diameter 450 mm
Plate Area 0.1589625 m^2

E: 575392.76
N: 572937.34
mOD 2.94

	G1	G2	G3	
Zero gauge	**43.70**	**39.34**	**-**	**41.52 mm**

Loading (kN)	Pressure (kPa)	Time (min)	Div (mm)	Div (mm)	Div (mm)	Average	D h, mm
0	0	0	43.70	39.34	-	41.52	0.00
7	43	1	43.00	37.68	-	40.34	-1.18
7	43	2	43.00	37.63	-	40.32	-1.21
0	0	1	43.29	38.02	-	40.66	-0.87
0	0	2	43.29	38.02	-	40.66	-0.87
14	88	1	40.88	36.48	-	38.68	-2.84
14	88	2	40.88	36.37	-	38.63	-2.90
14	88	3	40.88	36.37	-	38.63	-2.90
28	177	1	34.63	31.50	-	33.07	-8.46
28	176	2	34.59	31.45	-	33.02	-8.50
28	176	3	34.57	31.43	-	33.00	-8.52
28	176	4	34.55	31.46	-	33.01	-8.52
42	264	1	-	23.58	-	23.58	-17.94
42	264	2	-	23.53	-	23.53	-17.99
42	264	3	-	23.57	-	23.57	-17.95
0	0	1	-	25.35	-	25.35	-16.17
0	0	2	-	25.41	-	25.41	-16.11
0	0	3	-	25.44	-	25.44	-16.08
14	88	1	-	25.12	-	25.12	-16.40
14	88	2	-	25.12	-	25.12	-16.40
14	88	3	-	25.12	-	25.12	-16.40
28	176	1	-	22.81	-	22.81	-18.71
28	176	2	-	22.75	-	22.75	-18.77
28	176	3	-	22.72	-	22.72	-18.80
28	176	4	-	22.70	-	22.70	-18.82
28	176	5	-	22.68	-	22.68	-18.84
42	264	1	-	19.44	-	19.44	-22.08
42	264	2	-	19.25	-	19.25	-22.27
42	264	3	-	19.19	-	19.19	-22.33
42	264	4	-	19.12	-	19.12	-22.40
42	264	5	-	19.09	-	19.09	-22.43

Load to Achieve 1.25mm of Settlement:	**17**	kPa
Subgrade Modulus ($MN/m^2/m$) k $_{750}$:	**9**	
Estimated CBR (NRA DMRB HD25-26 3.62)	**0.4**	%
Plate scaling factor	**0.64**	
Plate rigidity factor	**1.00**	
Estimated failure load Δh 0.1R	**-**	kPa
Estimated undrained shear strength	**-**	kPa



Photographic Record

Number:	**TP01**	**Project** **Project No** **Engineer**	Little Island/ N25 Pedestrian & Cycle Bridge P22156 Arup

Photographic Record

Number:	**TP01**	**Project** **Project No** **Engineer**	Little Island/ N25 Pedestrian & Cycle Bridge P22156 Arup

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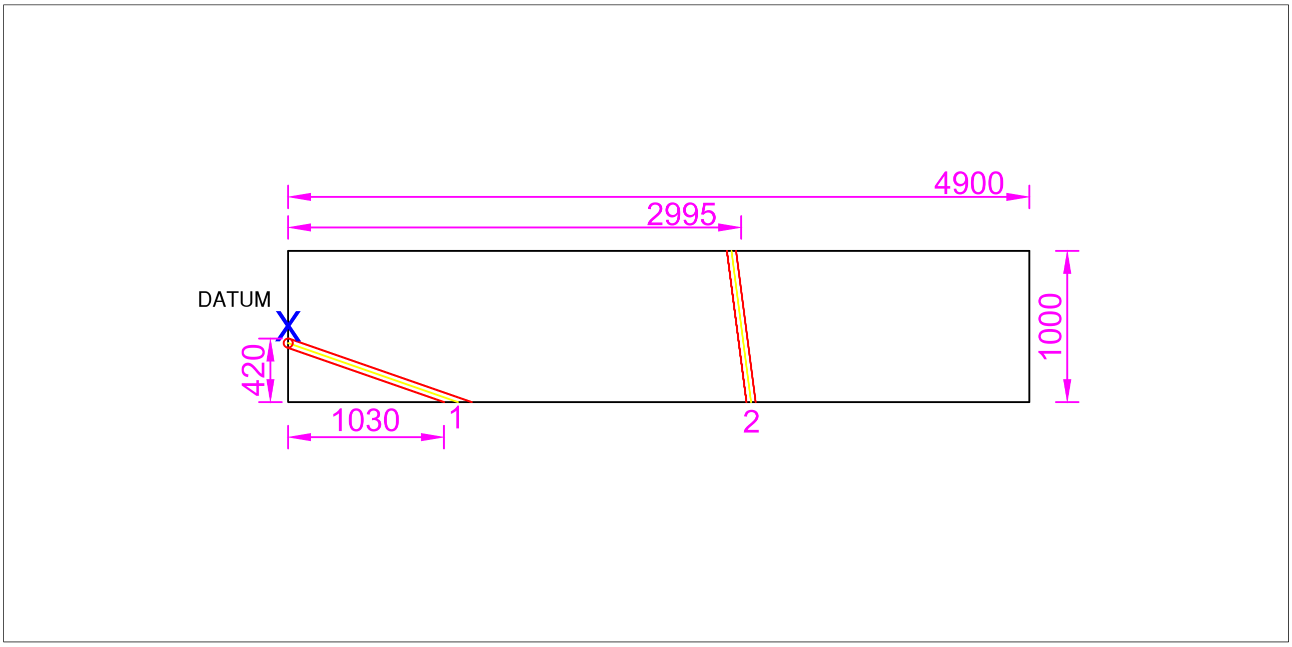
Trial Pit No
TP02
Sheet 1 of 1

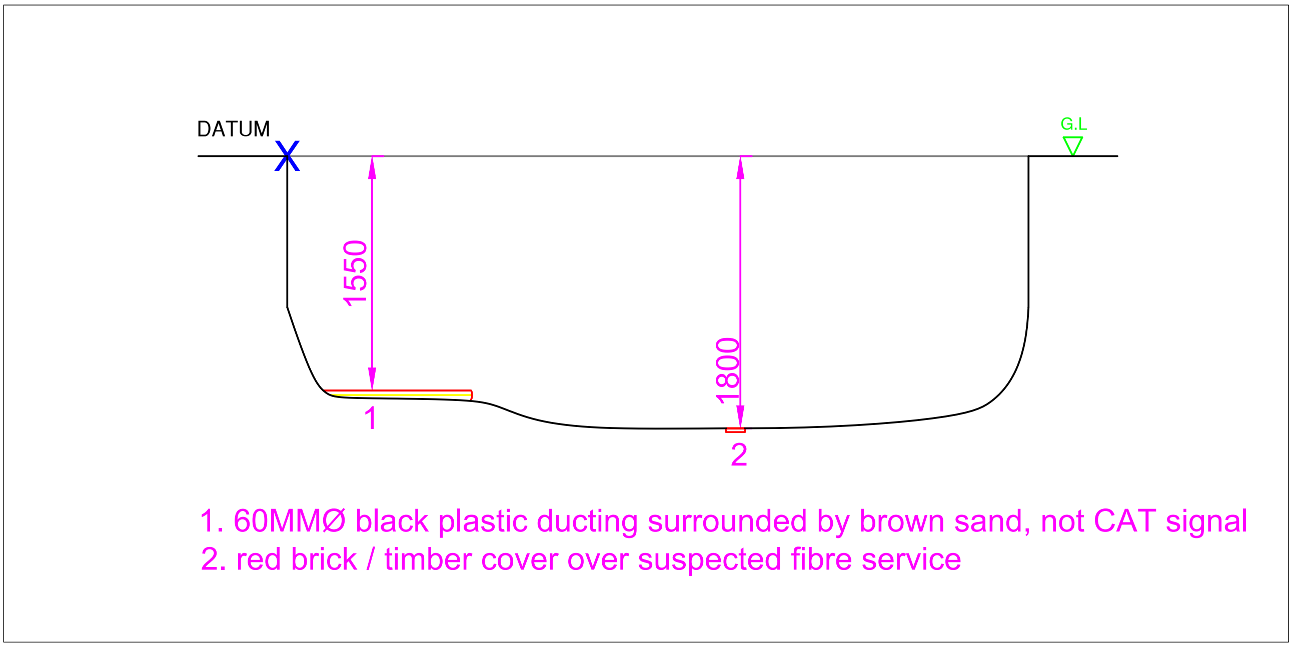
Project Name: N25 LI Pedestrian & Cycle Bridge
Project No. P22156
Co-ords: 575319E - 572928N
Level: 2.91m OD
Date 12/12/2022
Location: Little Island, Co. Cork
Dimensions (m): 4.90 × 1.00
Depth: 1.70m BGL
Scale 1:25
Client: Cork County Council
Logged SR

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	**Type**	**Results**				
				0.15	2.76		(TOPSOIL) Stiff, brown, slightly sandy gravelly SILT.
	0.50 0.50 0.50 0.50	B D ENV ES		1.20	1.71		(MADE GROUND) Brown, sandy gravelly SILT with high cobble content, low boulder content, (Layer of 804 clause or similar), pea gravel on North side, (subbase for walkway?), chunks of bituminous material, large concrete block, piece of cast iron pipe, and Iron bar. Sand is fine to coarse. Gravel is fine to coarse, angular to rounded. Cobbles are 63mm to 200mm, angular to sub rounded. Boulders are up to 400mm, angular.
	1.30 1.30 1.30 1.30	B D ENV ES		1.70	1.21		(MADE GROUND) Brown, very silty sandy GRAVEL with medium cobble content, purple fabric, timber and red brick. Sand is fine to coarse. Gravel is fine to coarse, angular to rounded, various lithologies. Cobbles are 63mm to 200mm, angular to rounded, various lithologies. *Brown, SAND. Black plastic 60mm ducting surrounded by brown SAND at 1.55m bgl, extended eastwards.*
							End of Pit at 1.700m

Stability: Good to moderate
Plant: 14t Track machine
Backfill: Arisings
Groundwater: None encountered.
Remarks: Trial pit terminated at 1.70m bgl, Services present. PLT carried out at 0.5m.

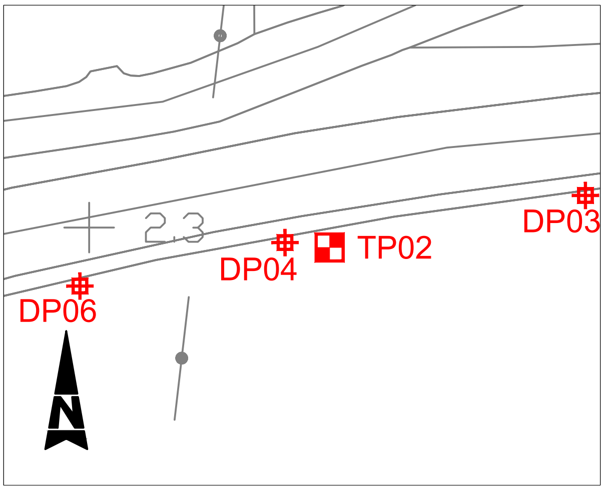


TRIAL PIT PLAN, 1:50 ON A4



1. 60MMØ black plastic ducting surrounded by brown sand, not CAT signal
2. red brick / timber cover over suspected fibre service

TRIAL PIT SECTION, 1:50 ON A4



TRIAL PIT LOCATION PLAN, 1:1000 ON A4

DATUM COORDINATES:
EASTING: 575318.98
NORTHING: 572928.37
LEVEL: 2.91mAOD

KEY:
DATUM: X

TRIAL PIT DIMENSIONS:
LENGTH: 4.90m
WIDTH: 1.00m
DEPTH: 1.70m

STRATA SHOWN ON DETAILED LOG

DRAWN BY: G.C.	DATE: 14/12/2022
LOGGED BY: R.S.	DATE: 12/12/2022

SCALE: AS STATED	APPROVED: GH	REVISION: D01

TRIAL PIT NUMBER:
TP02

JOB NAME:
N25 Pedestrian & Cycle Bridge

JOB NUMBER:
P22156

DRAWING NUMBER:
P22156-TP02

JOB REF: P22156

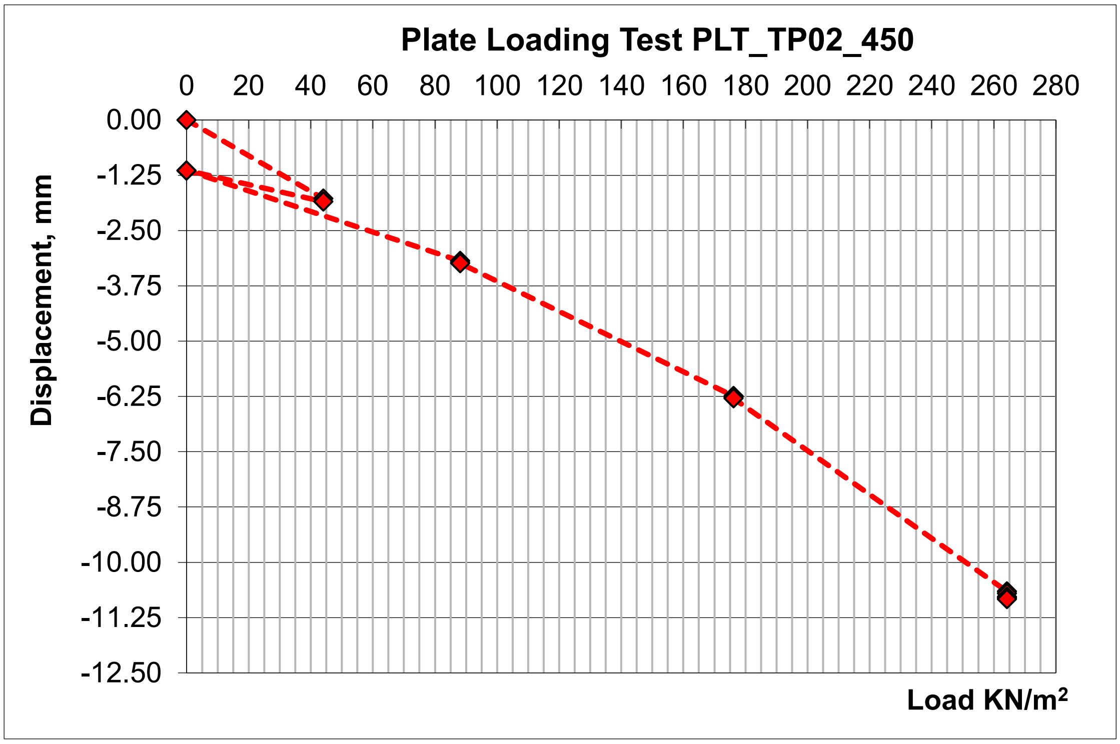
JOB Name: N25 LI Pedestrian & Cycle Bridge

Plate Bearing Test	PLT TP02		**E: 575318.98**
Test Number	1		**N: 572928.37**
Depth	0.5m	**m bgl**	**mOD 2.91**
Bedding Material	Sand		
Date	12/12/2022		
Ground Conditions	(Made Ground) Slightly sandy gravelly SILT with high cobble content.		
Seating Load	0.75t/ 25kPa		
Plate Diameter	450	mm	
Plate Area	0.1589625	m^2	

	G1	G2	G3	
Zero gauge	**32.35**	**41.25**	**-**	**36.80 mm**

Loading (kN)	Pressure (kPa)	Time (min)	Div (mm)	Div (mm)	Div (mm)	Average	D h, mm
0	0	0	32.35	41.25	-	36.80	0.00
7	44	1	30.00	40.05	-	35.03	-1.78
7	44	2	29.86	40.05	-	34.96	-1.85
0	0	1	30.88	40.44	-	35.66	-1.14
0	0	2	30.92	40.40	-	35.66	-1.14
14	88	1	28.53	38.70	-	33.62	-3.19
14	88	2	28.45	38.69	-	33.57	-3.23
14	88	3	28.43	38.69	-	33.56	-3.24
28	176	1	24.59	36.53	-	30.56	-6.24
28	176	2	24.56	36.50	-	30.53	-6.27
28	176	3	24.52	36.49	-	30.51	-6.29
42	264	1	19.60	32.68	-	26.14	-10.66
42	264	2	19.59	32.61	-	26.10	-10.70
42	264	3	19.52	32.52	-	26.02	-10.78
42	264	4	19.49	32.50	-	26.00	-10.81
42	264	5	19.46	32.48	-	25.97	-10.83

Load to Achieve 1.25mm of Settlement:	**31**	kPa
Subgrade Modulus ($MN/m^2/m$) k_{750}:	**16**	
Estimated CBR (NRA DMRB HD25-26 3.62)	**1.2**	%
Plate scaling factor	**0.64**	
Plate rigidity factor	**1.00**	
Estimated failure load Δh 0.1R	**-**	kPa
Estimated undrained shear strength	**-**	kPa



Photographic Record

Number:	TP02	**Project** **Project No** **Engineer**	Little Island/ N25 Pedestrian & Cycle Bridge P22156 Arup

Photographic Record

Number:	**TP02**	**Project** **Project No** **Engineer**	Little Island/ N25 Pedestrian & Cycle Bridge P22156 Arup	

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Trial Pit No
TP03
Sheet 1 of 1

Project Name: N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords:** 575182E - 572889N **Level:** 3.16m OD	**Date** 12/12/2022
Location: Little Island, Co. Cork		**Dimensions (m):** 3.50 × 1.00	**Scale** 1:25
Client: Cork County Council		**Depth:** 1.20m BGL	**Logged** SR

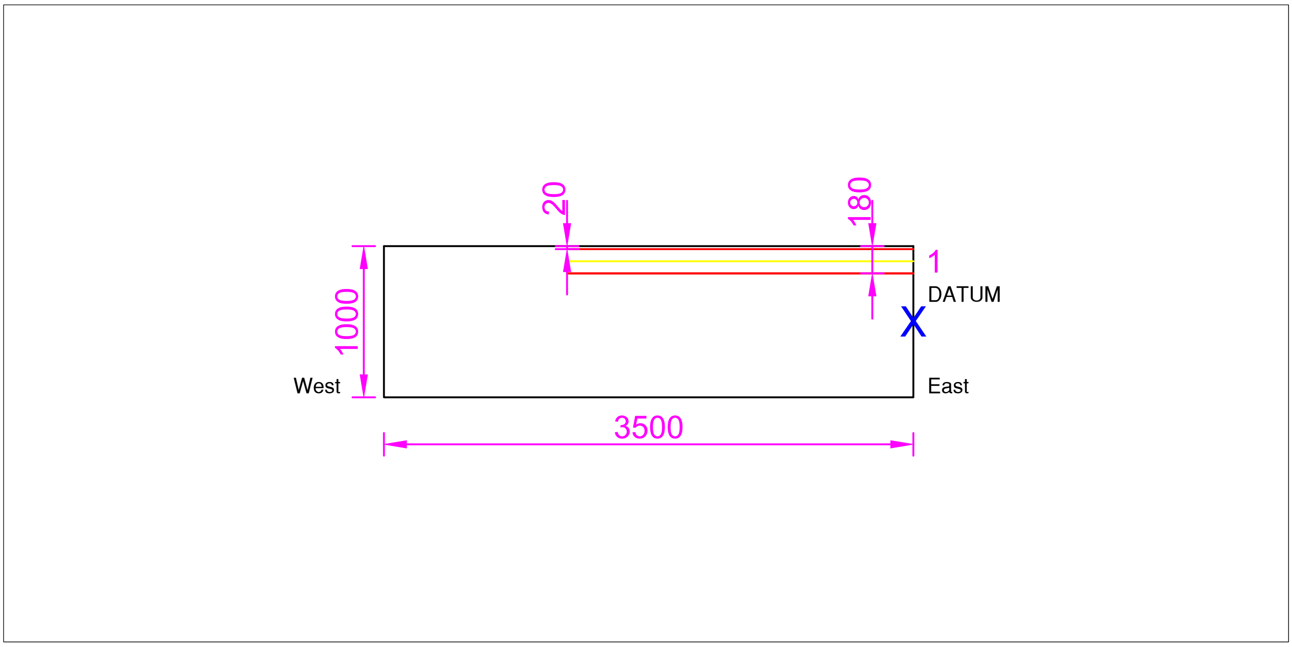
Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
▨				0.15	3.01	▩	(TOPSOIL) Brown, slightly sandy gravelly SILT with tree roots.
▨				0.45	2.71	▩	(MADE GROUND) Brown, sandy very gravelly SILT with medium cobble content, ceramics and pieces of plastic piping.
▨	0.50 0.50 0.50 0.50	B D ENV ES		0.75	2.41	▩	(MADE GROUND) Brown, silty sandy GRAVEL with high cobble content, wrappers, foil and pieces of metal. Sand is fine to coarse. Gravel is fine to coarse, angular to rounded. Cobbles are 63mm to 200mm angular to rounded.
▨	1.00 1.00 1.00 1.00	B D ENV ES		1.20	1.96	☰	Grey to brown, CLAY with organic odor and shells.
							End of Pit at 1.200m

1
2
3
4
5

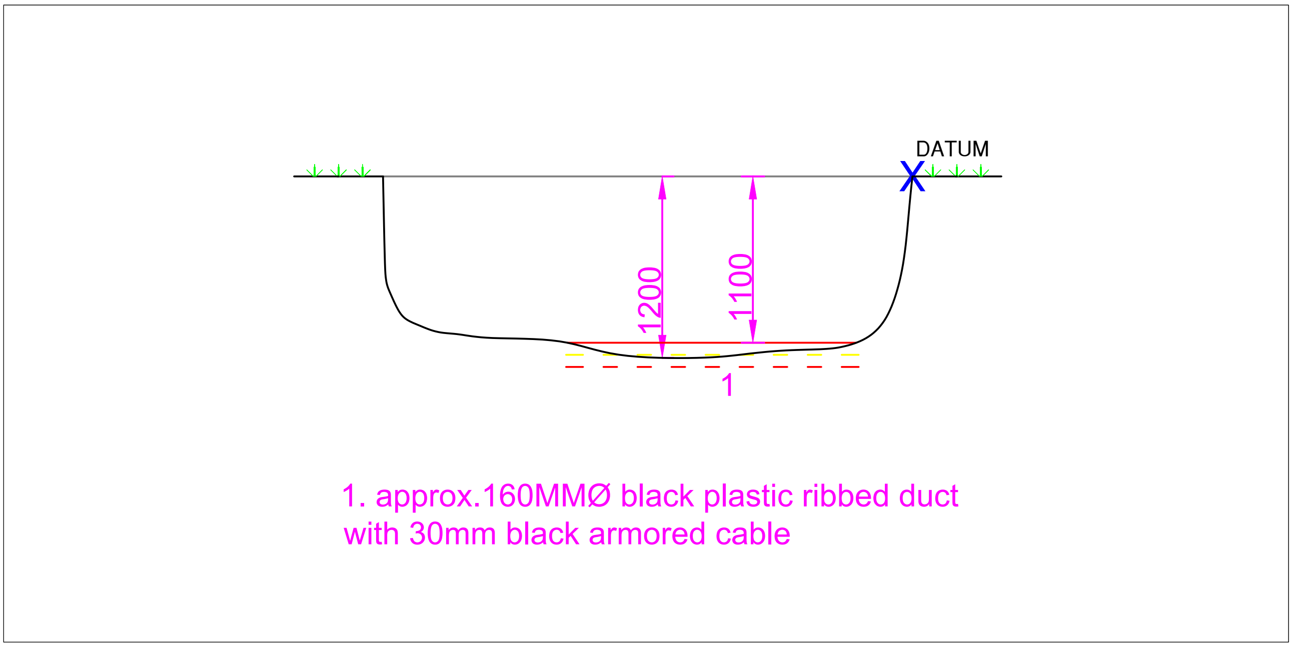
Stability: Good
Plant: 14t Track machine
Backfill: Arisings

Groundwater: None encountered.

Remarks: Trial pit terminated at 1.20m bgl, services found.

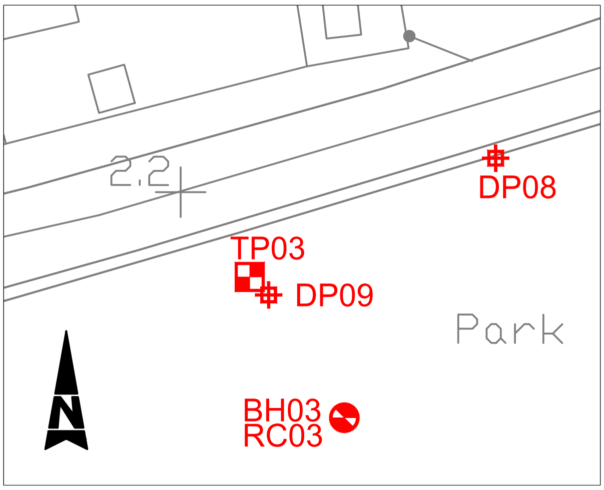


TRIAL PIT PLAN, 1:50 ON A4



1. approx.160MMØ black plastic ribbed duct
with 30mm black armored cable

TRIAL PIT SECTION, 1:50 ON A4



TRIAL PIT LOCATION PLAN, 1:1000 ON A4

DATUM COORDINATES:

EASTING:	575181.54
NORTHING:	572888.69
LEVEL:	3.16mAOD

KEY:
DATUM: X

TRIAL PIT DIMENSIONS:

LENGTH:	3.50m
WIDTH:	1.00m
DEPTH:	1.20m

STRATA SHOWN ON DETAILED LOG

DRAWN BY: G.C.		DATE: 14/12/2022
LOGGED BY: R.S.		DATE: 12/12/2022
SCALE: AS STATED	APPROVED: GH	REVISION: D01

TRIAL PIT NUMBER:

TP03

JOB NAME:
N25 Pedestrian & Cycle Bridge

JOB NUMBER:
P22156

DRAWING NUMBER:
P22156-TP03

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Photographic Record

Number:	**TP03**	**Project** **Project No** **Engineer**	Little Island/ N25 Pedestrian & Cycle Bridge P22156 Arup

Number:	**TP03**	**Project** **Project No** **Engineer**	Little Island/ N25 Pedestrian & Cycle Bridge P22156 Arup

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Trial Pit No
TP04
Sheet 1 of 1

Project Name: N25 LI Pedestrian & Cycle Bridge

Project No. P22156

Co-ords: 575257E - 572732N

Level: 4.92m OD

Date 29/06/2023

Location: Little Island, Co. Cork

Dimensions (m): 3.20 × 0.65

Depth: 1.10m BGL

Scale 1:25

Client: Cork County Council

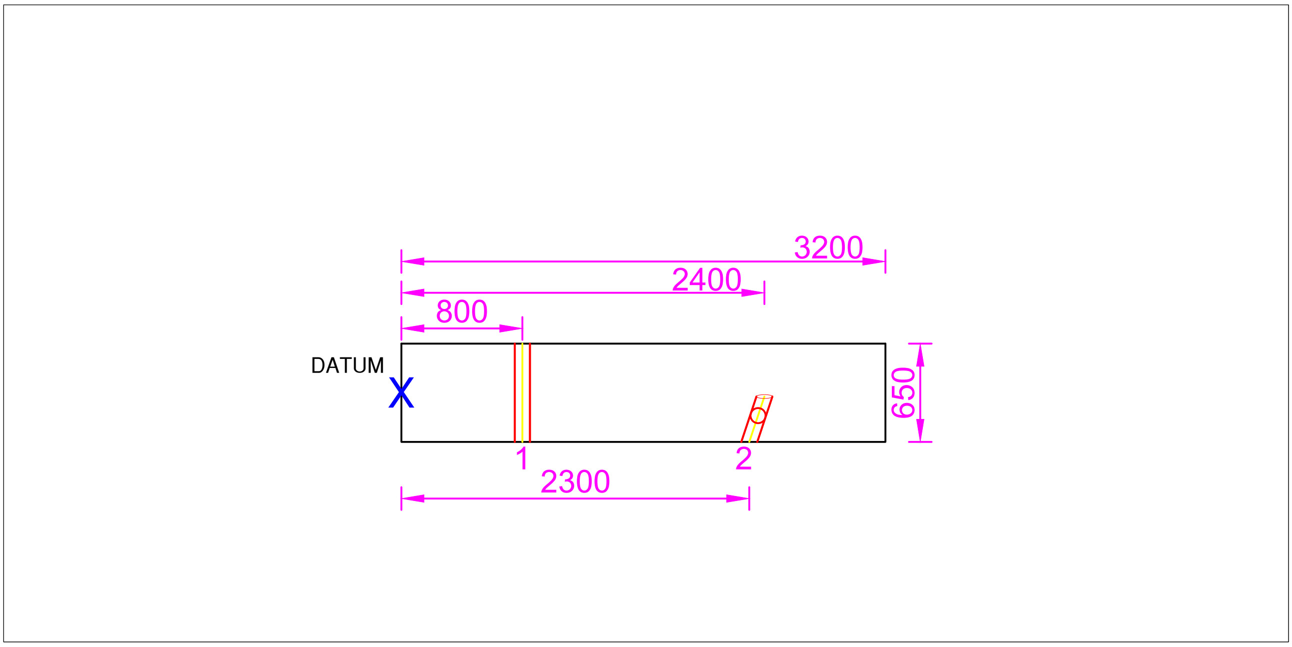
Logged MM

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
▨	0.10 0.10 0.10 - 1.10	B ES ENV		0.10	4.82	▨	Bituminous surfacing
▨				1.10	3.82	▨	(MADE GROUND) Clause 804 or similar. *0.80m: Water main and broken pipe.*
							End of Pit at 1.100m

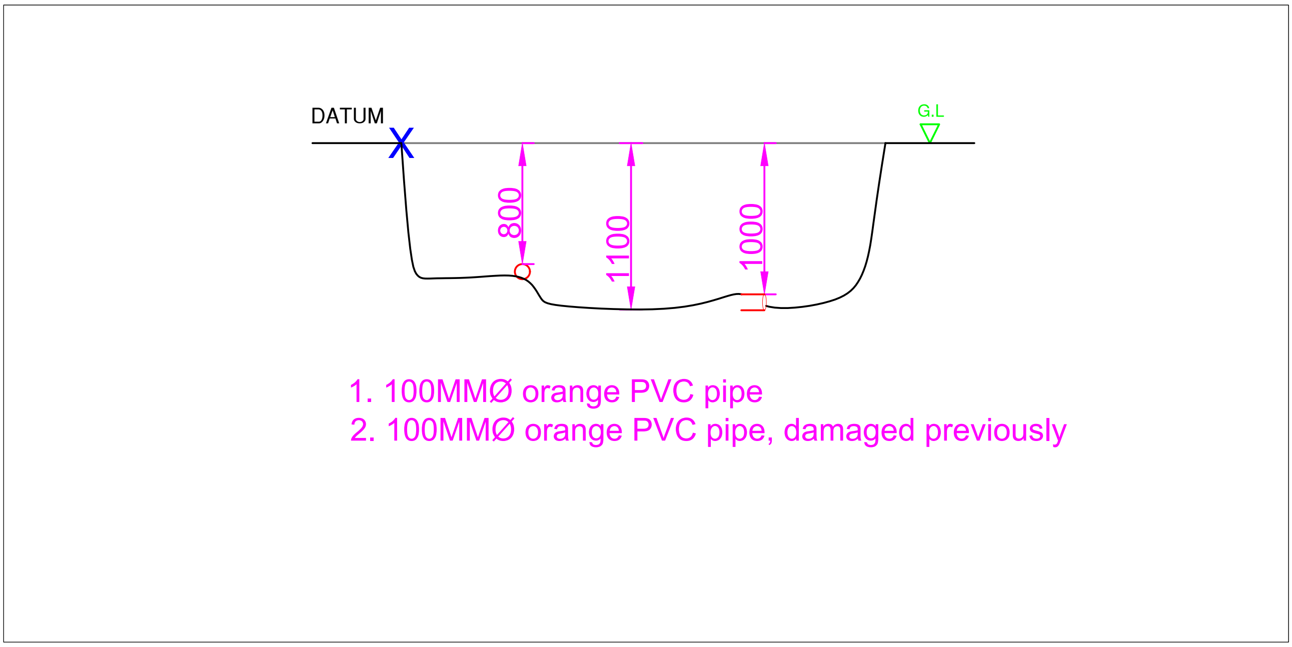
Stability: Poor
Plant: 10t tracked excavator.
Backfill: Arisings

Groundwater: None encountered.

Remarks: Trial pit terminated at 1.10m bgl, refusal on steel structure.

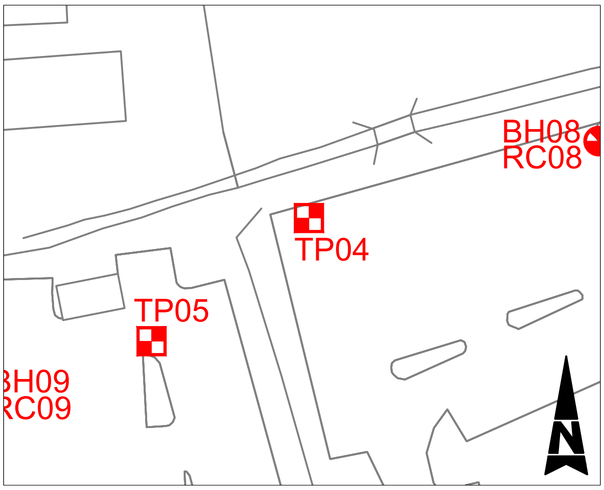


TRIAL PIT PLAN, 1:150 ON A4



1. 100MMØ orange PVC pipe
2. 100MMØ orange PVC pipe, damaged previously

TRIAL PIT SECTION, 1:50 ON A4



TRIAL PIT LOCATION PLAN, 1:1000 ON A4

DATUM COORDINATES:
EASTING: 575256.58
NORTHING: 572732.37
LEVEL: 4.921mAOD

KEY:
DATUM: X

TRIAL PIT DIMENSIONS:

LENGTH:	3.20m
WIDTH:	0.65m
DEPTH:	1.10m

STRATA SHOWN ON DETAILED LOG

TRIAL PIT NUMBER:
TP04

JOB NAME:
N25 Pedestrian & Cycle Bridge

JOB NUMBER:
P22156

DRAWING NUMBER:
P22156-TP04

DRAWN BY: G.C.		DATE: 06/07/2023
LOGGED BY: M.M.		DATE: 29/06/2023
SCALE: AS STATED	APPROVED: GH	REVISION: D01

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Photographic Record

Number:	**TP04**	**Project** **Project No** **Engineer**	Little Island/ N25 Pedestrian & Cycle Bridge P22156 Arup

Photographic Record

Number:	**TP04**	**Project** **Project No** **Engineer**	Little Island/ N25 Pedestrian & Cycle Bridge P22156 Arup	

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Trial Pit No
TP05
Sheet 1 of 1

Project Name: N25 LI Pedestrian & Cycle Bridge

Project No. P22156

Co-ords: 575236E - 572716N

Level: 3.80m OD

Date 29/06/2023

Location: Little Island, Co. Cork

Dimensions (m): 2.40 × 0.70

Scale 1:25

Client: Cork County Council

Depth: 2.30m BGL

Logged MM

Water Strike & Backfill	Samples & In Situ Testing		
	Depth (m)	**Type**	**Results**
	0.10	ES	
	0.10 - 0.30	B	
	0.10 - 0.30	ENV	
	0.30	ES	
	0.30 - 0.40	B	
	0.30 - 0.40	ENV	
	0.40 - 2.30	B	
	0.40 - 2.30	ENV	

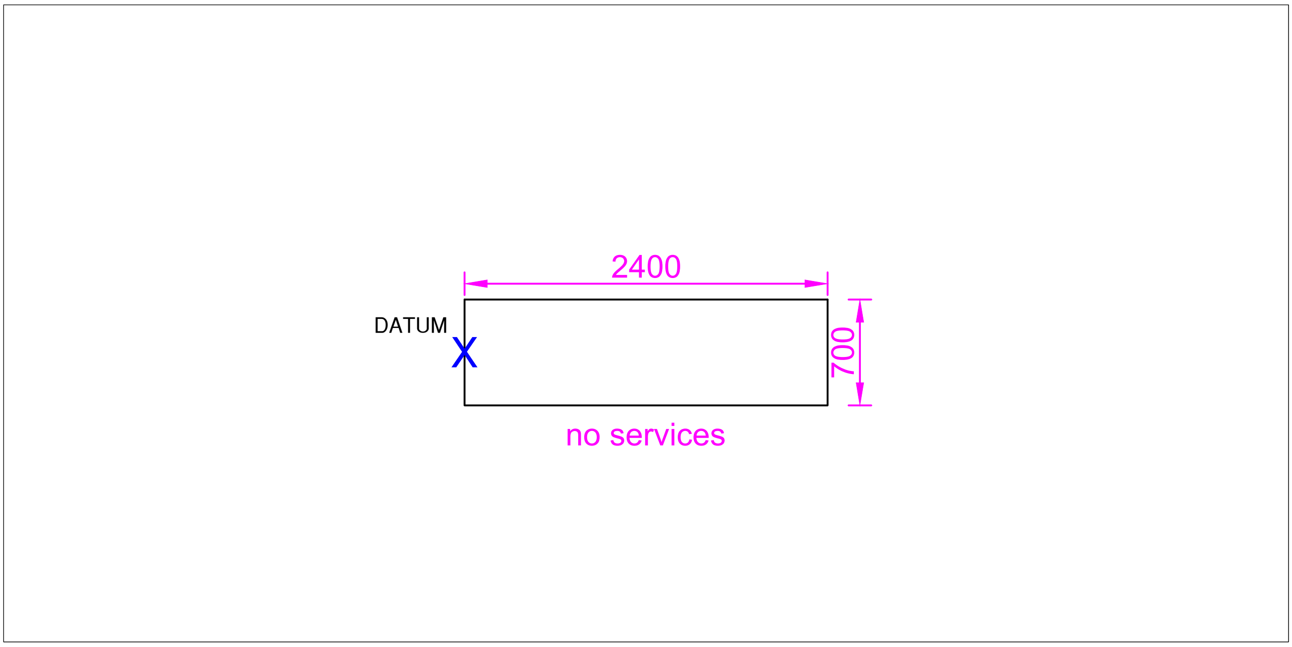
Depth (m)	**Level (m OD)**	**Legend**	**Stratum Description**
0.10	3.70		Bituminous surfacing.
0.30	3.50		(MADE GROUND) Clause 804 or similar.
0.40	3.40		Purple slightly clayey sandy GRAVEL with high cobble content with high cobble content. Gravel is coarse, sub-angular to sub-rounded, Siltstone lithology. Cobbles are 63mm to 80mm, sub-angular to sub-rounded, Siltstone Lithology.
2.30	1.50		Orange brown, slightly clayey sandy GRAVEL with low cobble content. Sand is coarse. Gravel is coarse, rounded to sub-rounded. Cobbles are 63mm to100mm, sub-rounded.
			End of Pit at 2.300m

1
2
3
4
5

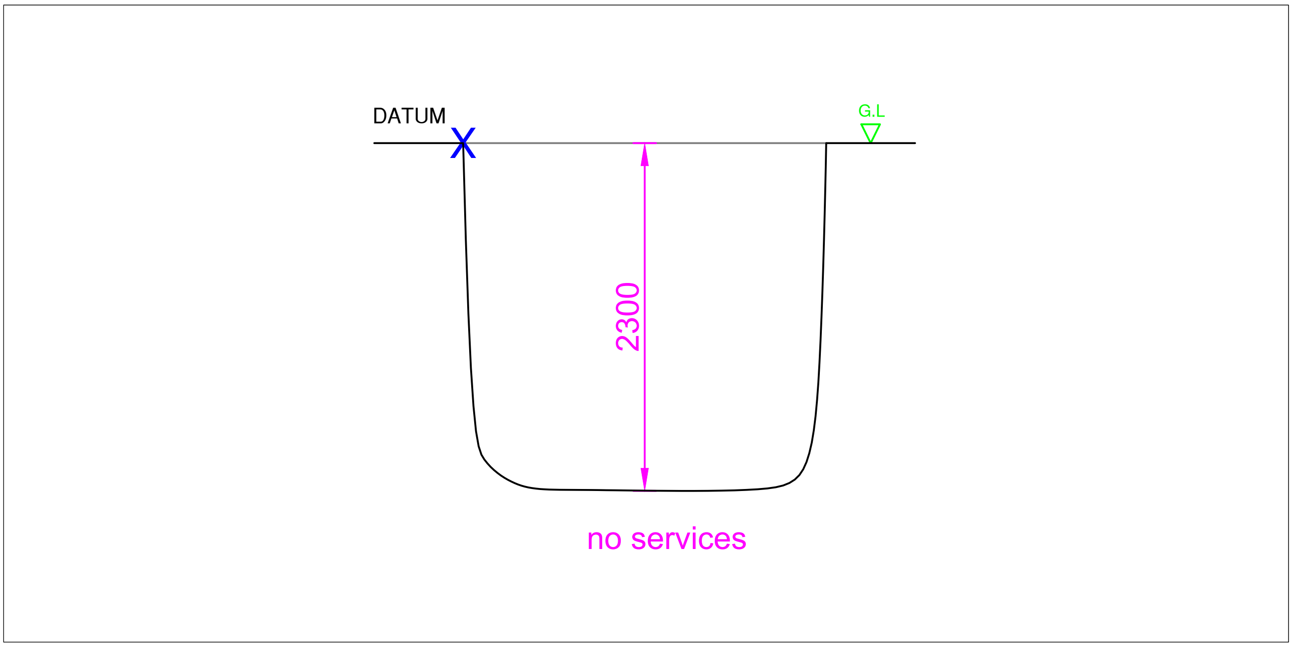
Stability: Poor
Plant: 10t tracked excavator.
Backfill: Arisings

Groundwater: None encountered.

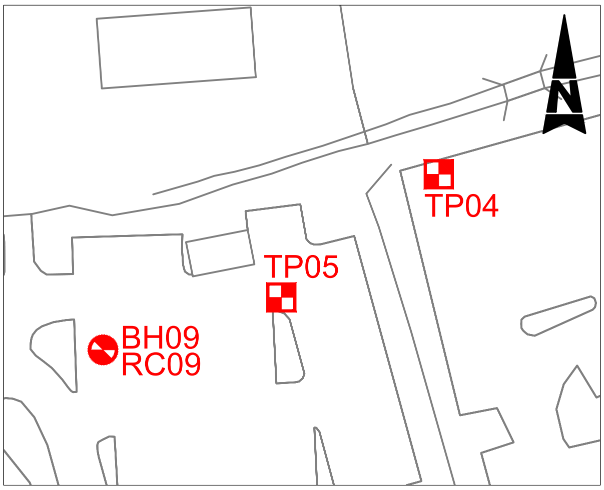
Remarks: Trial pit terminated at 2.30 m bgl due to collapsing side walls.



TRIAL PIT PLAN, 1:50 ON A4



TRIAL PIT SECTION, 1:50 ON A4



TRIAL PIT LOCATION PLAN, 1:1000 ON A4

DATUM COORDINATES:

EASTING:	575235.79
NORTHING:	572716.09
LEVEL:	3.801mAOD

KEY:

DATUM: X

TRIAL PIT DIMENSIONS:

LENGTH:	2.40m
WIDTH:	0.70m
DEPTH:	2.30m

STRATA SHOWN ON DETAILED LOG

TRIAL PIT NUMBER:

TP05

JOB NAME:

N25 Pedestrian & Cycle Bridge

JOB NUMBER:

P22156

DRAWING NUMBER:

P22156-TP05

DRAWN BY: G.C.		DATE: 19/07/2022
LOGGED BY: M.M.		DATE: 29/06/2022
SCALE: AS STATED	APPROVED: GH	REVISION: D01

Photographic Record

Number:	**TP05**	**Project** **Project No** **Engineer**	Little Island/ N25 Pedestrian & Cycle Bridge P22156 Arup	

Number:	**TP05**	**Project** **Project No** **Engineer**	Little Island/ N25 Pedestrian & Cycle Bridge P22156 Arup

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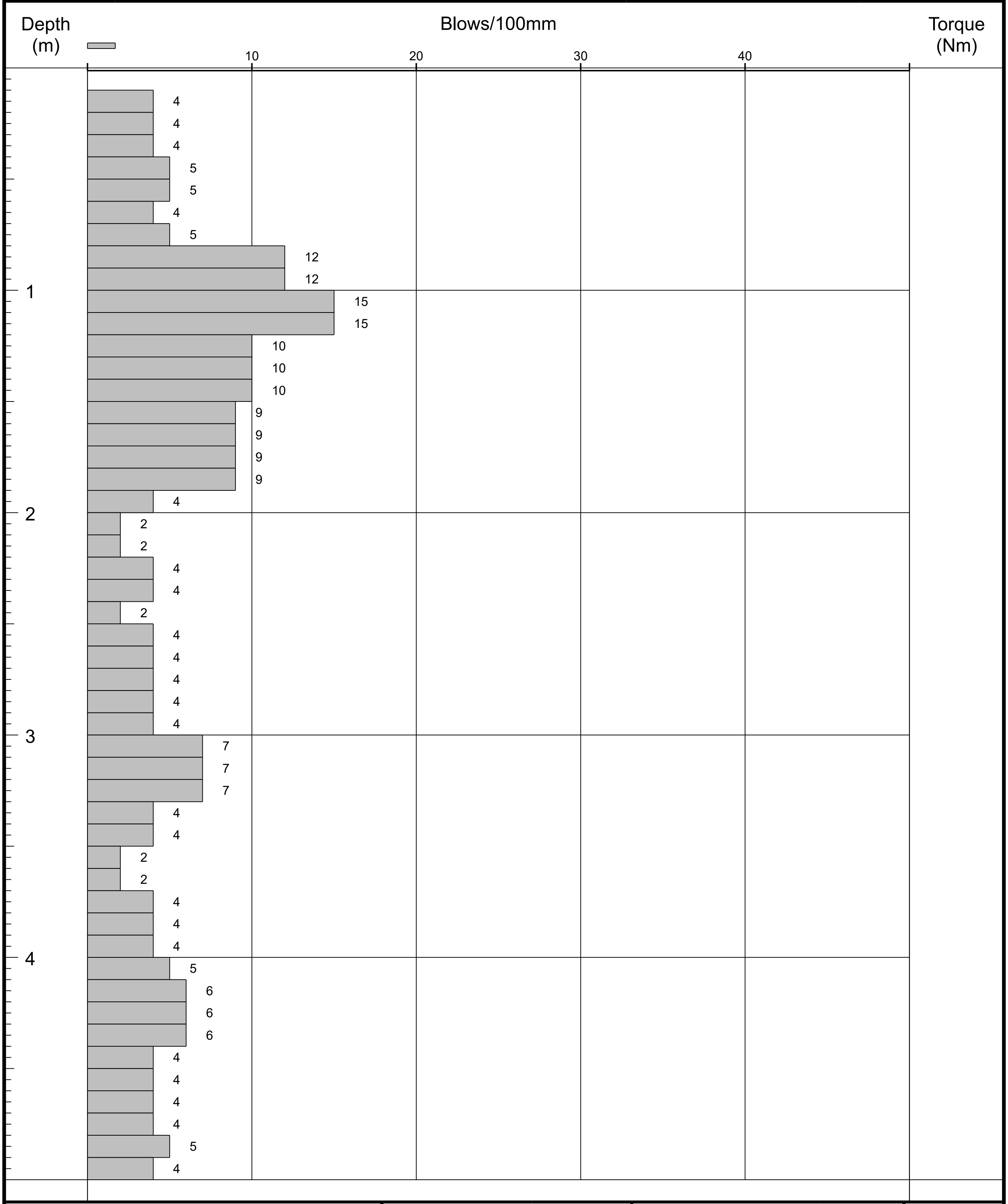
Probe No
DP01
Sheet 1 of 2

Project Name:	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords:**	575390E - 572938N	**Hole Type** DP
Location:	Little Island, Co. Cork		**Level:**	2.96m OD	**Scale** 1:25
Client:	Cork County Council		**Dates:**	06/03/2023	**Logged By** LG



Remarks:
Dynamic probe terminated at 8.70m bgl, refusal.

Fall Height (mm):	500	**Cone Base Dia. (mm):**	50
Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90
Probe Type:	DPH	**Final Depth (m bgl):**	8.70

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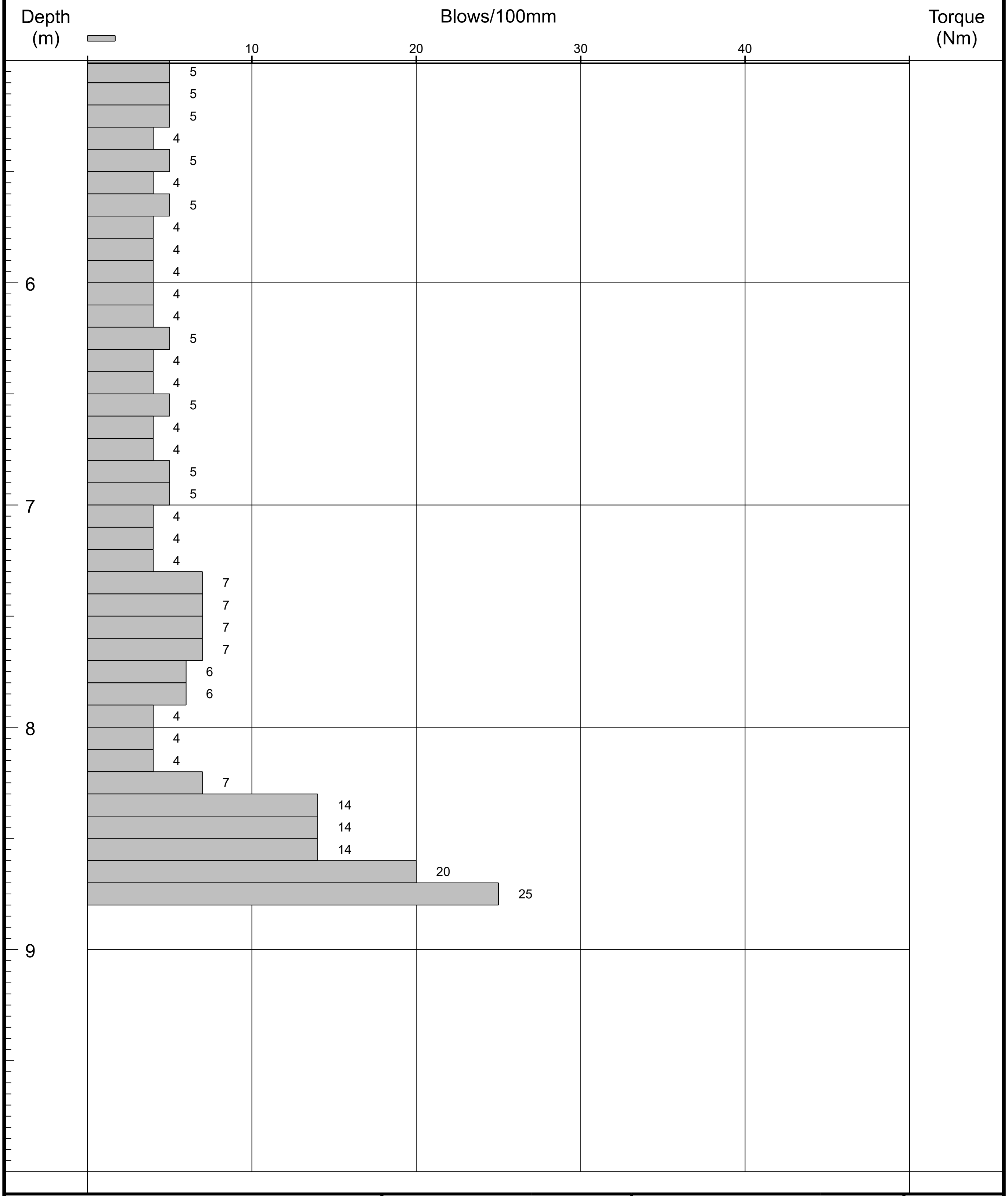
Probe No
DP01
Sheet 2 of 2

Project Name:	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords:**	575390E - 572938N	**Hole Type** DP
Location:	Little Island, Co. Cork		**Level:**	2.96m OD	**Scale** 1:25
Client:	Cork County Council		**Dates:**	06/03/2023	**Logged By** LG



Remarks:
Dynamic probe terminated at 8.70m bgl, refusal.

Fall Height (mm):	500	**Cone Base Dia. (mm):**	50
Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90
Probe Type:	DPH	**Final Depth (m bgl):**	8.70

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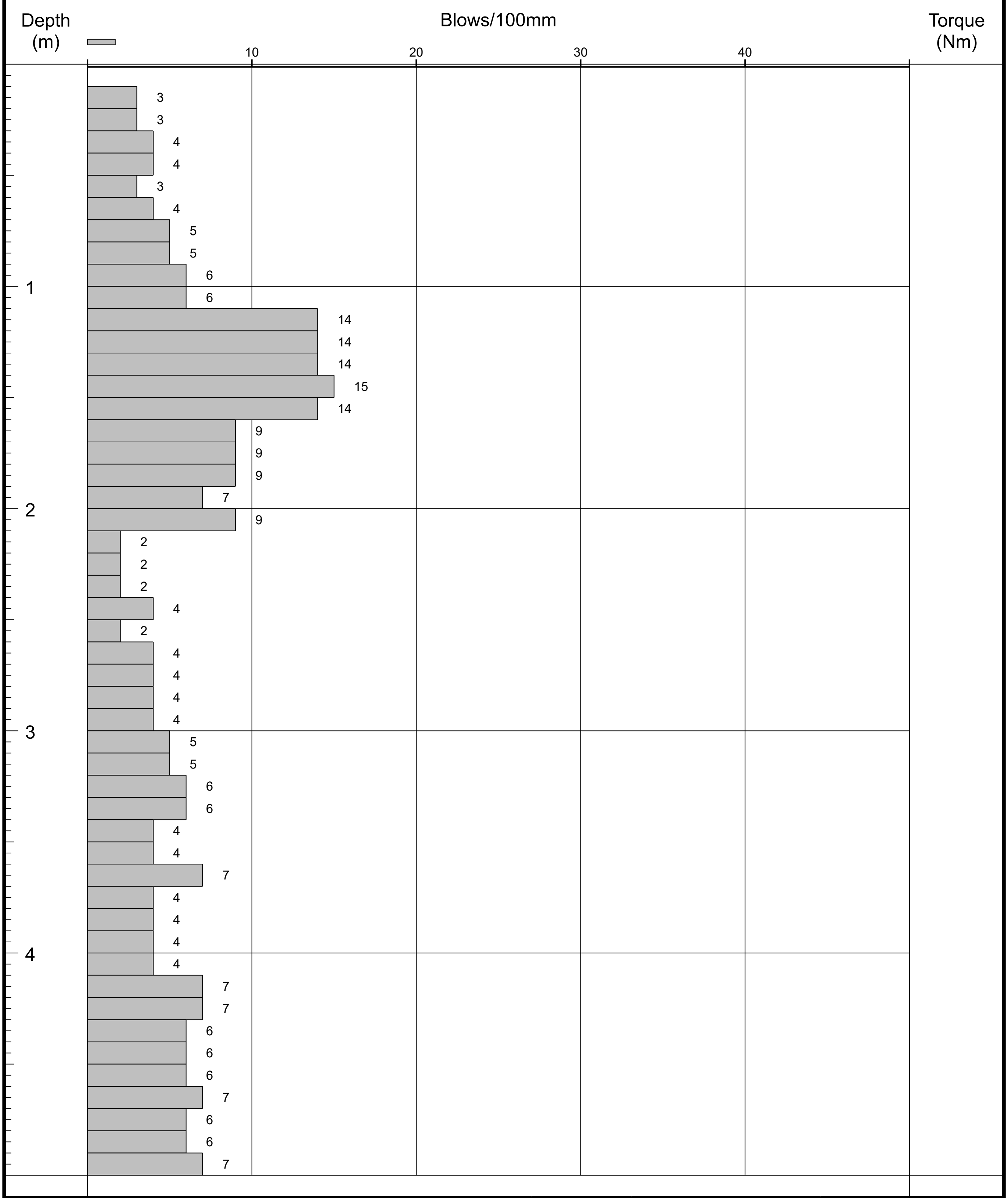
Probe No
DP02
Sheet 1 of 2

Project Name: N25 LI Pedestrian & Cycle Bridge
Project No. P22156
Co-ords: 575379E - 572936N
Hole Type DP
Location: Little Island, Co. Cork
Level: 2.98m OD
Scale 1:25
Client: Cork County Council
Dates: 06/03/2023
Logged By LG



Remarks:
Dynamic probe terminated at 8.80m bgl, refusal.

Fall Height (mm): 500
Hammer Mass (Kg): 50.0
Probe Type: DPH
Cone Base Dia. (mm): 50
Cone Angle (Deg): 90
Final Depth (m bgl): 8.80

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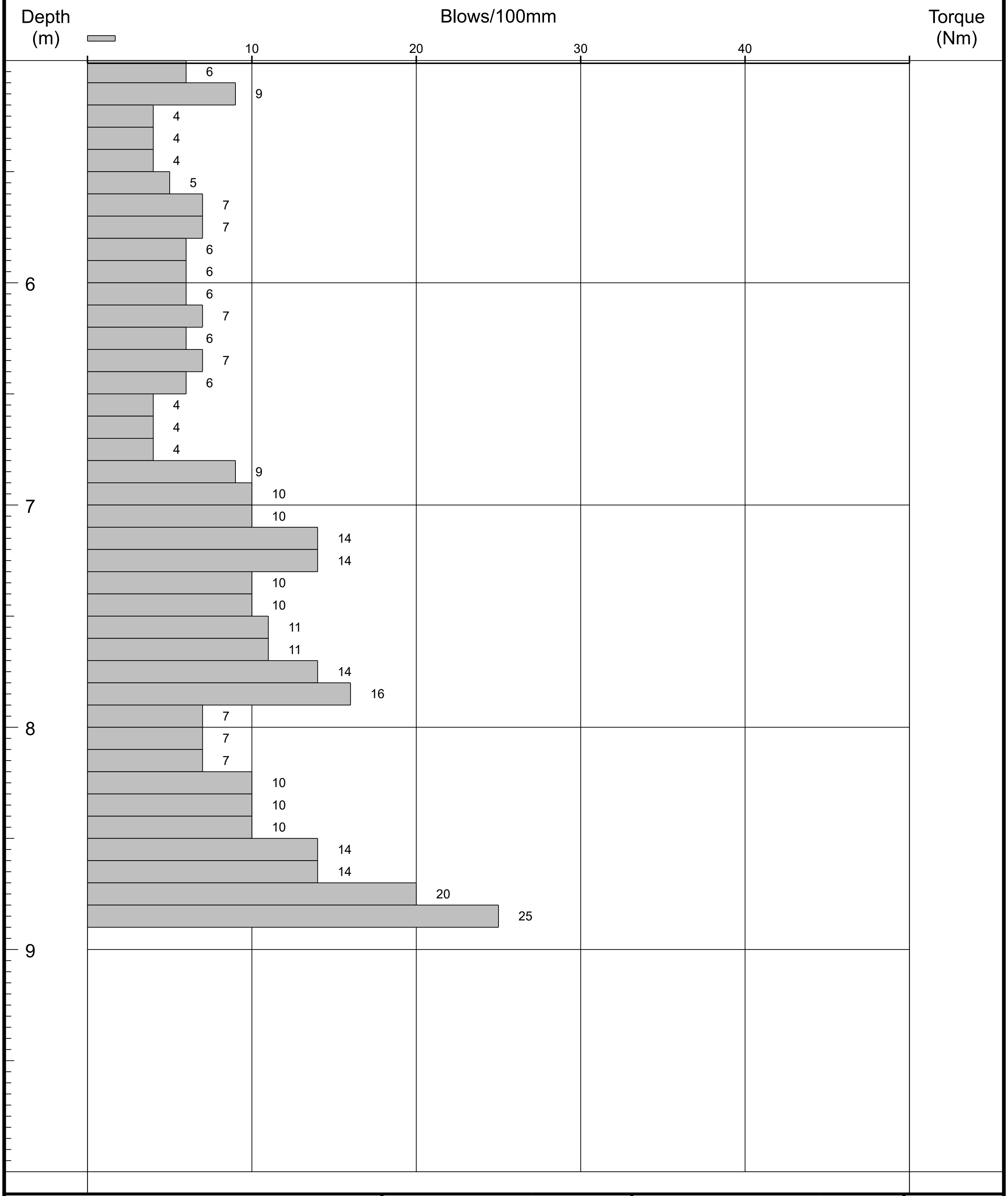
Probe No
DP02
Sheet 2 of 2

Project Name:	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords:** 575379E - 572936N		**Hole Type** DP
Location:	Little Island, Co. Cork		**Level:** 2.98m OD		**Scale** 1:25
Client:	Cork County Council		**Dates:** 06/03/2023		**Logged By** LG



Remarks:
Dynamic probe terminated at 8.80m bgl, refusal.

Fall Height (mm):	500	**Cone Base Dia. (mm):**	50
Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90
Probe Type:	DPH	**Final Depth (m bgl):**	8.80

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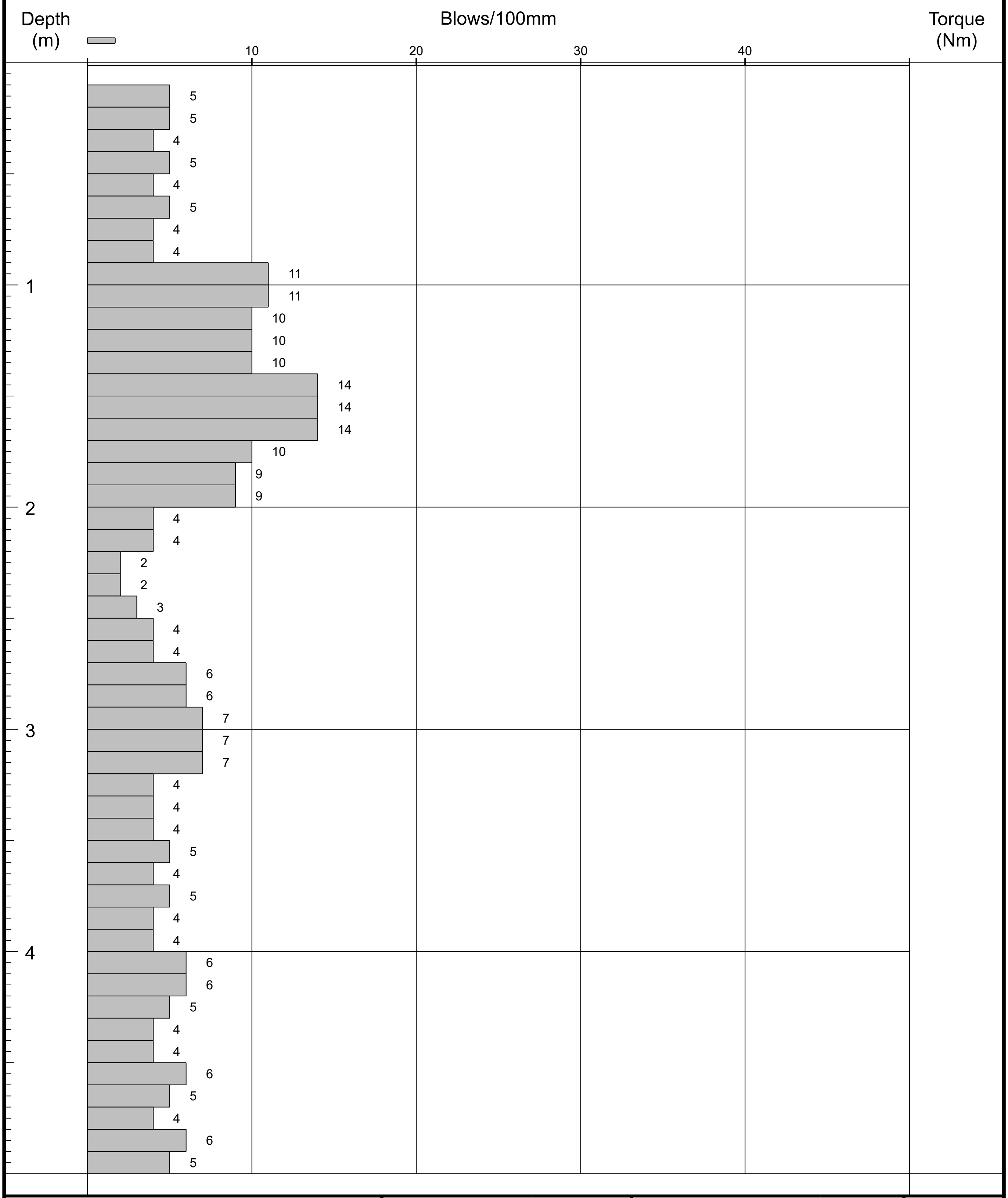
Probe No
DP03
Sheet 1 of 2

Project Name:	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords:** 575353E - 572935N		**Hole Type** DP
Location:	Little Island, Co. Cork		**Level:** 2.98m OD		**Scale** 1:25
Client:	Cork County Council		**Dates:** 06/03/2023		**Logged By** LG



Remarks:
Dynamic probe terminated at 8.50m bgl, refusal.

Fall Height (mm):	500	**Cone Base Dia. (mm):**	50
Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90
Probe Type:	DPH	**Final Depth (m bgl):**	8.50

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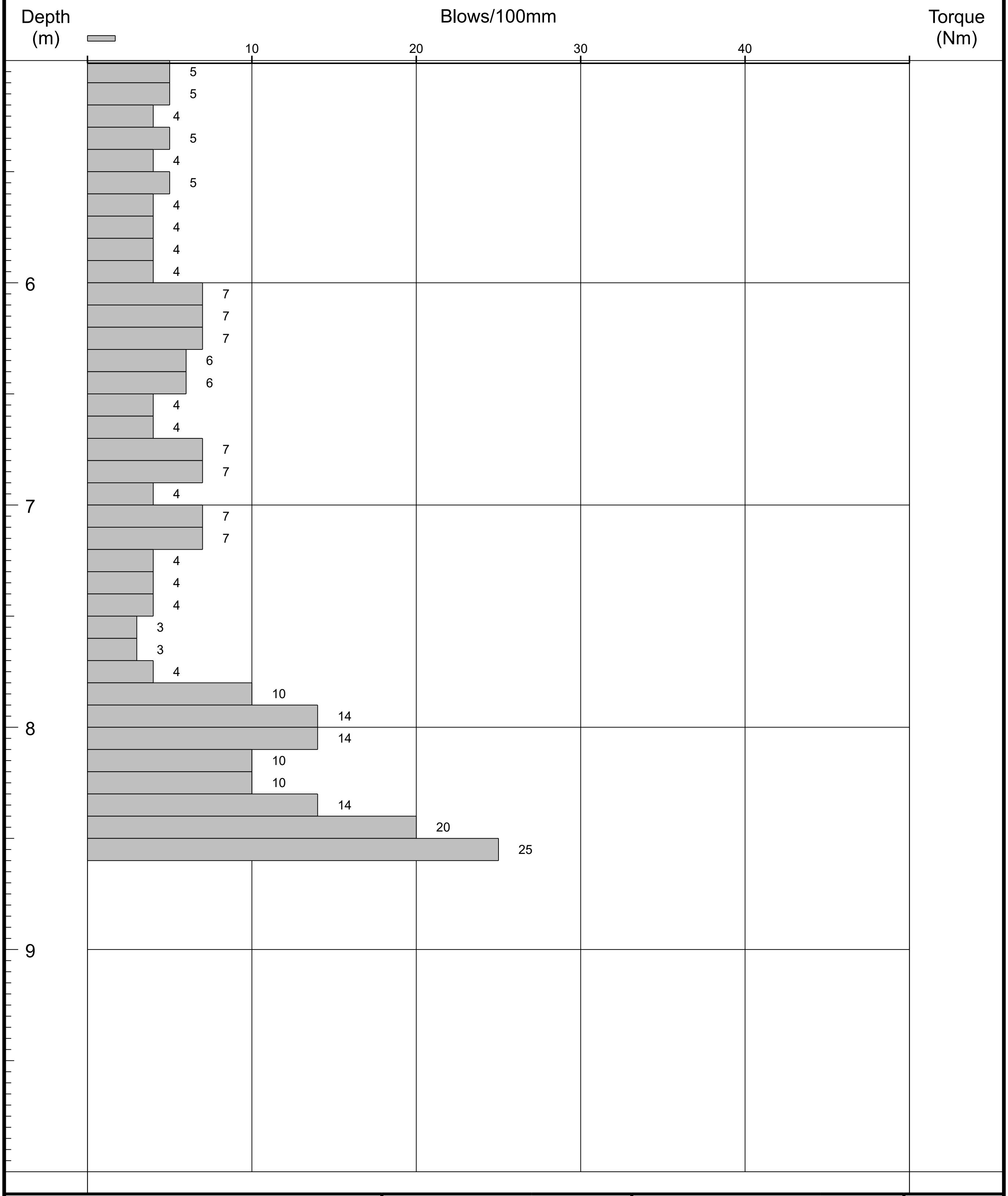
Probe No
DP03
Sheet 2 of 2

Project Name:	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords:**	575353E - 572935N	**Hole Type** DP
Location:	Little Island, Co. Cork		**Level:**	2.98m OD	**Scale** 1:25
Client:	Cork County Council		**Dates:**	06/03/2023	**Logged By** LG



Remarks:
Dynamic probe terminated at 8.50m bgl, refusal.

Fall Height (mm):	500	**Cone Base Dia. (mm):**	50
Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90
Probe Type:	DPH	**Final Depth (m bgl):**	8.50

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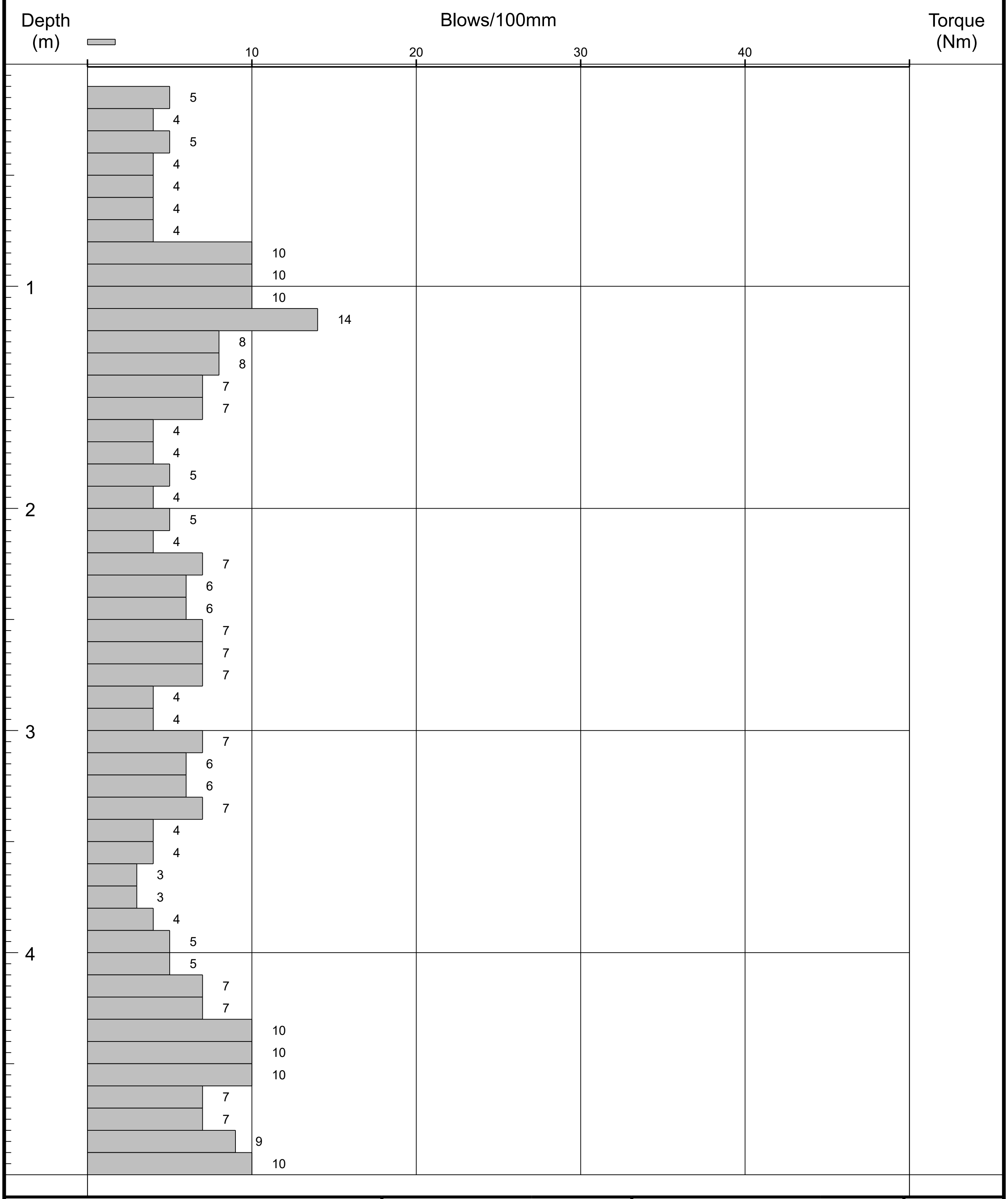
Probe No
DP04
Sheet 1 of 2

Project Name:	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords:**	575313E - 572929N	**Hole Type** DP
Location:	Little Island, Co. Cork		**Level:**	2.87m OD	**Scale** 1:25
Client:	Cork County Council		**Dates:**	06/01/2023	**Logged By** LG



Remarks: Dynamic probe terminated at 8.70m bgl, refusal.	**Fall Height (mm):**	500	**Cone Base Dia. (mm):**	50
	Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90
	Probe Type:	DPH	**Final Depth (m bgl):**	8.70

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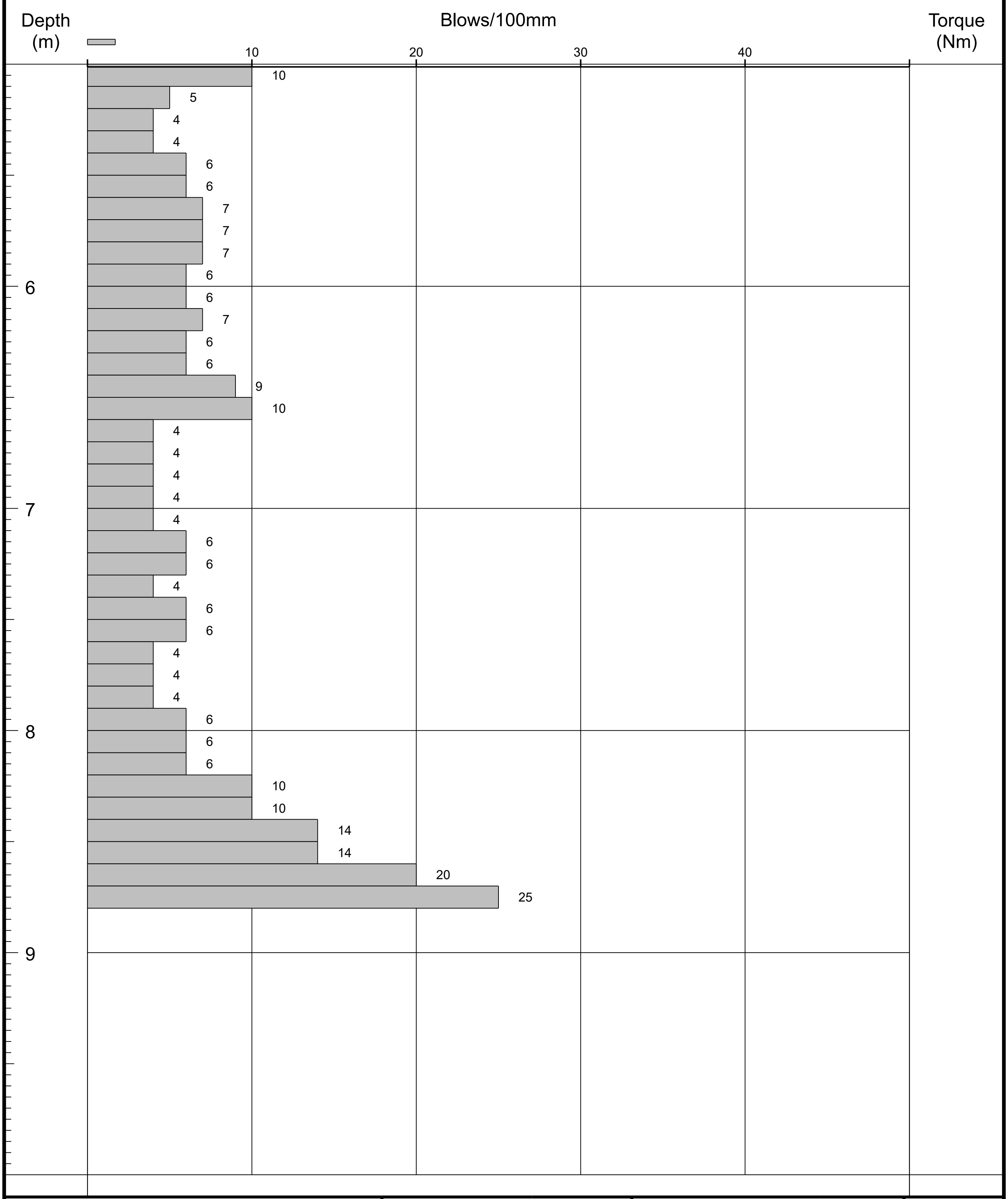
Probe No
DP04
Sheet 2 of 2

Project Name:	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords:**	575313E - 572929N	**Hole Type** DP
Location:	Little Island, Co. Cork		**Level:**	2.87m OD	**Scale** 1:25
Client:	Cork County Council		**Dates:**	06/01/2023	**Logged By** LG



Remarks: Dynamic probe terminated at 8.70m bgl, refusal.	**Fall Height (mm):**	500	**Cone Base Dia. (mm):**	50	
	Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90	
	Probe Type:	DPH	**Final Depth (m bgl):**	8.70	

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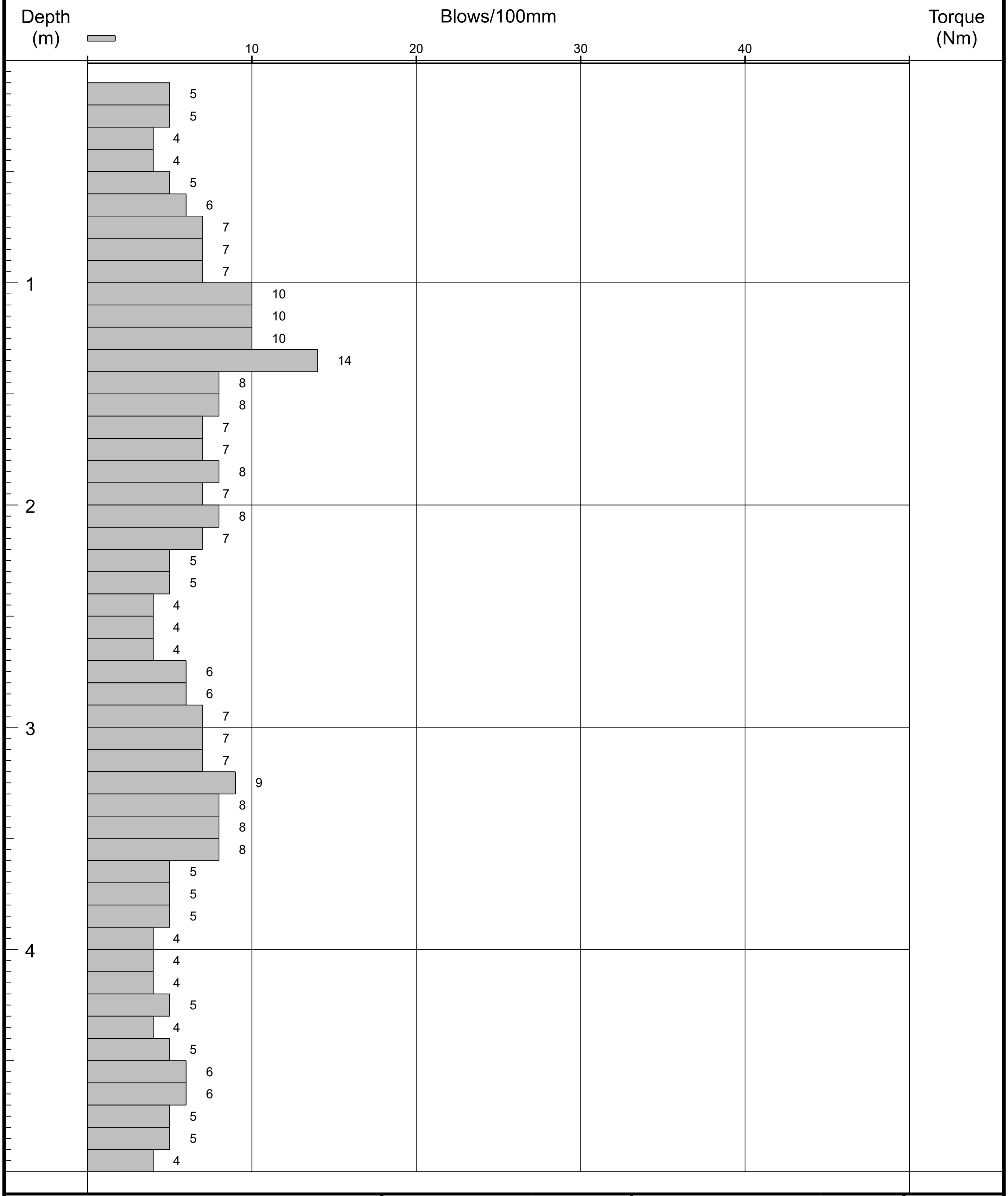
Probe No
DP05
Sheet 1 of 2

Project Name:	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords:**	575310E - 572918N	**Hole Type** DP
Location:	Little Island, Co. Cork		**Level:**	2.58m OD	**Scale** 1:25
Client:	Cork County Council		**Dates:**	06/03/2023	**Logged By** LG



Remarks:
Dynamic probe terminated at 8.40m bgl, refusal.

Fall Height (mm):	500	**Cone Base Dia. (mm):**	50
Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90
Probe Type:	DPH	**Final Depth (m bgl):**	8.40

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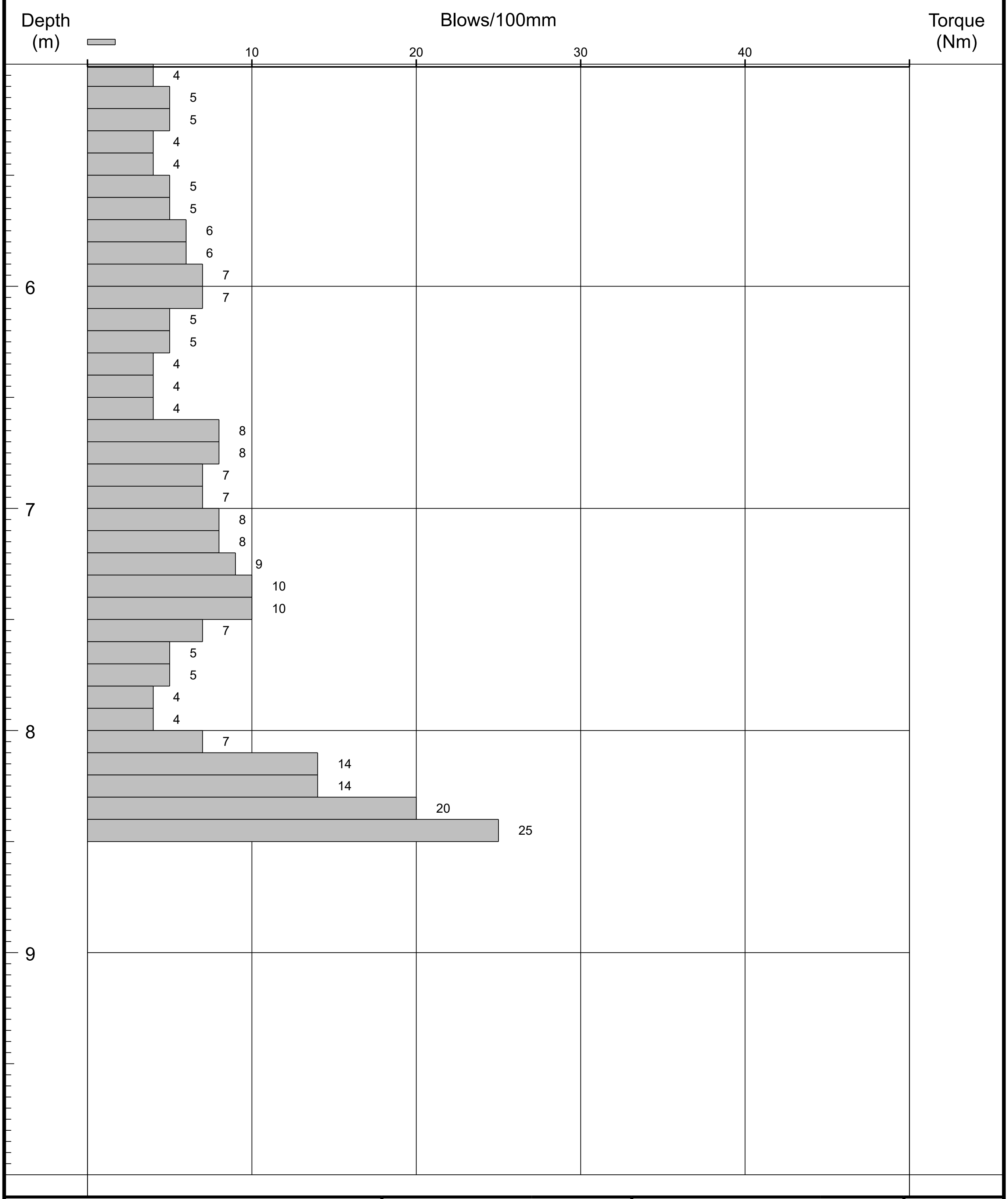
Probe No
DP05
Sheet 2 of 2

Project Name:	N25 LI Pedestrian & Cycle Bridge	**Project No.**	P22156
Co-ords:	575310E - 572918N	**Hole Type**	DP
Location:	Little Island, Co. Cork	**Level:**	2.58m OD
Scale	1:25		
Client:	Cork County Council	**Dates:**	06/03/2023
Logged By	LG		



Remarks:
Dynamic probe terminated at 8.40m bgl, refusal.

Fall Height (mm):	500	**Cone Base Dia. (mm):**	50
Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90
Probe Type:	DPH	**Final Depth (m bgl):**	8.40

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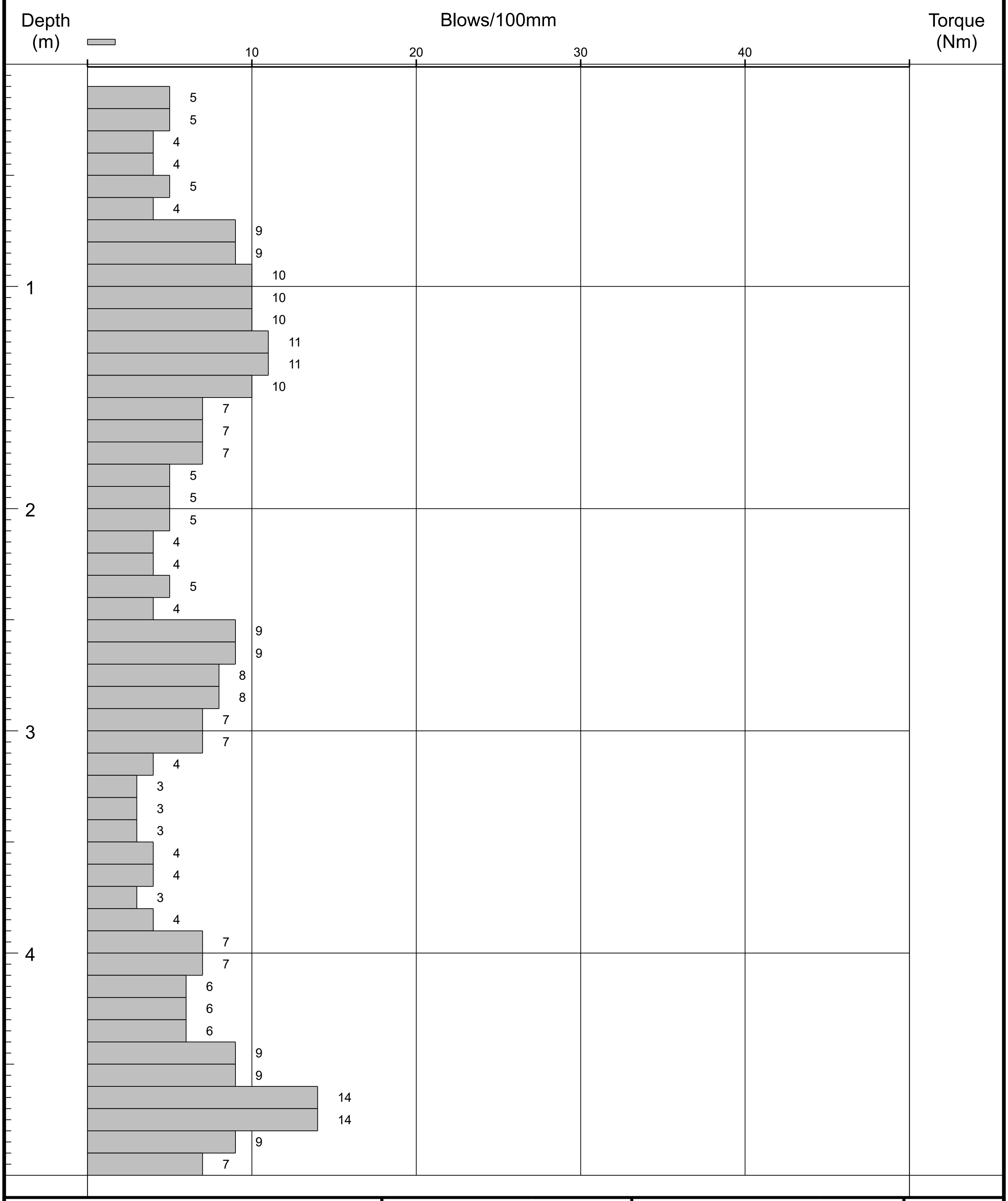
Probe No
DP06
Sheet 1 of 2

Project Name: N25 LI Pedestrian & Cycle Bridge
Project No. P22156
Co-ords: 575286E - 572923N
Hole Type DP
Location: Little Island, Co. Cork
Level: 2.84m OD
Scale 1:25
Client: Cork County Council
Dates: 06/03/2023
Logged By LG



Remarks:
Dynamic probe terminated at 8.60m bgl, refusal.

Fall Height (mm): 500
Hammer Mass (Kg): 50.0
Probe Type: DPH
Cone Base Dia. (mm): 50
Cone Angle (Deg): 90
Final Depth (m bgl): 8.60

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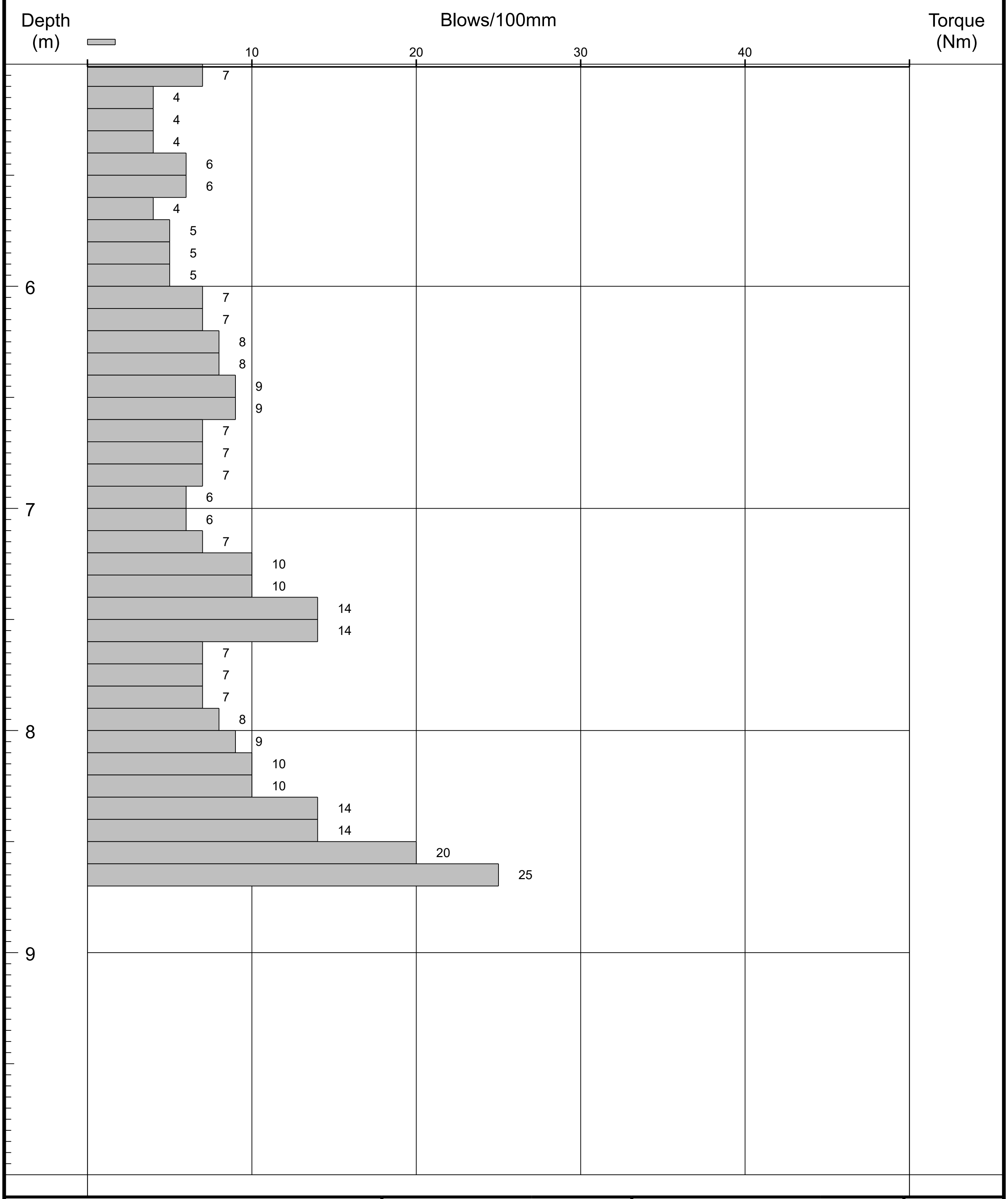
Probe No
DP06
Sheet 2 of 2

Project Name:	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords:** 575286E - 572923N	**Hole Type** DP
Location:	Little Island, Co. Cork		**Level:** 2.84m OD	**Scale** 1:25
Client:	Cork County Council		**Dates:** 06/03/2023	**Logged By** LG



Remarks: Dynamic probe terminated at 8.60m bgl, refusal.	**Fall Height (mm):**	500	**Cone Base Dia. (mm):**	50	
	Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90	
	Probe Type:	DPH	**Final Depth (m bgl):**	8.60	

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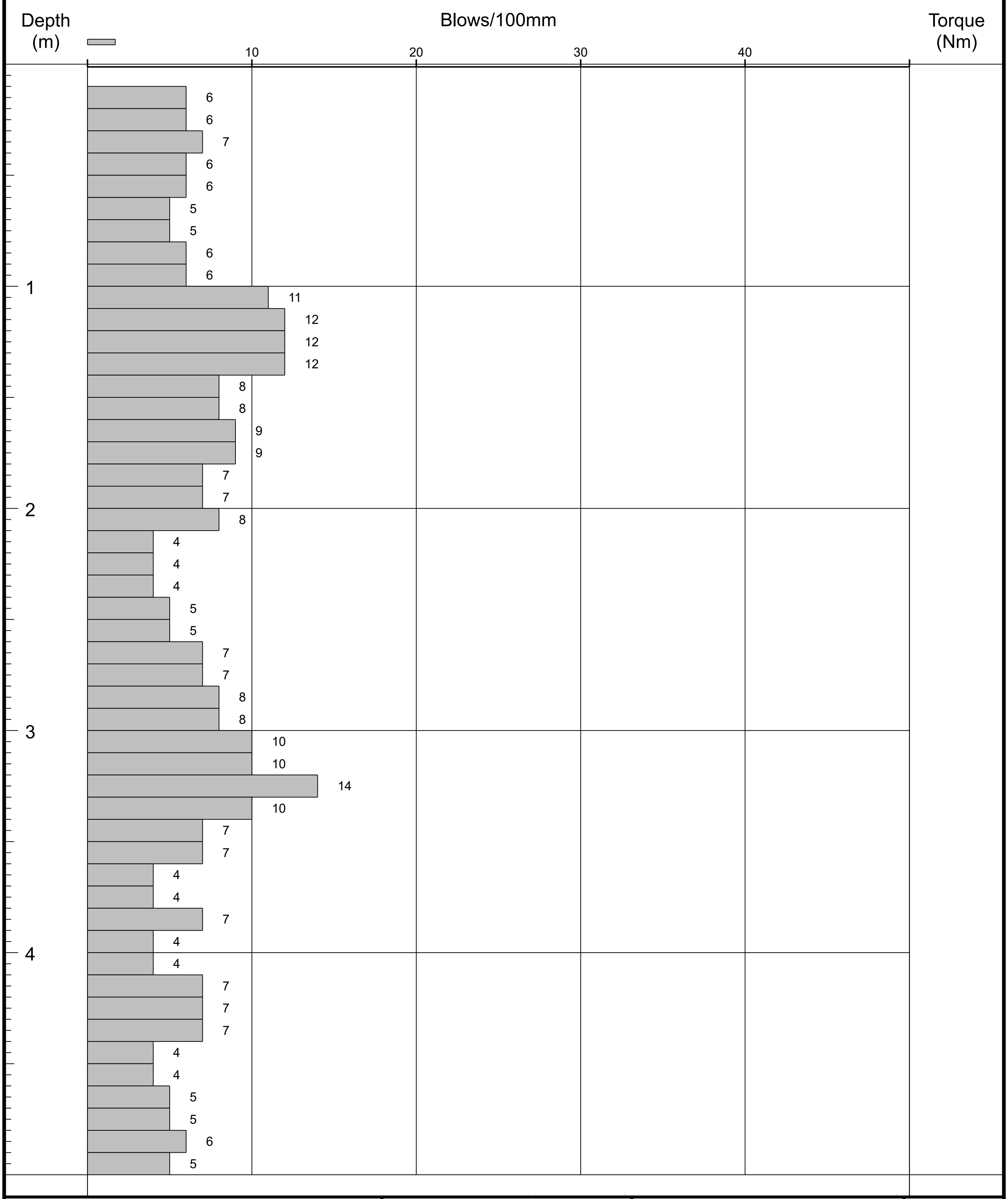
Probe No
DP07
Sheet 1 of 2

Project Name:	N25 LI Pedestrian & Cycle Bridge	**Project No.**	P22156
Co-ords:	575231E - 572909N	**Hole Type**	DP
Location:	Little Island, Co. Cork	**Level:**	2.73m OD
Scale	1:25		
Client:	Cork County Council	**Dates:**	06/03/2023
Logged By	LG		



Remarks:
Dynamic probe terminated at 7.60m bgl, refusal.

Fall Height (mm):	500	**Cone Base Dia. (mm):**	50
Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90
Probe Type:	DPH	**Final Depth (m bgl):**	7.60

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Fax: 021 4638690
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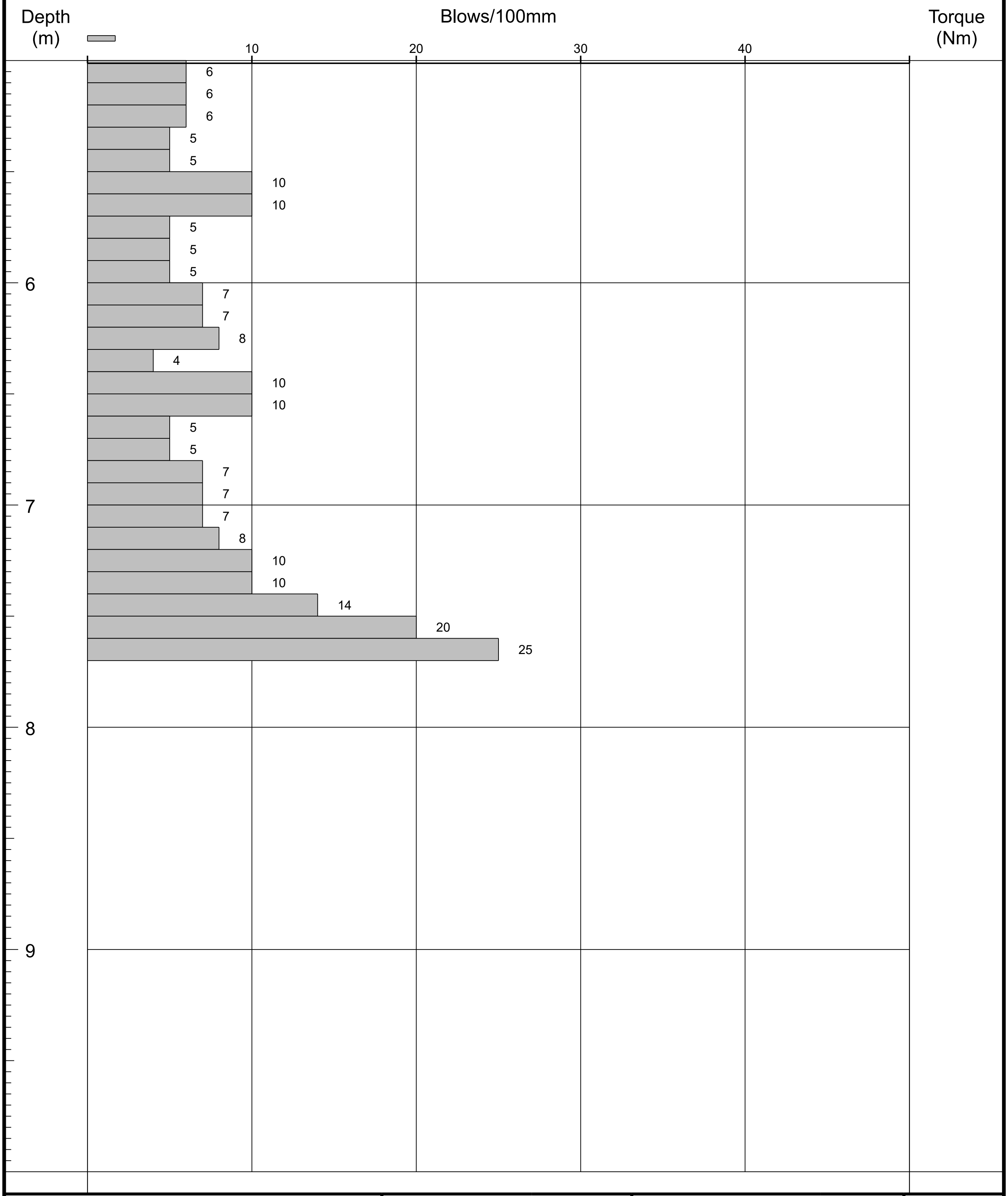
Probe No
DP07
Sheet 2 of 2

Project Name:	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords:** 575231E - 572909N		**Hole Type** DP
Location:	Little Island, Co. Cork		**Level:** 2.73m OD		**Scale** 1:25
Client:	Cork County Council		**Dates:** 06/03/2023		**Logged By** LG

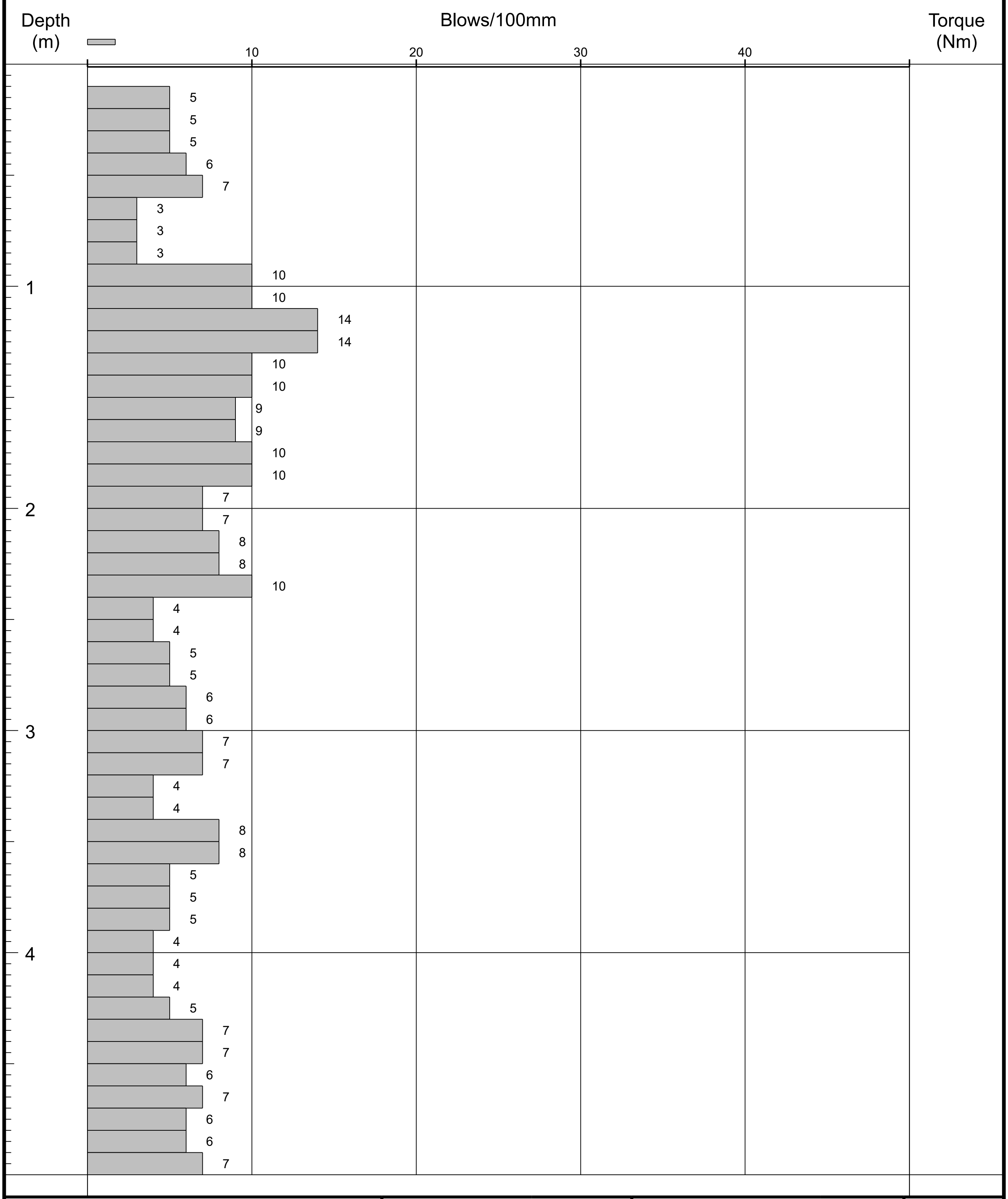


Remarks:
Dynamic probe terminated at 7.60m bgl, refusal.

Fall Height (mm):	500	**Cone Base Dia. (mm):**	50
Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90
Probe Type:	DPH	**Final Depth (m bgl):**	7.60

	Priority Geotechnical Ltd. **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**	Probe No **DP08** Sheet 1 of 2

Project Name:	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords:**	575214E - 572904N		**Hole Type** DP
Location:	Little Island, Co. Cork		**Level:**	2.91m OD		**Scale** 1:25
Client:	Cork County Council		**Dates:**	06/03/2023		**Logged By** LG



Remarks:
Dynamic probe terminated at 7.0m bgl, refusal.

Fall Height (mm):	500	**Cone Base Dia. (mm):**	50
Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90
Probe Type:	DPH	**Final Depth (m bgl):**	7.00

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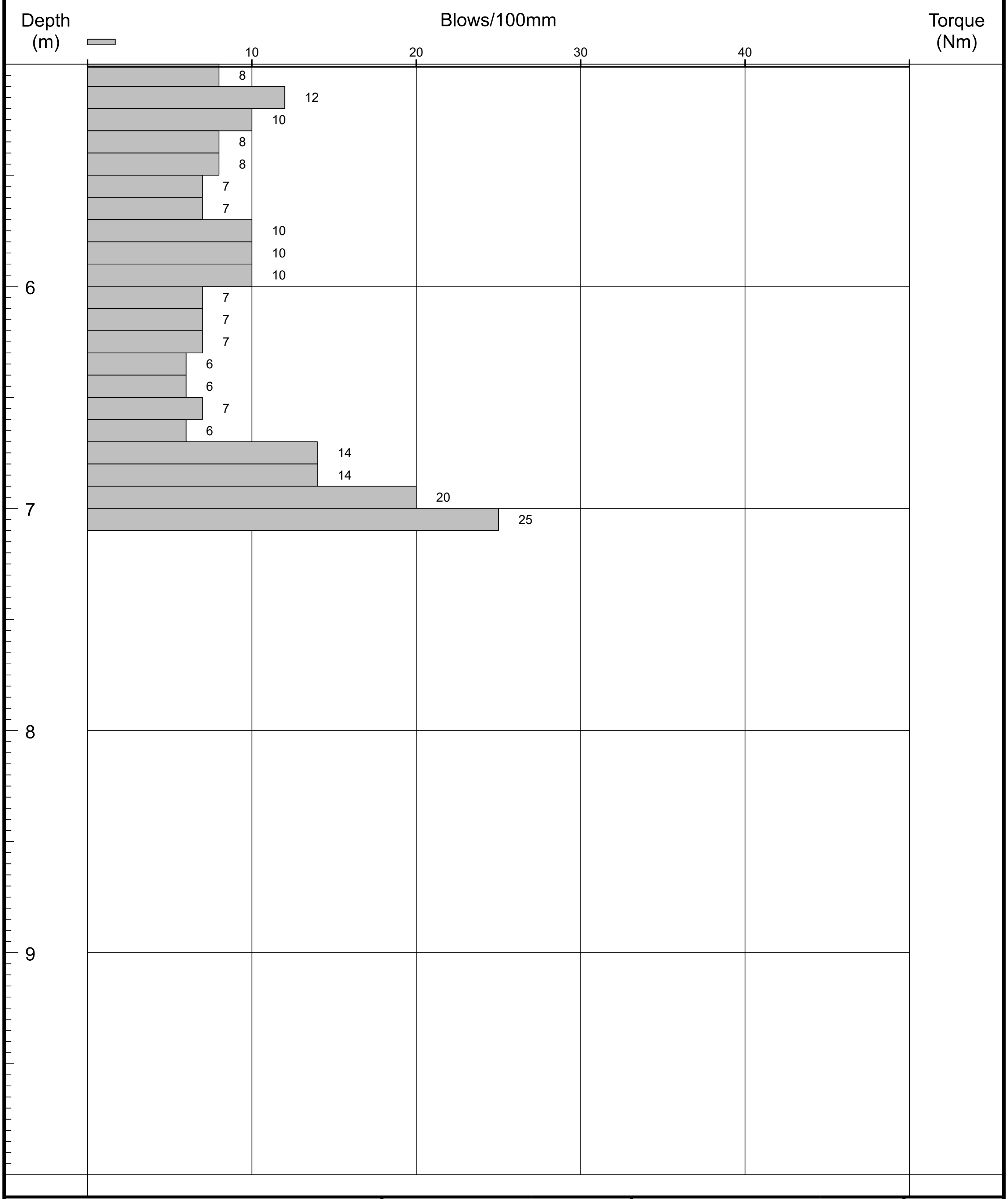
Probe No
DP08
Sheet 2 of 2

Project Name:	N25 LI Pedestrian & Cycle Bridge	**Project No.** P22156	**Co-ords:**	575214E - 572904N	**Hole Type** DP
Location:	Little Island, Co. Cork		**Level:**	2.91m OD	**Scale** 1:25
Client:	Cork County Council		**Dates:**	06/03/2023	**Logged By** LG



Remarks:
Dynamic probe terminated at 7.0m bgl, refusal.

Fall Height (mm):	500	**Cone Base Dia. (mm):**	50
Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90
Probe Type:	DPH	**Final Depth (m bgl):**	7.00

KEY TO SYMBOLS ON LAB RESULTS

U	Undisturbed Sample
P	Piston Sample
TWS	Thin Wall Sample
B	Bulk Sample - Disturbed
D	Jar Sample - Disturbed
W	Water Sample
pH	Acidity/Alkalinity Index
SO_3	% - Total Sulphate Content (acid soluble)
SO_3	g/ltr - Water Soluble Sulphate (Water or 2:1 Aqueous Soil Extract)
+	Calcareous Reaction
Cl	Chloride Content
PI	Plasticity Index
<425	% of material in sample passing 425 micron sieve
LL	Liquid Limit
PL	Plastic Limit
MC	Water Content
NP	Non Plastic
Yb	Bulk Density
Yd	Dry Density
Ps	Particle Density
U/D	Undrained/Drained Triaxial
U/C	Unconsolidated/Consolidated Triaxial
T/M	Single Stage/Multistage Triaxial
100/38	Sample Diameter (mm)
REM	Remoulded Triaxial Test Specimen
TST	Triaxial Suction Test
V	Vane Test
DSB	Drained Shear Box
RSB	Residual Shear Box
RS	Ring Shear σ_3 Cell Pressure
σ_1-σ_3	Deviator Stress
c	Cohesion
c_	Effective Cohesion Intercept ϕ
ϕ_	Effective Angle of Shearing Resistance εf
p_o	Effective Overburden Pressure m_v Coefficient of Volume
c_v	Coefficient of Consolidation
Std	Standard Compaction - 2.5kg Rammer
Hvy	Heavy Compaction - 4.5kg Rammer
Vib	Vibratory Compaction
CBR	California Bearing Ratio
MCV	Moisture Condition Value

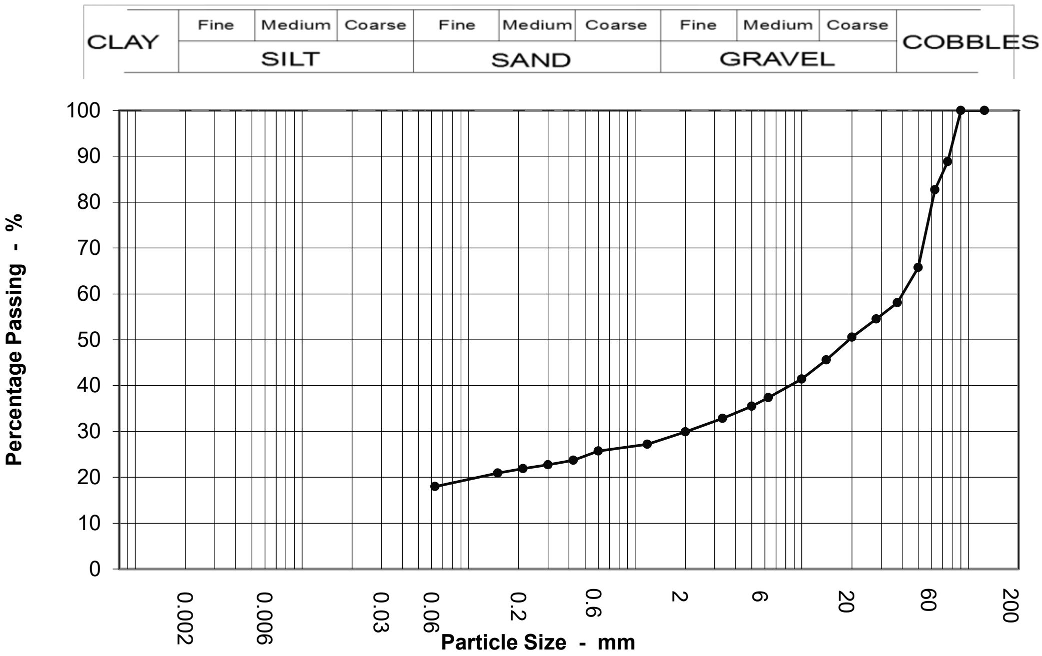
	Natural Moisture Content/Atterberg Limits Summary **BS 1377 : Part 2 : 1990 : Clause 3**	**Job Ref**
Location	**N25 LI Pedestrian & Cycle Bridge**	**P22156**

Hole ID	Sample Ref	Depth (m)	Sample Type	Sample Description	MC	LL	PL	PI	% Pass 425
BH01	1	0	B	Sandy very silty GRAVEL with medium cobble content	21				
BH01	2	1.2	B	Sandy very silty GRAVEL with high cobble content	19	47	28	19	57.1
BH01	3	2.2	B	Sandy silty GRAVEL with low cobble content	16				
BH01	4	3.2	B	Slightly sandy gravelly SILT	31				
BH01	5	4.2	B	Slightly sandy slightly gravelly SILT	42	52	31	21	79
BH01	6	5.2	B	Slightly sandy slightly gravelly SILT	39				
BH01	7	6.2	B	Slightly sandy slightly gravelly SILT	41	52	32	20	91.5
BH02	1	0	B	Slightly sandy slightly gravelly SILT with medium cobble content	39				
BH02	2	1	B	Slightly sandy slightly gravelly SILT	52	61	32	29	97
BH02	3	2	B	Slightly sandy slightly gravelly SILT	45				
BH02	4	3	B	Sandy very silty GRAVEL	29	55	33	22	60.8
BH02	5	4	B	Sandy very silty GRAVEL with high cobble content	26				
BH02A	2	1	B	Slightly sandy gravelly SILT	37				
BH03	2	1	B	Slightly sandy gravelly CLAY with low cobble content	21	41	25	16	65.6
BH03	3	2	B	Sandy very clayey GRAVEL	24				
BH03	4	3	B	Slightly gravelly slightly sandy CLAY	43	49	27	22	99.5
BH03	5	4	B	Slightly sandy slightly gravelly SILT	49				
BH03	6	5	B	Slightly gravelly slightly sandy SILT	47	57	36	21	97.7
BH03	8	7	B	Slightly gravelly slightly sandy SILT	49				
BH08	3	2.2	B	Silty very sandy GRAVEL		32	20	12	31.3

	Natural Moisture Content/Atterberg Limits Summary BS 1377 : Part 2 : 1990 : Clause 3	Job Ref
Location	**N25 LI Pedestrian & Cycle Bridge**	**P22156**

Hole ID	Sample Ref	Depth (m)	Sample Type	Sample Description	MC	LL	PL	PI	% Pass 425
BH10	2	1.2	B	Slightly gravelly slightly sandy SILT	56	53	29	24	100
TP03	4	1	D	Slightly sandy slightly gravelly SILT	30	45	28	17	78.1

pgl priority geotechnical	**PARTICLE SIZE DISTRIBUTION** **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P22156**
		Borehole / Pit No	BH01
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	1
		Depth	0.00 m
Soil Description	Sandy very silty GRAVEL with medium cobble content	Sample type	B



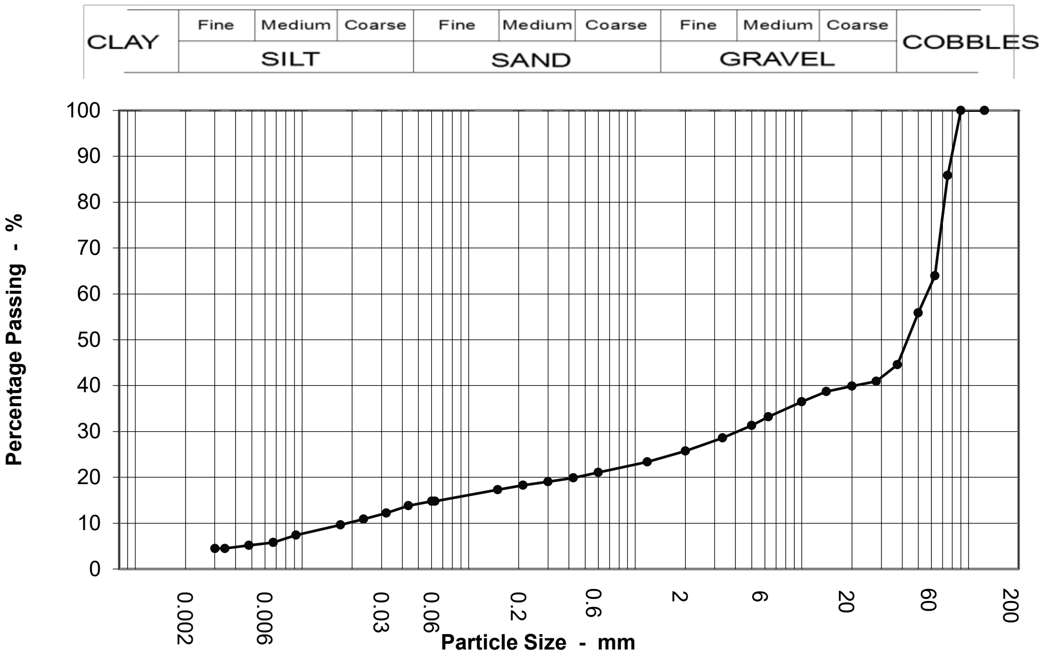
Sieving		**Sedimentation**	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	89		
63	83		
50	66		
37.5	58		
28	55		
20	51		
14	46		
10	41		
6.3	37		
5	36		
3.35	33		
2	30		
1.18	27		
0.6	26		
0.425	24		
0.3	23		
0.212	22		
0.15	21		
0.063	18		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	17.0
Gravel	53.0
Sand	12.0
Silt & Clay	18.0

Grading Analysis	
D100	90.00
D60	40.30
D10	
Uniformity Coefficient	

pgl priority geotechnical	**PARTICLE SIZE DISTRIBUTION** **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P22156**
		Borehole / Pit No	BH01
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	2
		Depth	1.20 m
Soil Description	Sandy very silty GRAVEL with high cobble content	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.060	15
90	100	0.044	14
75	86	0.032	12
63	64	0.023	11
50	56	0.017	10
37.5	45	0.009	7
28	41	0.007	6
20	40	0.005	5
14	39	0.003	4
10	36	0.003	4
6.3	33	0.001	3
5	31		
3.35	29		
2	26		
1.18	23		
0.6	21		
0.425	20		
0.3	19		
0.212	18		
0.15	17		
0.063	15		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

Sample Proportions	
Cobbles	36.0
Gravel	38.0
Sand	11.0
Silt	11.0
Clay	4.0

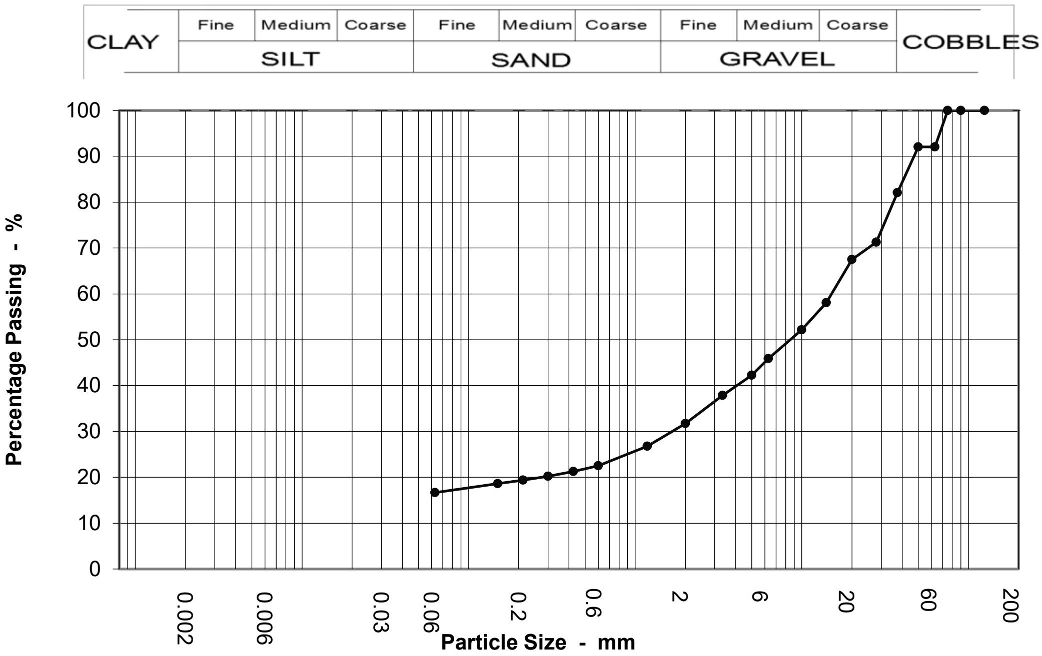
Grading Analysis	
D100	90.00
D60	56.30
D10	0.02
Uniformity Coefficient	3000.00

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

Job Ref	**P22156**
Borehole / Pit No	BH01
Sample No	3
Depth	2.20 m
Sample type	B

Location	**N25 LI Pedestrian & Cycle Bridge**
Soil Description	Sandy silty GRAVEL with low cobble content



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	92		
50	92		
37.5	82		
28	71		
20	67		
14	58		
10	52		
6.3	46		
5	42		
3.35	38		
2	32		
1.18	27		
0.6	23		
0.425	21		
0.3	20		
0.212	19		
0.15	19		
0.063	17		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

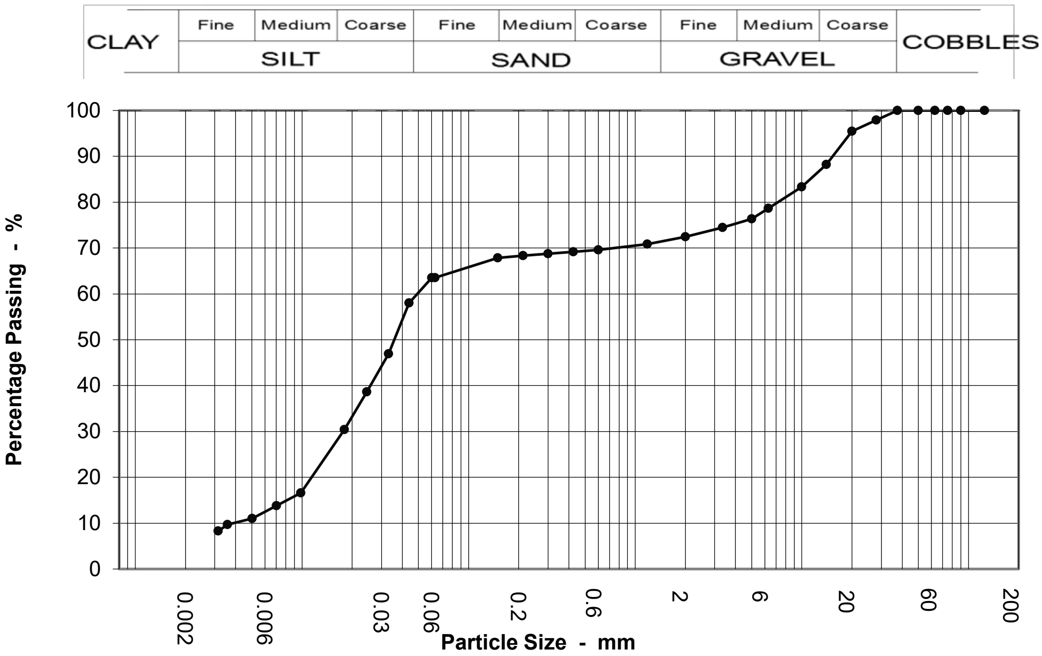
Sample Proportions	
Cobbles	8.0
Gravel	60.0
Sand	15.0
Silt & Clay	17.0

Grading Analysis	
D100	75.00
D60	15.10
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P22156**
		Borehole / Pit No	BH01
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	5
		Depth	4.20 m
Soil Description	Slightly sandy slightly gravelly SILT	Sample type	B



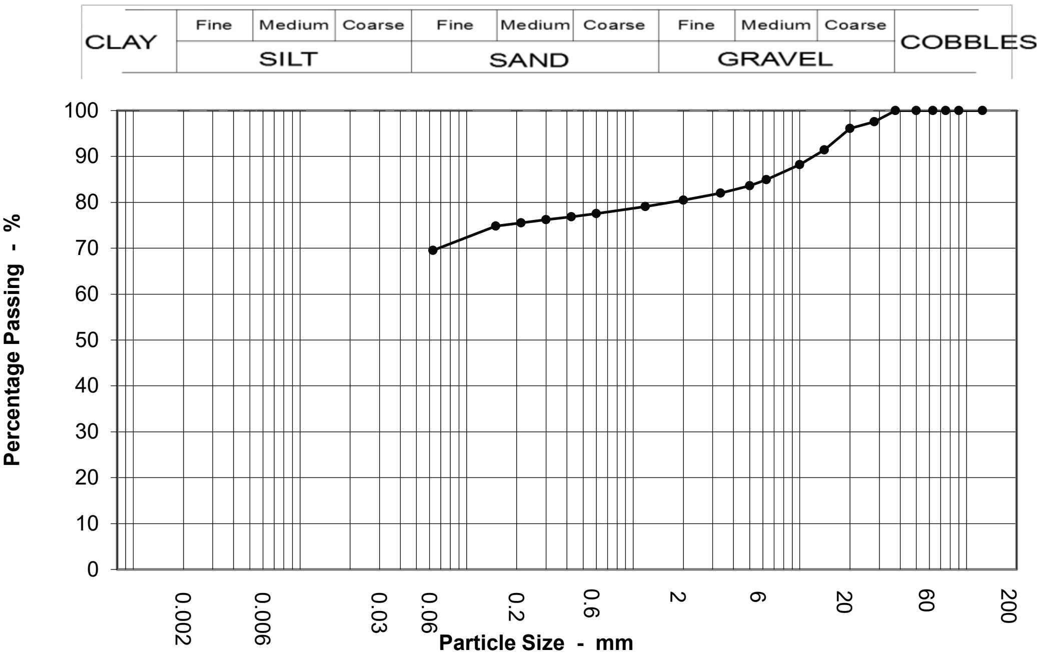
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.060	64
90	100	0.044	58
75	100	0.033	47
63	100	0.024	39
50	100	0.018	30
37.5	100	0.010	17
28	98	0.007	14
20	95	0.005	11
14	88	0.004	10
10	83	0.003	8
6.3	79	0.001	4
5	76		
3.35	74		
2	72		
1.18	71		
0.6	70		
0.425	69		
0.3	69		
0.212	68		
0.15	68		
0.063	64		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

Sample Proportions	
Cobbles	0.0
Gravel	28.0
Sand	9.0
Silt	57.0
Clay	7.0

Grading Analysis	
D100	37.50
D60	0.05
D10	0.00
Uniformity Coefficient	13.00

pgl priority geotechnical	**PARTICLE SIZE DISTRIBUTION** **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P22156**
		Borehole / Pit No	BH01
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	7
		Depth	6.20 m
Soil Description	Slightly sandy slightly gravelly SILT	Sample type	B



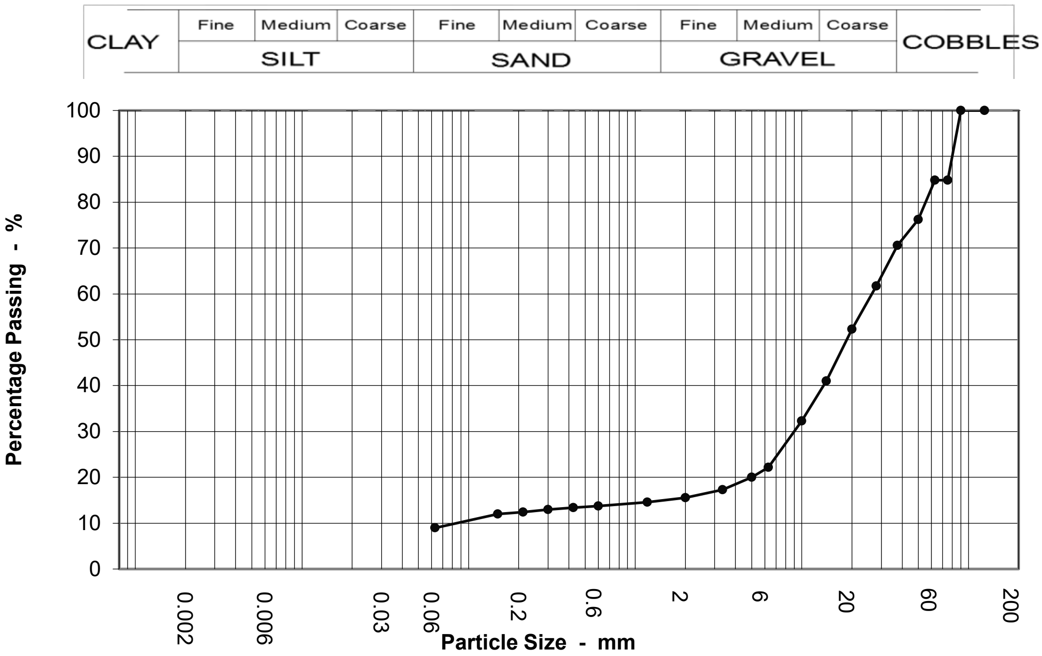
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	98		
20	96		
14	91		
10	88		
6.3	85		
5	84		
3.35	82		
2	80		
1.18	79		
0.6	78		
0.425	77		
0.3	76		
0.212	76		
0.15	75		
0.063	70		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	20.0
Sand	11.0
Silt & Clay	70.0

Grading Analysis	
D100	37.50
D60	
D10	
Uniformity Coefficient	

pgl priority geotechnical	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Job Ref	P22156
		Borehole / Pit No	BH01
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	8
		Depth	7.20 m
Soil Description	Slightly sandy silty GRAVEL with medium cobble content	Sample type	B



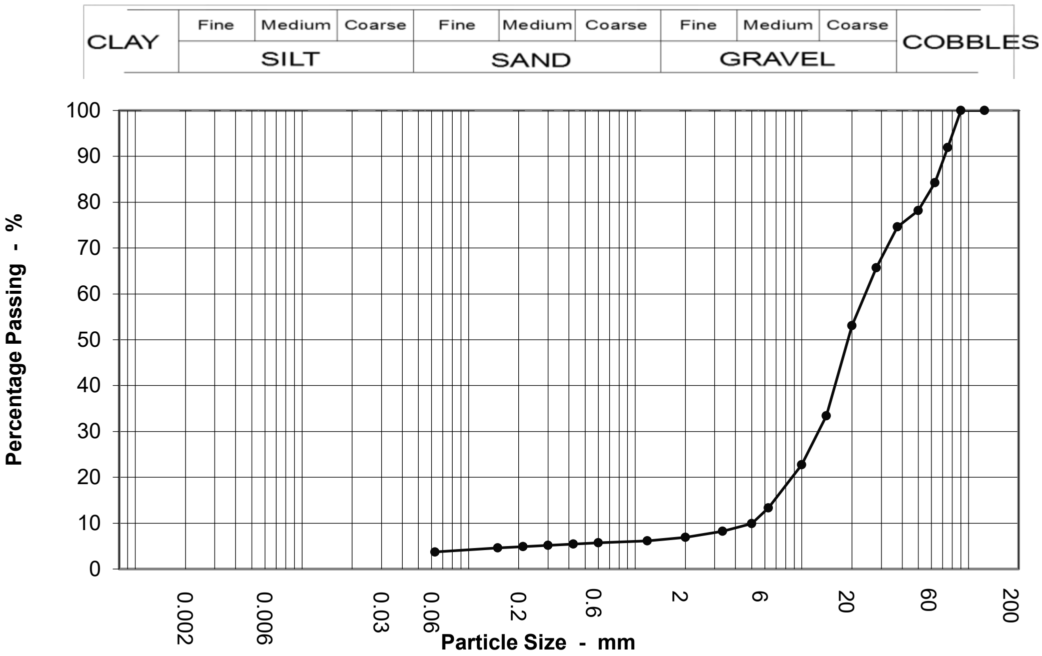
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	85		
63	85		
50	76		
37.5	71		
28	62		
20	52		
14	41		
10	32		
6.3	22		
5	20		
3.35	17		
2	16		
1.18	15		
0.6	14		
0.425	13		
0.3	13		
0.212	12		
0.15	12		
0.063	9		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	15.0
Gravel	69.0
Sand	7.0
Silt & Clay	9.0

Grading Analysis	
D100	90.00
D60	26.30
D10	0.09
Uniformity Coefficient	310.00

pgl priority geotechnical	**PARTICLE SIZE DISTRIBUTION** **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P22156**
		Borehole / Pit No	BH01
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	9
Soil Description	Slightly sandy slightly silty GRAVEL with medium cobble content	Depth	8.20 m
		Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	92		
63	84		
50	78		
37.5	75		
28	66		
20	53		
14	33		
10	23		
6.3	13		
5	10		
3.35	8		
2	7		
1.18	6		
0.6	6		
0.425	5		
0.3	5		
0.212	5		
0.15	5		
0.063	4		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

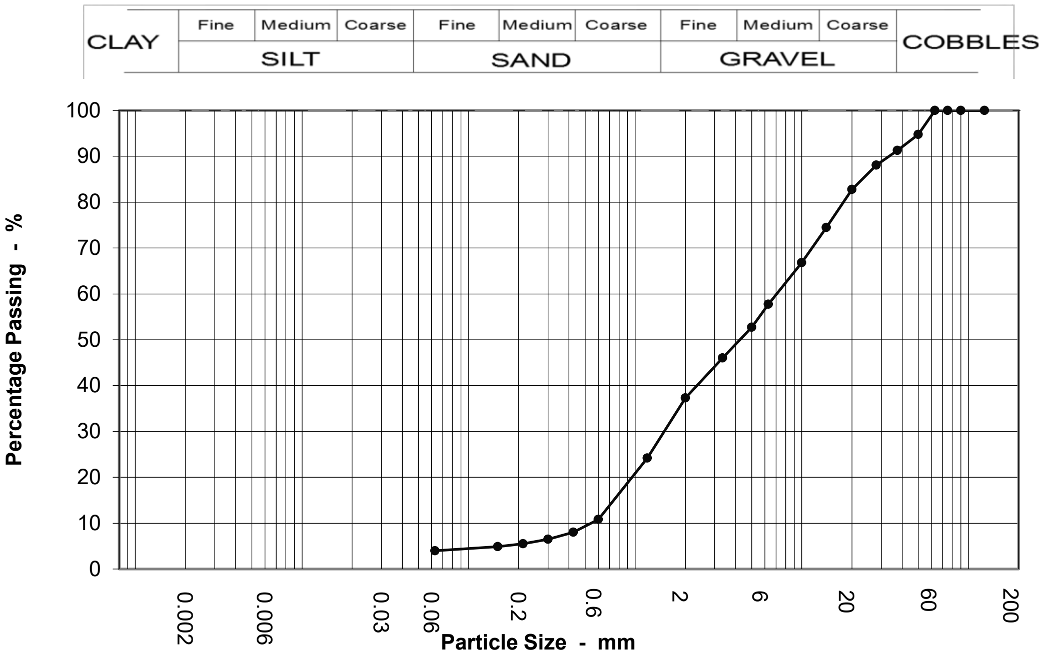
Sample Proportions	
Cobbles	16.0
Gravel	77.0
Sand	3.0
Silt & Clay	4.0

Grading Analysis	
D100	90.00
D60	24.10
D10	5.04
Uniformity Coefficient	4.80

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

Job Ref	**P22156**
Borehole / Pit No	BH01
Sample No	10
Depth	9.20 m
Sample type	B
Location	**N25 LI Pedestrian & Cycle Bridge**
Soil Description	Slightly silty very sandy GRAVEL



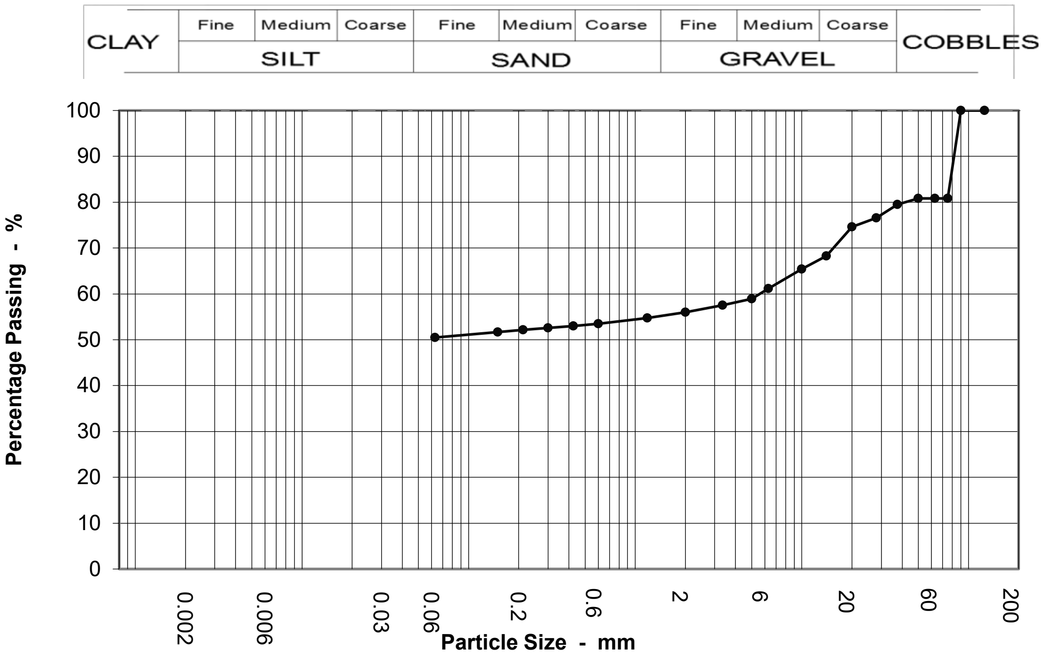
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	95		
37.5	91		
28	88		
20	83		
14	74		
10	67		
6.3	58		
5	53		
3.35	46		
2	37		
1.18	24		
0.6	11		
0.425	8		
0.3	6		
0.212	6		
0.15	5		
0.063	4		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	63.0
Sand	33.0
Silt & Clay	4.0

Grading Analysis	
D100	63.00
D60	7.07
D10	0.54
Uniformity Coefficient	13.00

pgl priority geotechnical	**PARTICLE SIZE DISTRIBUTION** **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P22156**
		Borehole / Pit No	BH02
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	1
		Depth	0.00 m
Soil Description	Slightly sandy slightly gravelly SILT with medium cobble content	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	81		
63	81		
50	81		
37.5	79		
28	77		
20	75		
14	68		
10	65		
6.3	61		
5	59		
3.35	58		
2	56		
1.18	55		
0.6	53		
0.425	53		
0.3	53		
0.212	52		
0.15	52		
0.063	50		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

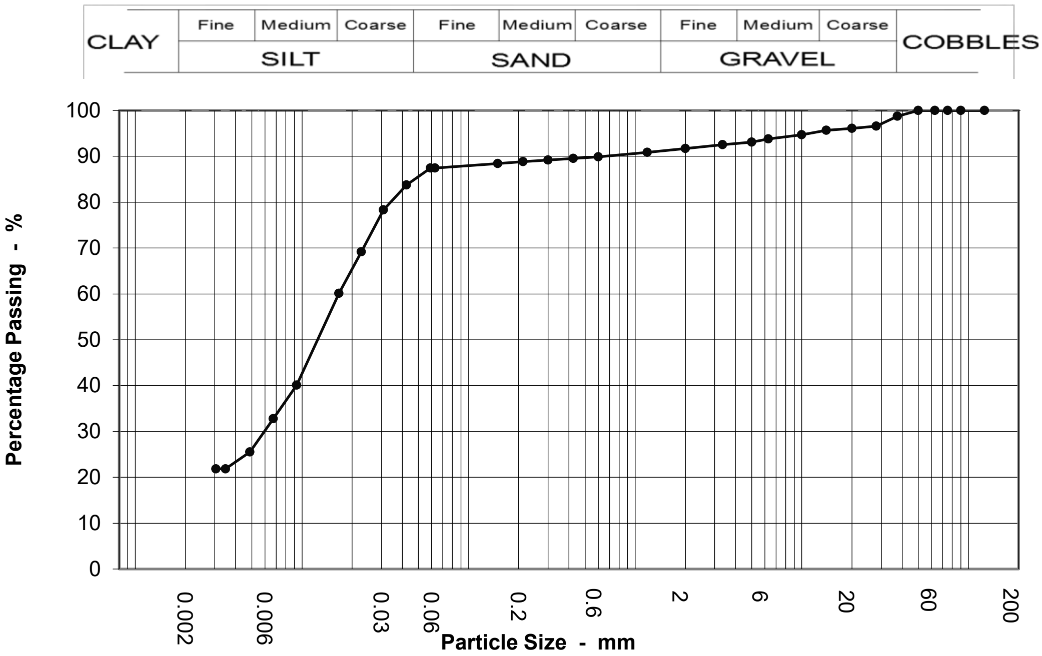
Sample Proportions	
Cobbles	19.0
Gravel	25.0
Sand	6.0
Silt & Clay	50.0

Grading Analysis	
D100	90.00
D60	5.58
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

Job Ref	**P22156**		
Borehole / Pit No	BH02		
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	2
		Depth	1.00 m
Soil Description	Slightly sandy slightly gravelly SILT	Sample type	B



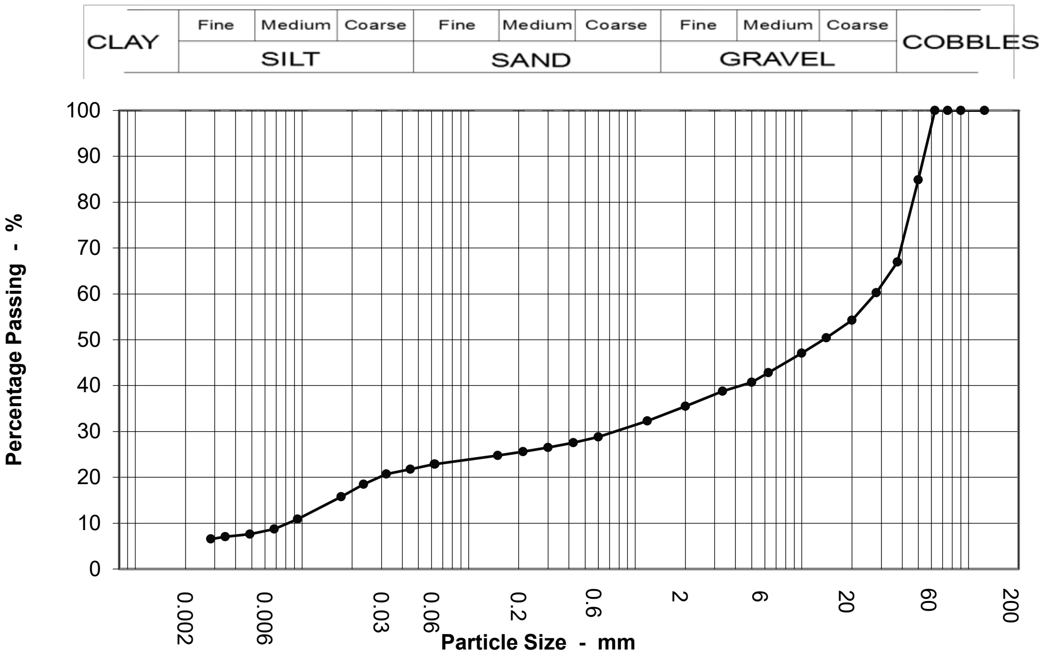
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.059	87
90	100	0.042	84
75	100	0.031	78
63	100	0.023	69
50	100	0.017	60
37.5	99	0.009	40
28	97	0.007	33
20	96	0.005	25
14	96	0.003	22
10	95	0.003	22
6.3	94	0.001	11
5	93		
3.35	93		
2	92		
1.18	91		
0.6	90		
0.425	90		
0.3	89		
0.212	89		
0.15	88		
0.063	87		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

Sample Proportions	
Cobbles	0.0
Gravel	8.0
Sand	4.0
Silt	69.0
Clay	19.0

Grading Analysis	
D100	50.00
D60	0.02
D10	
Uniformity Coefficient	

pgl priority geotechnical	**PARTICLE SIZE DISTRIBUTION** **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P22156**
		Borehole / Pit No	BH02
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	4
		Depth	3.00 m
Soil Description	Sandy very silty GRAVEL	Sample type	B



Sieving		**Sedimentation**	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.062	23
90	100	0.045	22
75	100	0.032	21
63	100	0.023	19
50	85	0.017	16
37.5	67	0.009	11
28	60	0.007	9
20	54	0.005	8
14	50	0.003	7
10	47	0.003	7
6.3	43	0.002	5
5	41		
3.35	39		
2	35		
1.18	32		
0.6	29		
0.425	28		
0.3	27		
0.212	26		
0.15	25		
0.063	23		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

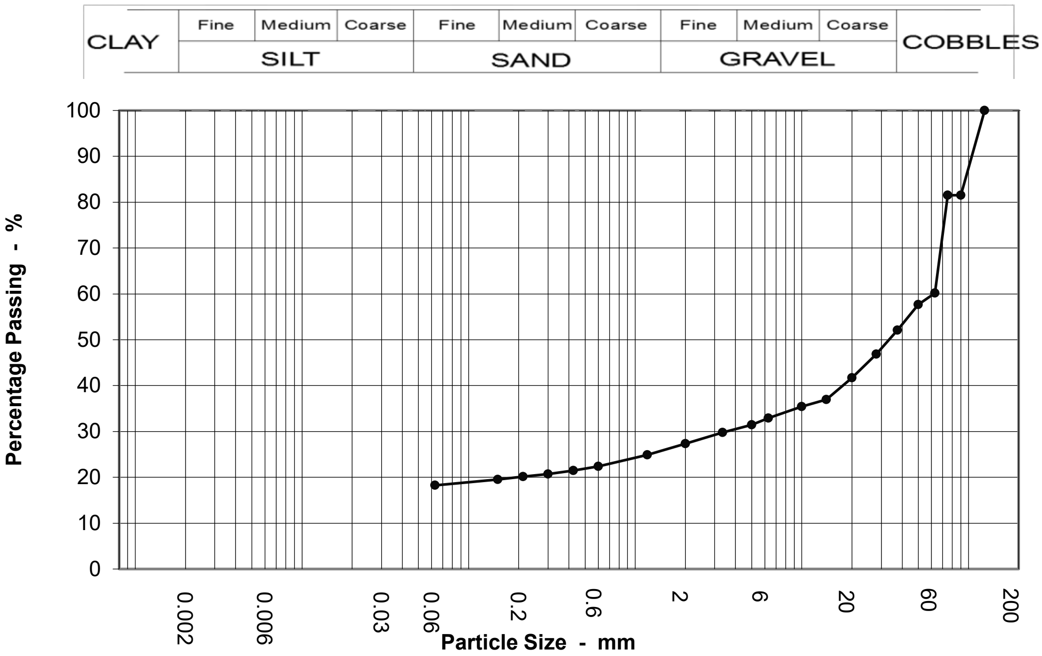
Sample Proportions	
Cobbles	0.0
Gravel	65.0
Sand	13.0
Silt	17.0
Clay	6.0

Grading Analysis	
D100	63.00
D60	27.60
D10	0.01
Uniformity Coefficient	3300.00

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

Location	**N25 LI Pedestrian & Cycle Bridge**	**Job Ref**	**P22156**
		Borehole / Pit No	BH02
		Sample No	5
Soil Description	Sandy very silty GRAVEL with high cobble content	Depth	4.00 m
		Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	82		
75	82		
63	60		
50	58		
37.5	52		
28	47		
20	42		
14	37		
10	35		
6.3	33		
5	31		
3.35	30		
2	27		
1.18	25		
0.6	22		
0.425	21		
0.3	21		
0.212	20		
0.15	19		
0.063	18		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

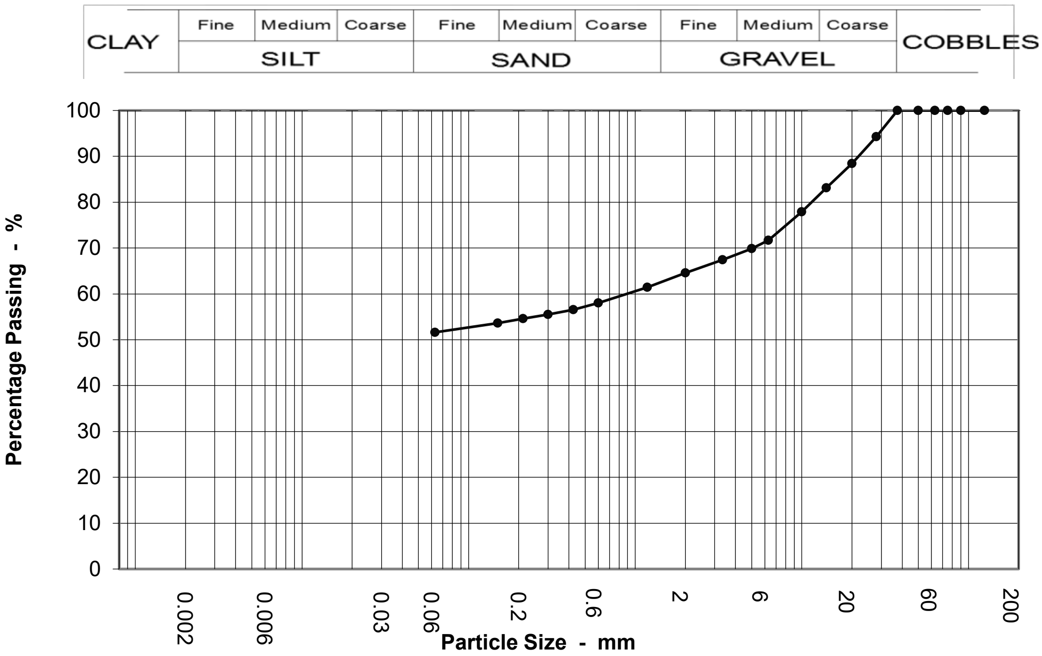
Sample Proportions	
Cobbles	40.0
Gravel	33.0
Sand	9.0
Silt & Clay	18.0

Grading Analysis	
D100	125.00
D60	61.80
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

Job Ref	**P22156**
Borehole / Pit No	BH02A
Sample No	2
Depth	1.00 m
Sample type	B
Location	**N25 LI Pedestrian & Cycle Bridge**
Soil Description	Slightly sandy gravelly SILT



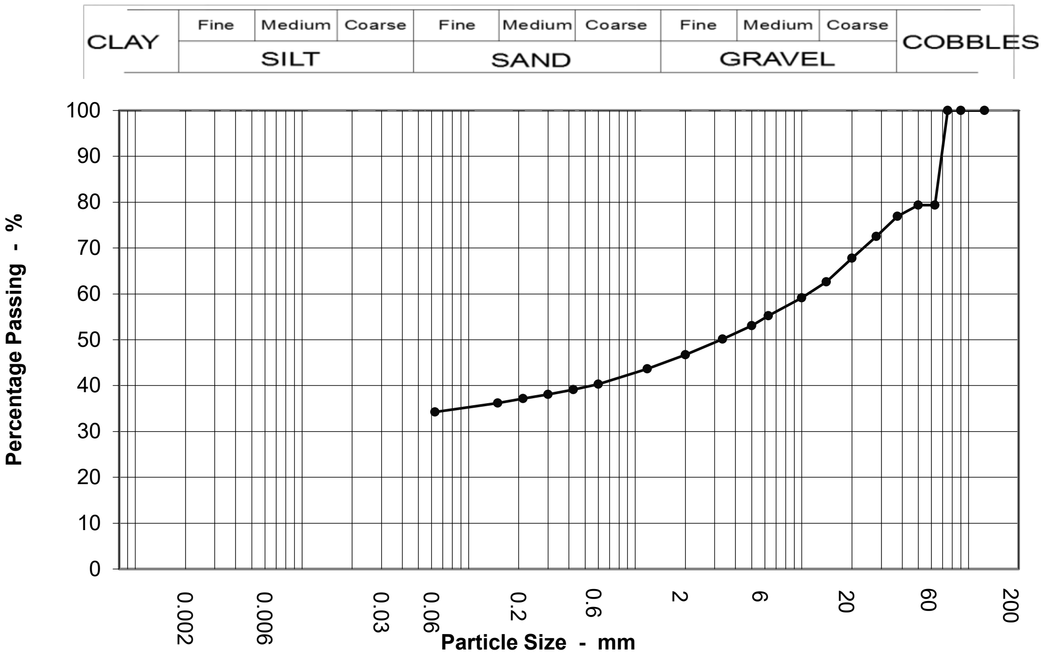
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	94		
20	88		
14	83		
10	78		
6.3	72		
5	70		
3.35	67		
2	65		
1.18	61		
0.6	58		
0.425	57		
0.3	56		
0.212	55		
0.15	54		
0.063	52		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	35.0
Sand	13.0
Silt & Clay	52.0

Grading Analysis	
D100	37.50
D60	0.89
D10	
Uniformity Coefficient	

priority geotechnical	# PARTICLE SIZE DISTRIBUTION **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P22156**
		Borehole / Pit No	BH02A
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	3
		Depth	2.00 m
Soil Description	Slightly sandy gravelly SILT with high cobble content	Sample type	B



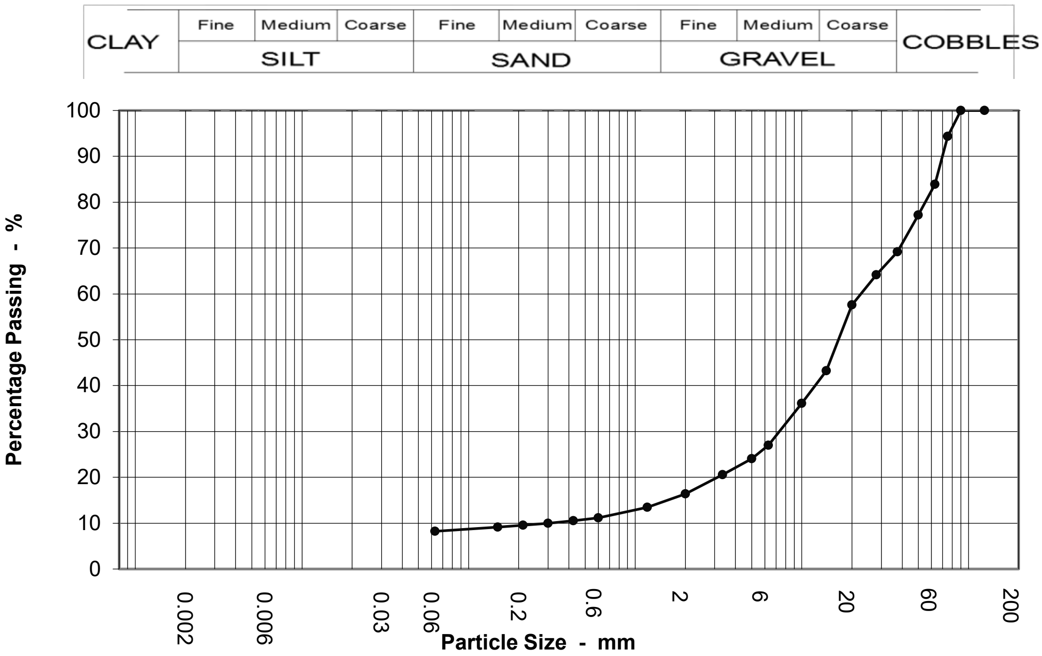
Sieving		**Sedimentation**	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	79		
50	79		
37.5	77		
28	73		
20	68		
14	63		
10	59		
6.3	55		
5	53		
3.35	50		
2	47		
1.18	44		
0.6	40		
0.425	39		
0.3	38		
0.212	37		
0.15	36		
0.063	34		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	21.0
Gravel	33.0
Sand	12.0
Silt & Clay	34.0

Grading Analysis	
D100	75.00
D60	10.90
D10	
Uniformity Coefficient	

pgl priority geotechnical	**PARTICLE SIZE DISTRIBUTION** **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P22156**
		Borehole / Pit No	BH02A
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	4
		Depth	3.00 m
Soil Description	Silty sandy GRAVEL with medium cobble content	Sample type	B



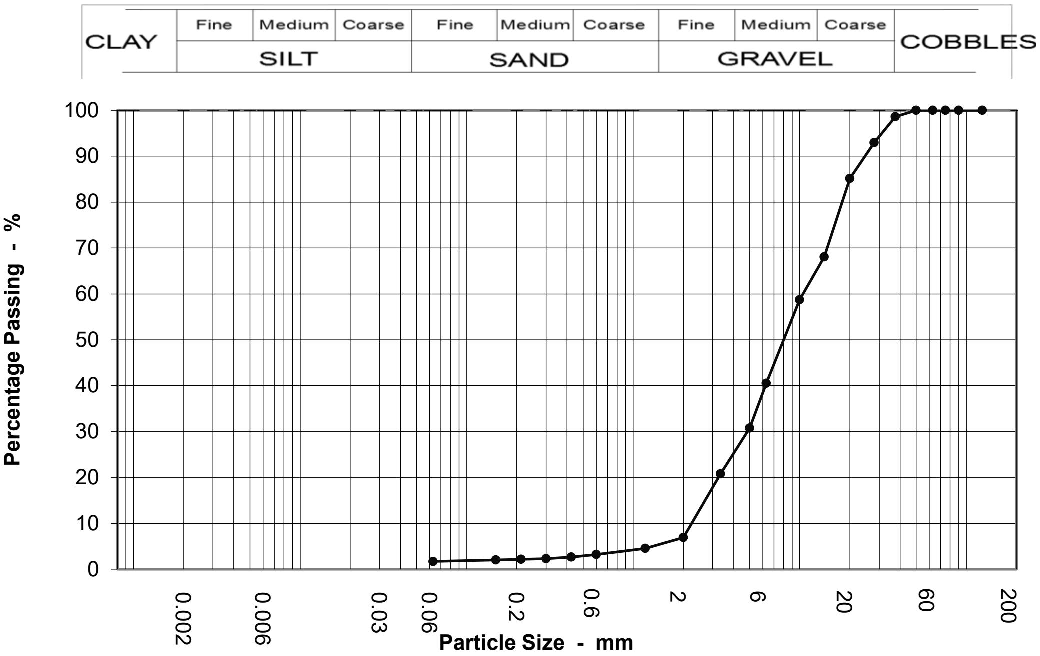
Sieving		**Sedimentation**	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	94		
63	84		
50	77		
37.5	69		
28	64		
20	58		
14	43		
10	36		
6.3	27		
5	24		
3.35	21		
2	16		
1.18	13		
0.6	11		
0.425	11		
0.3	10		
0.212	10		
0.15	9		
0.063	8		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	16.0
Gravel	67.0
Sand	8.0
Silt & Clay	8.0

Grading Analysis	
D100	90.00
D60	22.60
D10	0.30
Uniformity Coefficient	75.00

PARTICLE SIZE DISTRIBUTION **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P22156**
	Borehole / Pit No	BH02A
Location: **N25 LI Pedestrian & Cycle Bridge**	Sample No	6
	Depth	5.00 m
Soil Description: Slightly silty slightly sandy GRAVEL	Sample type	B



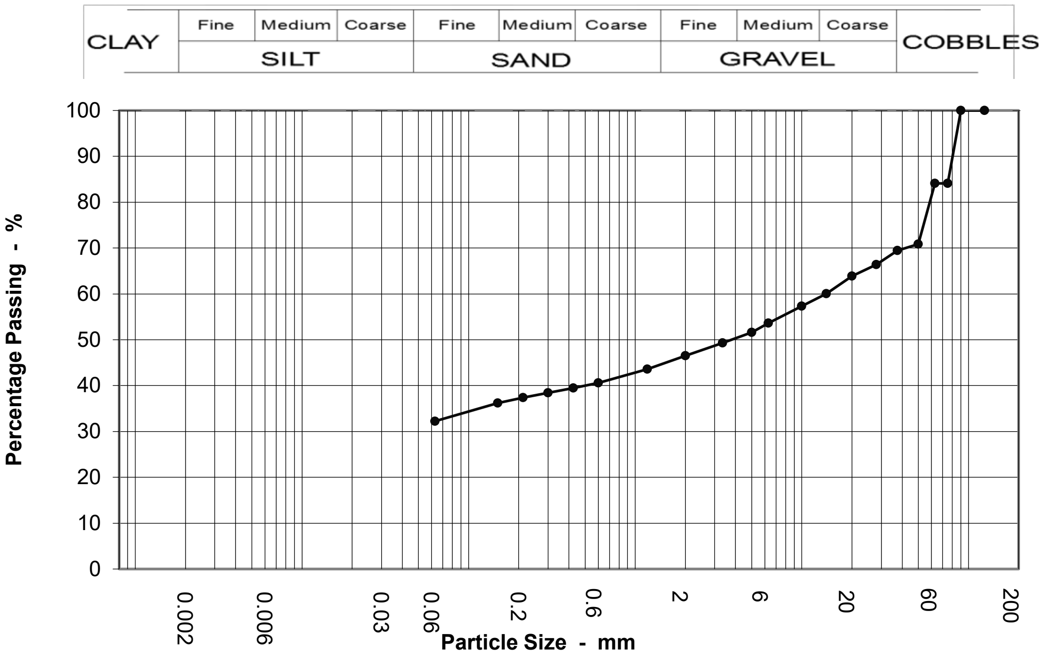
Sieving		**Sedimentation**	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	99		
28	93		
20	85		
14	68		
10	59		
6.3	41		
5	31		
3.35	21		
2	7		
1.18	5		
0.6	3		
0.425	3		
0.3	2		
0.212	2		
0.15	2		
0.063	2		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	93.0
Sand	5.0
Silt & Clay	2.0

Grading Analysis	
D100	50.00
D60	10.50
D10	2.25
Uniformity Coefficient	4.70

	# PARTICLE SIZE DISTRIBUTION **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P22156**
		Borehole / Pit No	BH03
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	1
		Depth	0.00 m
Soil Description	Slightly sandy gravelly CLAY with medium cobble content	Sample type	B



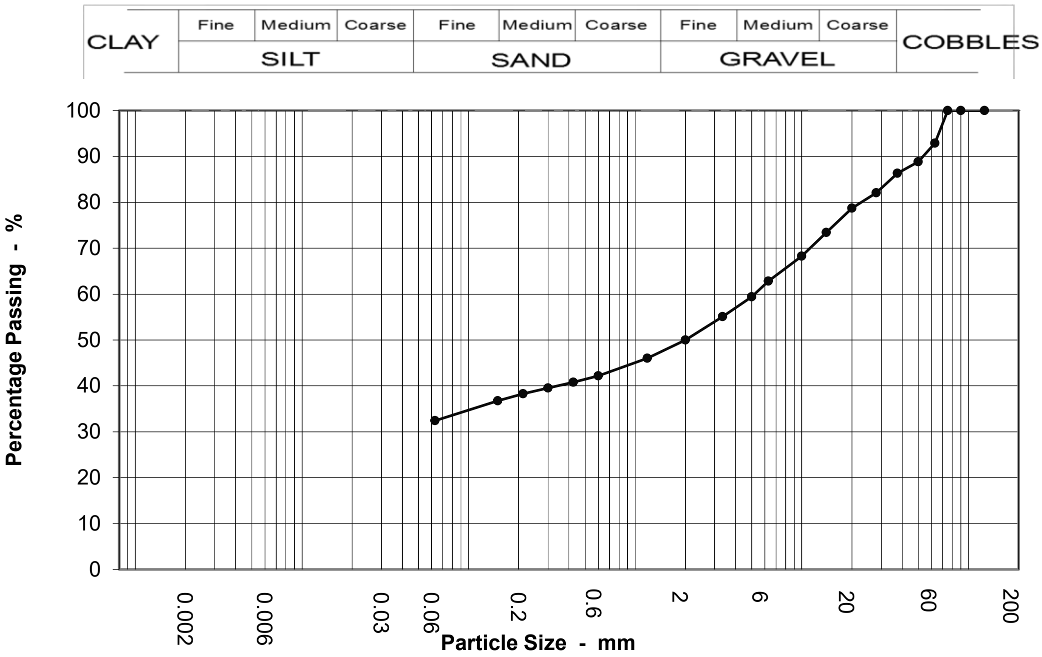
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	84		
63	84		
50	71		
37.5	69		
28	66		
20	64		
14	60		
10	57		
6.3	54		
5	52		
3.35	49		
2	47		
1.18	44		
0.6	41		
0.425	39		
0.3	38		
0.212	37		
0.15	36		
0.063	32		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	16.0
Gravel	38.0
Sand	14.0
Silt & Clay	32.0

Grading Analysis	
D100	90.00
D60	13.90
D10	
Uniformity Coefficient	

pgl priority geotechnical	**PARTICLE SIZE DISTRIBUTION** **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P22156**
		Borehole / Pit No	BH03
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	2
		Depth	1.00 m
Soil Description	Slightly sandy gravelly CLAY with low cobble content	Sample type	B



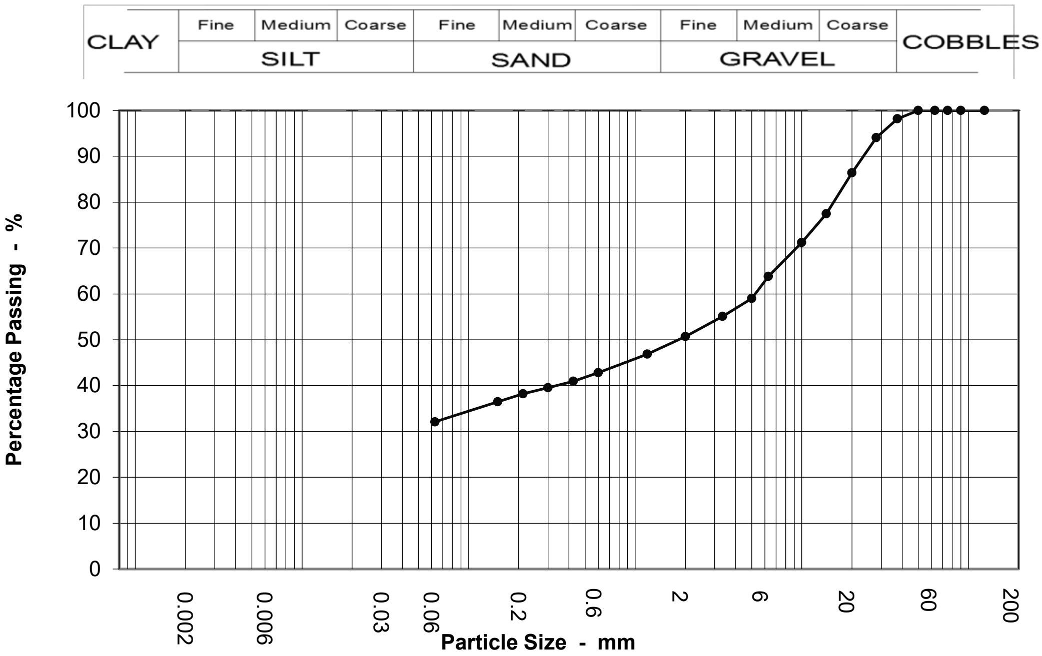
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	93		
50	89		
37.5	86		
28	82		
20	79		
14	73		
10	68		
6.3	63		
5	59		
3.35	55		
2	50		
1.18	46		
0.6	42		
0.425	41		
0.3	40		
0.212	38		
0.15	37		
0.063	32		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	7.0
Gravel	43.0
Sand	18.0
Silt & Clay	32.0

Grading Analysis	
D100	75.00
D60	5.20
D10	
Uniformity Coefficient	

	PARTICLE SIZE DISTRIBUTION **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P22156**
		Borehole / Pit No	BH03
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	3
		Depth	2.00 m
Soil Description	Sandy very clayey GRAVEL	Sample type	B



Sieving		**Sedimentation**	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	98		
28	94		
20	86		
14	77		
10	71		
6.3	64		
5	59		
3.35	55		
2	51		
1.18	47		
0.6	43		
0.425	41		
0.3	40		
0.212	38		
0.15	36		
0.063	32		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

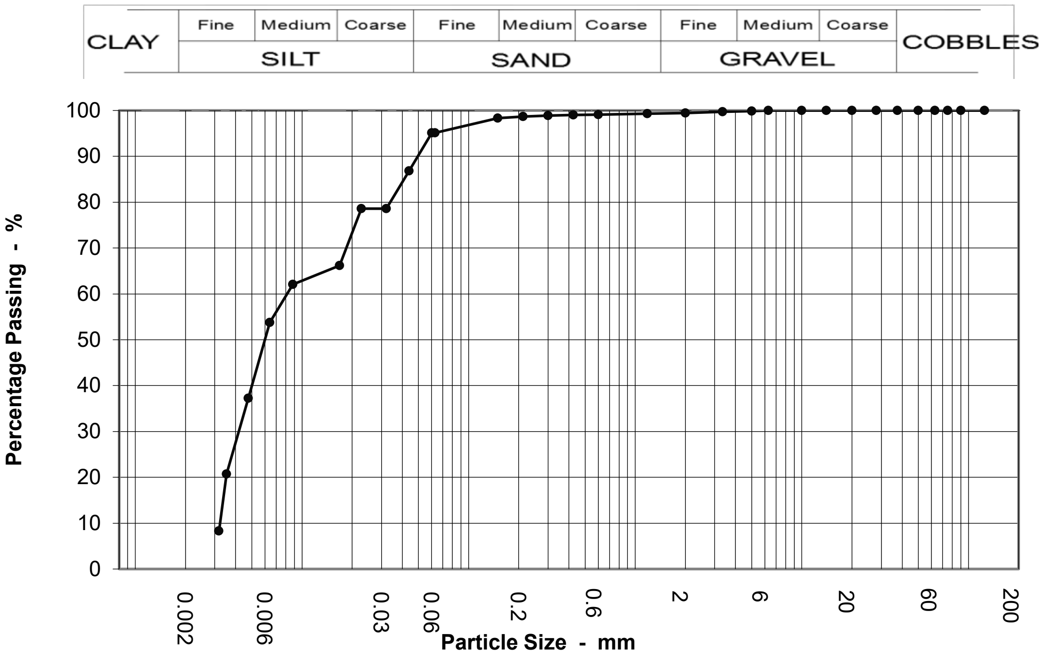
Sample Proportions	
Cobbles	0.0
Gravel	49.0
Sand	19.0
Silt & Clay	32.0

Grading Analysis	
D100	50.00
D60	5.25
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P22156**
		Borehole / Pit No	BH03
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	4
		Depth	3.00 m
Soil Description	Slightly gravelly slightly sandy CLAY	Sample type	B



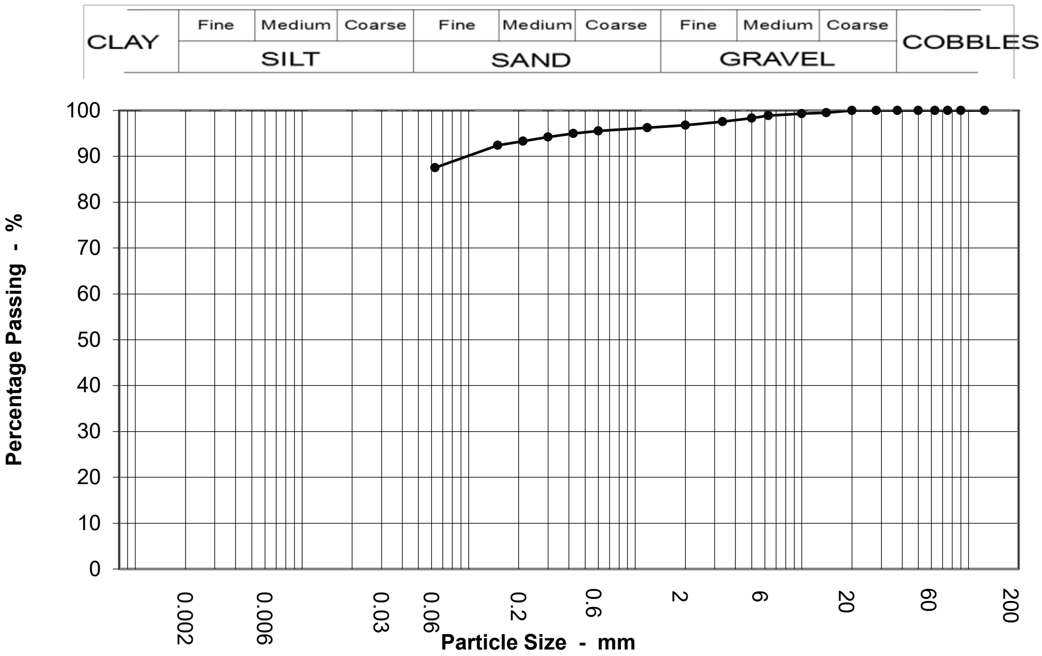
Sieving		**Sedimentation**	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.060	95
90	100	0.044	87
75	100	0.032	79
63	100	0.023	79
50	100	0.017	66
37.5	100	0.009	62
28	100	0.006	54
20	100	0.005	37
14	100	0.004	21
10	100	0.003	8
6.3	100	0.001	8
5	100		
3.35	100		
2	99		
1.18	99		
0.6	99		
0.425	99		
0.3	99		
0.212	99		
0.15	98		
0.063	95		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

Sample Proportions	
Cobbles	0.0
Gravel	1.0
Sand	4.0
Silt	87.0
Clay	8.0

Grading Analysis	
D100	10.00
D60	0.01
D10	0.00
Uniformity Coefficient	2.50

pgl priority geotechnical	**PARTICLE SIZE DISTRIBUTION** **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P22156**
		Borehole / Pit No	BH03
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	6
		Depth	5.00 m
Soil Description	Slightly gravelly slightly sandy SILT	Sample type	B



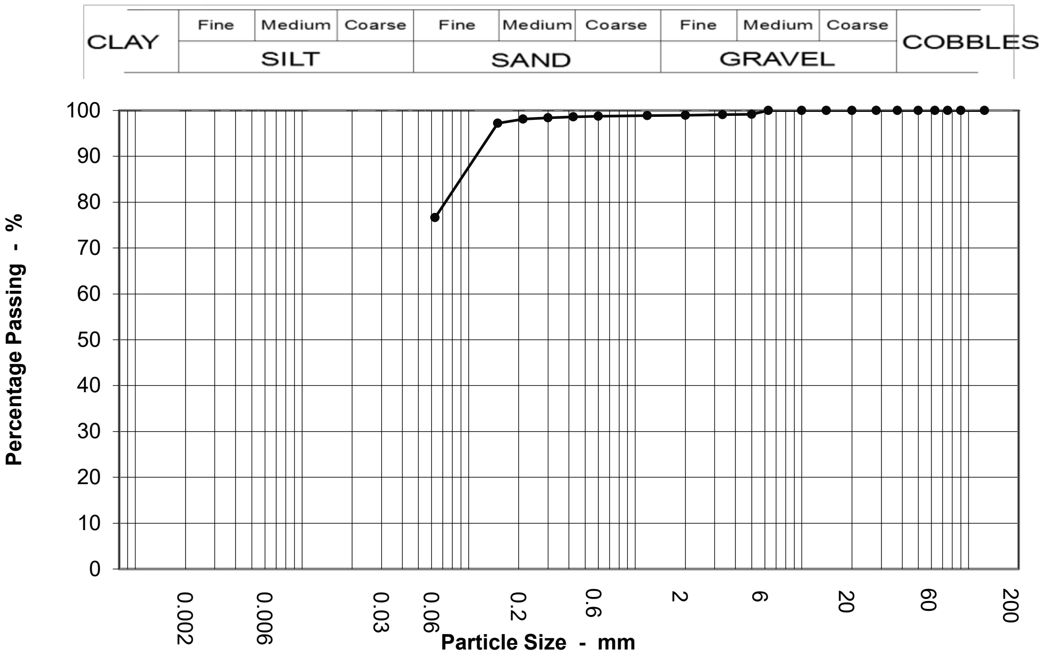
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	99		
10	99		
6.3	99		
5	98		
3.35	98		
2	97		
1.18	96		
0.6	96		
0.425	95		
0.3	94		
0.212	93		
0.15	92		
0.063	88		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	3.0
Sand	9.0
Silt & Clay	88.0

Grading Analysis	
D100	20.00
D60	
D10	
Uniformity Coefficient	

pgl priority geotechnical	# PARTICLE SIZE DISTRIBUTION **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P22156**
		Borehole / Pit No	BH03
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	8
		Depth	7.00 m
Soil Description	Slightly gravelly slightly sandy SILT	Sample type	B



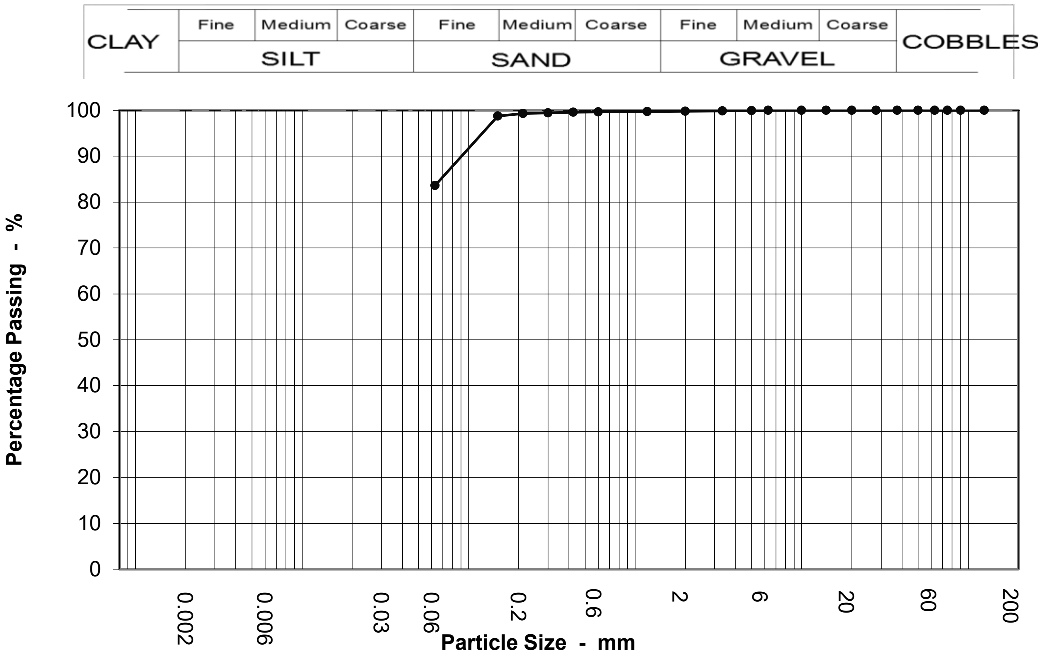
Sieving		**Sedimentation**	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	99		
3.35	99		
2	99		
1.18	99		
0.6	99		
0.425	99		
0.3	98		
0.212	98		
0.15	97		
0.063	77		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	1.0
Sand	22.0
Silt & Clay	77.0

Grading Analysis	
D100	6.30
D60	
D10	
Uniformity Coefficient	

pgl priority geotechnical	**PARTICLE SIZE DISTRIBUTION** **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P22156**
		Borehole / Pit No	BH03
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	10
		Depth	9.00 m
Soil Description	Slightly sandy SILT	Sample type	B



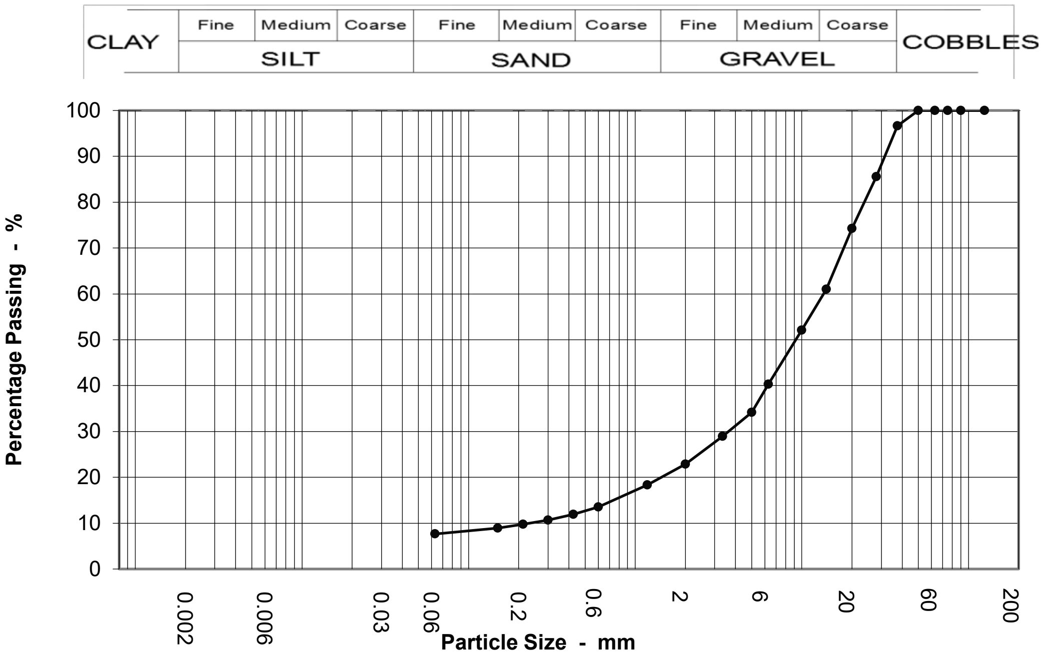
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	99		
0.212	99		
0.15	99		
0.063	84		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	16.0
Silt & Clay	84.0

Grading Analysis	
D100	6.30
D60	
D10	
Uniformity Coefficient	

priority geotechnical	**PARTICLE SIZE DISTRIBUTION** **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P22156**
		Borehole / Pit No	BH08
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	1
		Depth	0.00 m
Soil Description	Slightly silty sandy GRAVEL	Sample type	B



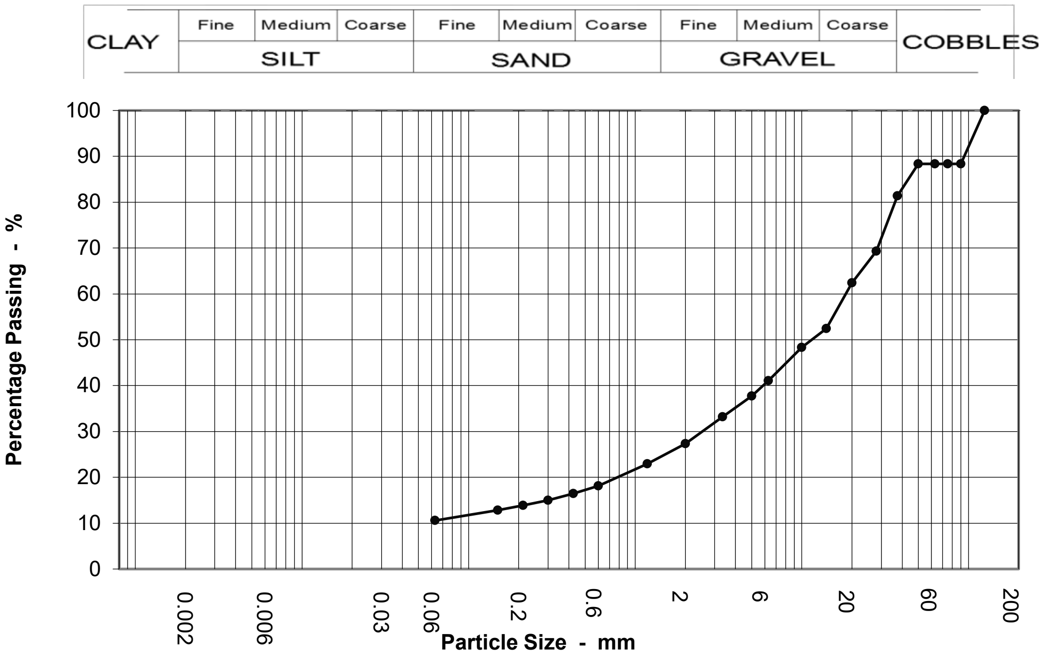
Sieving		**Sedimentation**	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	97		
28	86		
20	74		
14	61		
10	52		
6.3	40		
5	34		
3.35	29		
2	23		
1.18	18		
0.6	14		
0.425	12		
0.3	11		
0.212	10		
0.15	9		
0.063	8		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	77.0
Sand	15.0
Silt & Clay	8.0

Grading Analysis	
D100	50.00
D60	13.50
D10	0.23
Uniformity Coefficient	58.00

pgl priority geotechnical	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Job Ref	P22156
		Borehole / Pit No	BH08
Location	N25 LI Pedestrian & Cycle Bridge	Sample No	2
		Depth	1.20 m
Soil Description	Silty sandy GRAVEL with medium cobble content	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	88		
75	88		
63	88		
50	88		
37.5	81		
28	69		
20	62		
14	52		
10	48		
6.3	41		
5	38		
3.35	33		
2	27		
1.18	23		
0.6	18		
0.425	16		
0.3	15		
0.212	14		
0.15	13		
0.063	11		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

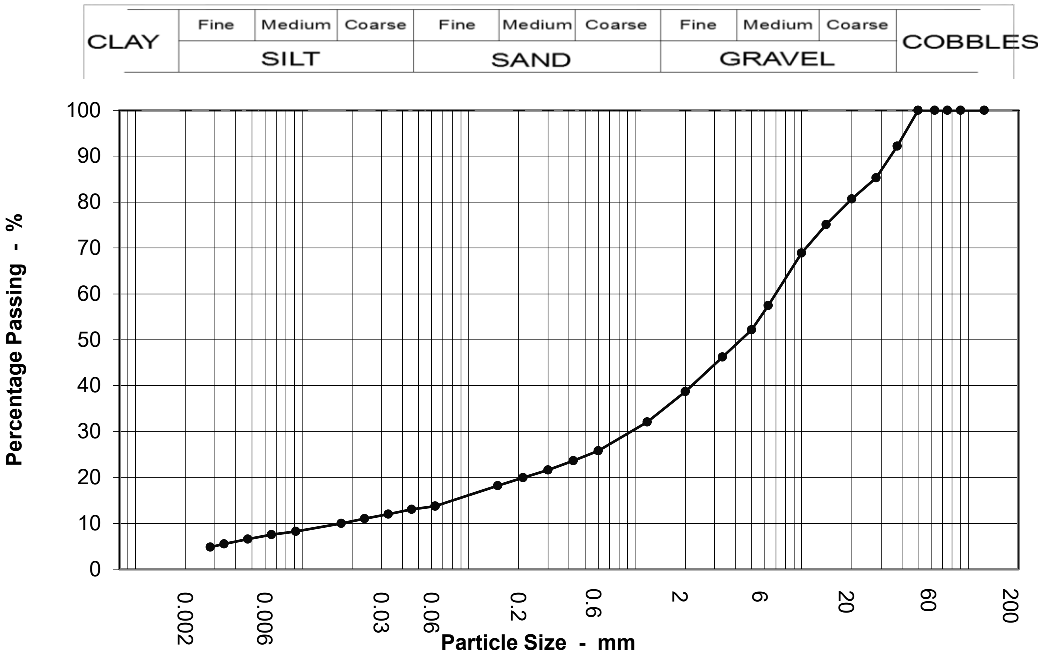
Sample Proportions	
Cobbles	12.0
Gravel	61.0
Sand	17.0
Silt & Clay	11.0

Grading Analysis	
D100	125.00
D60	18.30
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P22156**
		Borehole / Pit No	BH08
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	3
		Depth	2.20 m
Soil Description	Silty very sandy GRAVEL	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.063	14
90	100	0.045	13
75	100	0.033	12
63	100	0.024	11
50	100	0.017	10
37.5	92	0.009	8
28	85	0.007	8
20	81	0.005	7
14	75	0.003	5
10	69	0.003	5
6.3	57	0.001	4
5	52		
3.35	46		
2	39		
1.18	32		
0.6	26		
0.425	24		
0.3	22		
0.212	20		
0.15	18		
0.063	14		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

Sample Proportions	
Cobbles	0.0
Gravel	61.0
Sand	25.0
Silt	9.0
Clay	4.0

Grading Analysis	
D100	50.00
D60	6.99
D10	0.02
Uniformity Coefficient	400.00

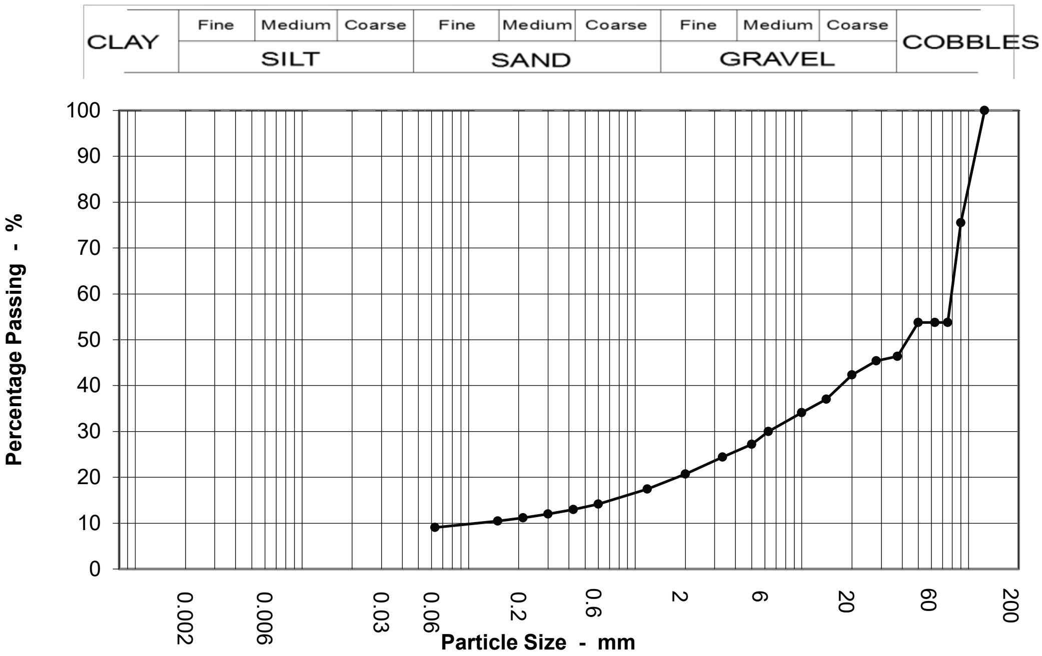
pgl priority geotechnical

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

Job Ref	**P22156**
Borehole / Pit No	BH08
Sample No	4
Depth	3.20 m
Sample type	B

Location	**N25 LI Pedestrian & Cycle Bridge**
Soil Description	Silty very sandy GRAVEL with high cobble content



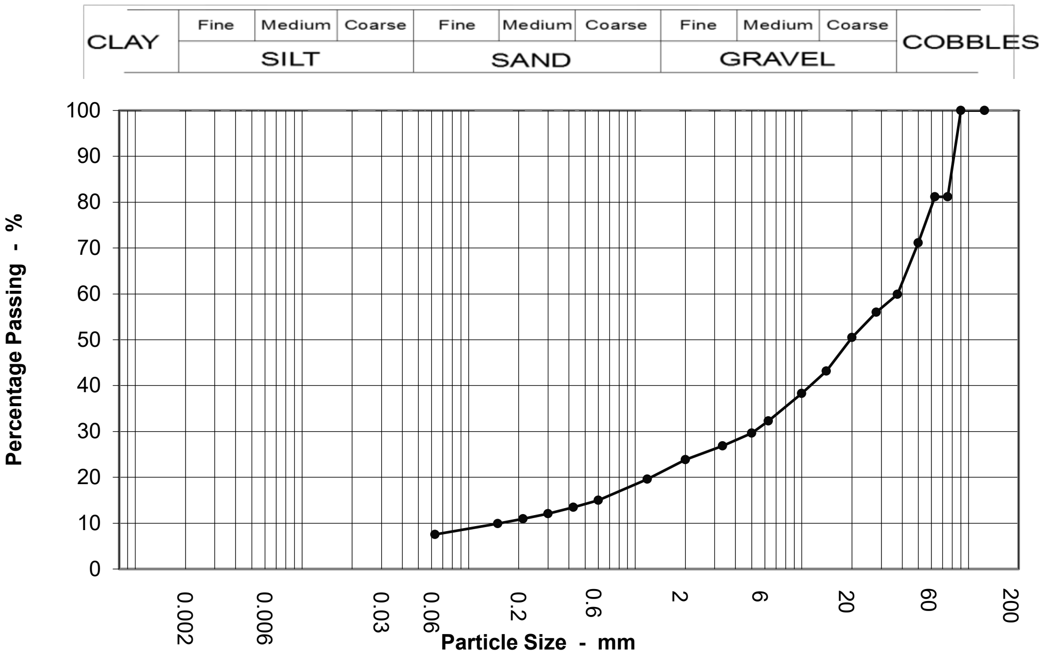
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	76		
75	54		
63	54		
50	54		
37.5	46		
28	45		
20	42		
14	37		
10	34		
6.3	30		
5	27		
3.35	24		
2	21		
1.18	17		
0.6	14		
0.425	13		
0.3	12		
0.212	11		
0.15	10		
0.063	9		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	46.0
Gravel	33.0
Sand	12.0
Silt & Clay	9.0

Grading Analysis	
D100	125.00
D60	79.00
D10	0.11
Uniformity Coefficient	710.00

pgl priority geotechnical	**PARTICLE SIZE DISTRIBUTION** **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P22156**
		Borehole / Pit No	BH08
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	5
		Depth	4.20 m
Soil Description	Silty very sandy GRAVEL with medium cobble content	Sample type	B



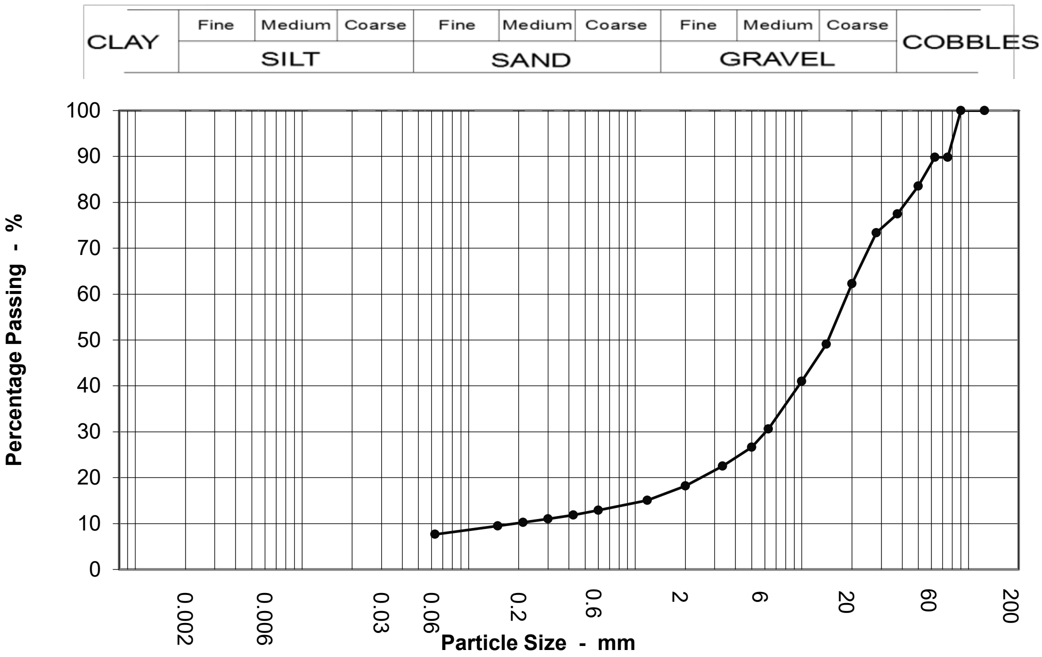
Sieving		**Sedimentation**	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	81		
63	81		
50	71		
37.5	60		
28	56		
20	50		
14	43		
10	38		
6.3	32		
5	30		
3.35	27		
2	24		
1.18	20		
0.6	15		
0.425	13		
0.3	12		
0.212	11		
0.15	10		
0.063	8		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	19.0
Gravel	57.0
Sand	16.0
Silt & Clay	8.0

Grading Analysis	
D100	90.00
D60	37.60
D10	0.16
Uniformity Coefficient	240.00

pgl priority geotechnical	**PARTICLE SIZE DISTRIBUTION** **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P22156**
		Borehole / Pit No	BH09
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	1
		Depth	0.00 m
Soil Description	Slightly silty sandy GRAVEL with medium cobble content	Sample type	B



Sieving		**Sedimentation**	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	90		
63	90		
50	84		
37.5	77		
28	73		
20	62		
14	49		
10	41		
6.3	31		
5	27		
3.35	23		
2	18		
1.18	15		
0.6	13		
0.425	12		
0.3	11		
0.212	10		
0.15	9		
0.063	8		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	10.0
Gravel	72.0
Sand	11.0
Silt & Clay	8.0

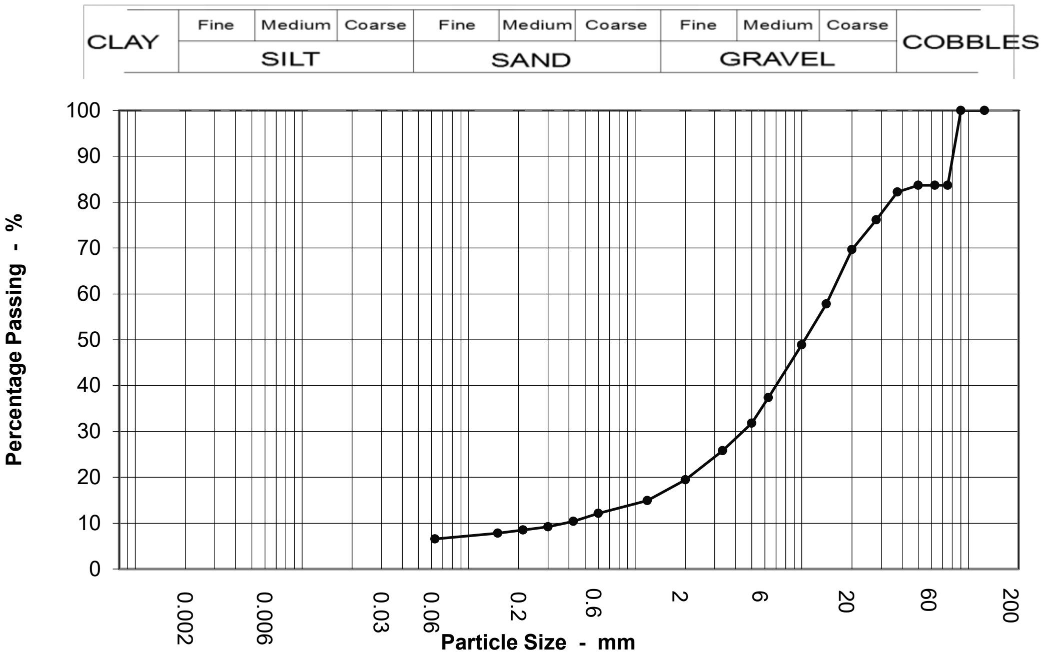
Grading Analysis	
D100	90.00
D60	18.80
D10	0.19
Uniformity Coefficient	99.00

pgl priority geotechnical

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

Job Ref	**P22156**		
Borehole / Pit No	BH09		
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	2
		Depth	1.20 m
Soil Description	Slightly silty sandy GRAVEL with medium cobble content	Sample type	B



Sieving		**Sedimentation**	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	84		
63	84		
50	84		
37.5	82		
28	76		
20	70		
14	58		
10	49		
6.3	37		
5	32		
3.35	26		
2	19		
1.18	15		
0.6	12		
0.425	10		
0.3	9		
0.212	9		
0.15	8		
0.063	7		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

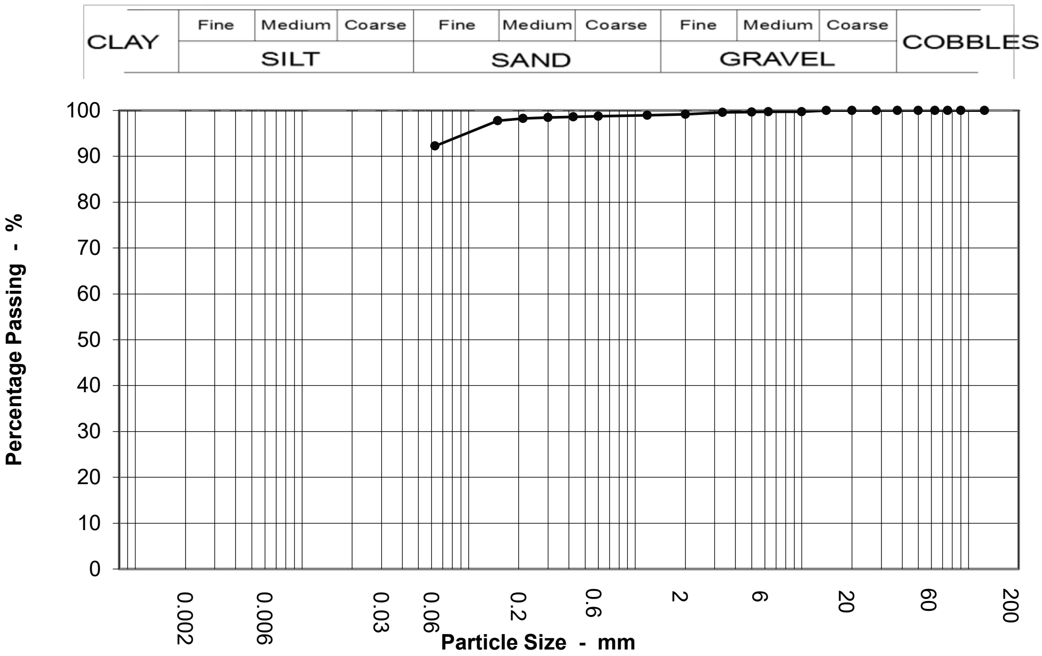
Sample Proportions	
Cobbles	16.0
Gravel	64.0
Sand	13.0
Silt & Clay	7.0

Grading Analysis	
D100	90.00
D60	15.00
D10	0.38
Uniformity Coefficient	39.00

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

Job Ref	**P22156**	Borehole / Pit No	BH10
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	2
		Depth	1.20 m
Soil Description	Slightly gravelly slightly sandy SILT	Sample type	B



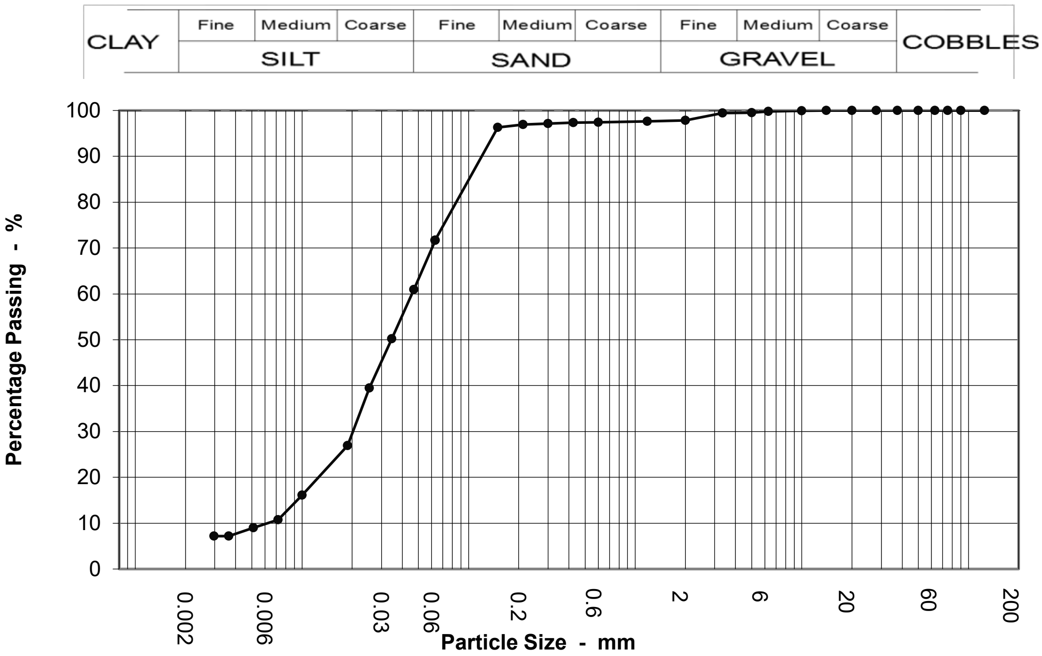
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	99		
0.6	99		
0.425	99		
0.3	98		
0.212	98		
0.15	98		
0.063	92		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	1.0
Sand	7.0
Silt & Clay	92.0

Grading Analysis	
D100	14.00
D60	
D10	
Uniformity Coefficient	

pgl priority geotechnical	**PARTICLE SIZE DISTRIBUTION** **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P22156**
		Borehole / Pit No	BH10
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	3
		Depth	2.20 m
Soil Description	Slightly gravelly slightly sandy SILT	Sample type	B



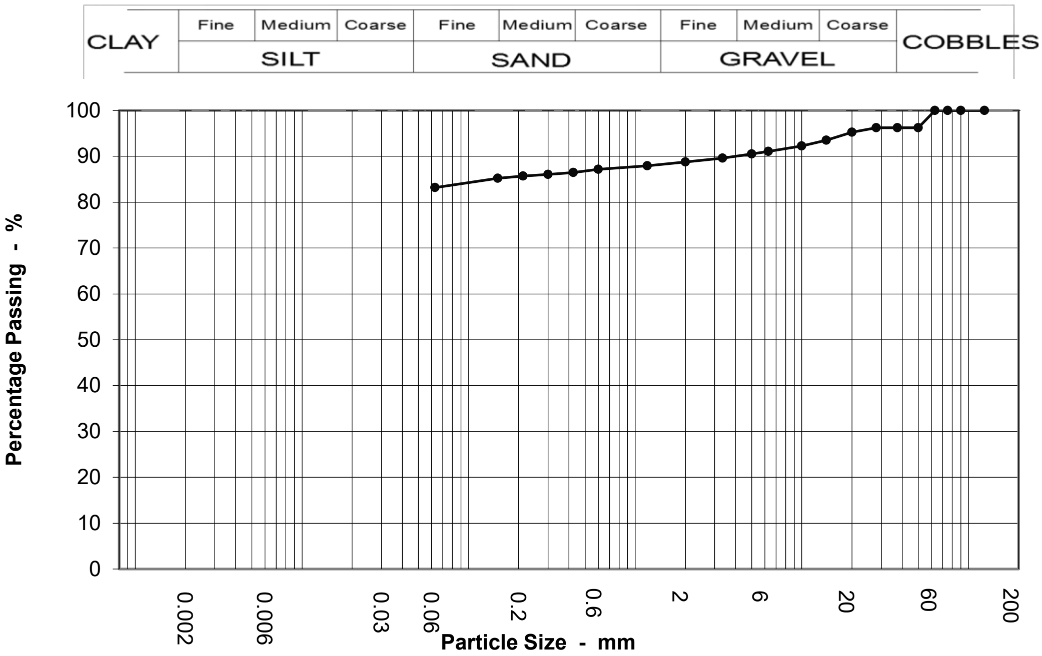
Sieving		**Sedimentation**	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.063	72
90	100	0.047	61
75	100	0.035	50
63	100	0.025	39
50	100	0.019	27
37.5	100	0.010	16
28	100	0.007	11
20	100	0.005	9
14	100	0.004	7
10	100	0.003	7
6.3	100	0.002	5
5	100		
3.35	99		
2	98		
1.18	98		
0.6	97		
0.425	97		
0.3	97		
0.212	97		
0.15	96		
0.063	72		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	Clause 9.5

Sample Proportions	
Cobbles	0.0
Gravel	2.0
Sand	26.0
Silt	66.0
Clay	6.0

Grading Analysis	
D100	14.00
D60	0.05
D10	0.01
Uniformity Coefficient	7.30

pgl priority geotechnical	**PARTICLE SIZE DISTRIBUTION** **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P22156**
		Borehole / Pit No	BH10
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	5
		Depth	4.20 m
Soil Description	Slightly sandy slightly gravelly SILT	Sample type	B



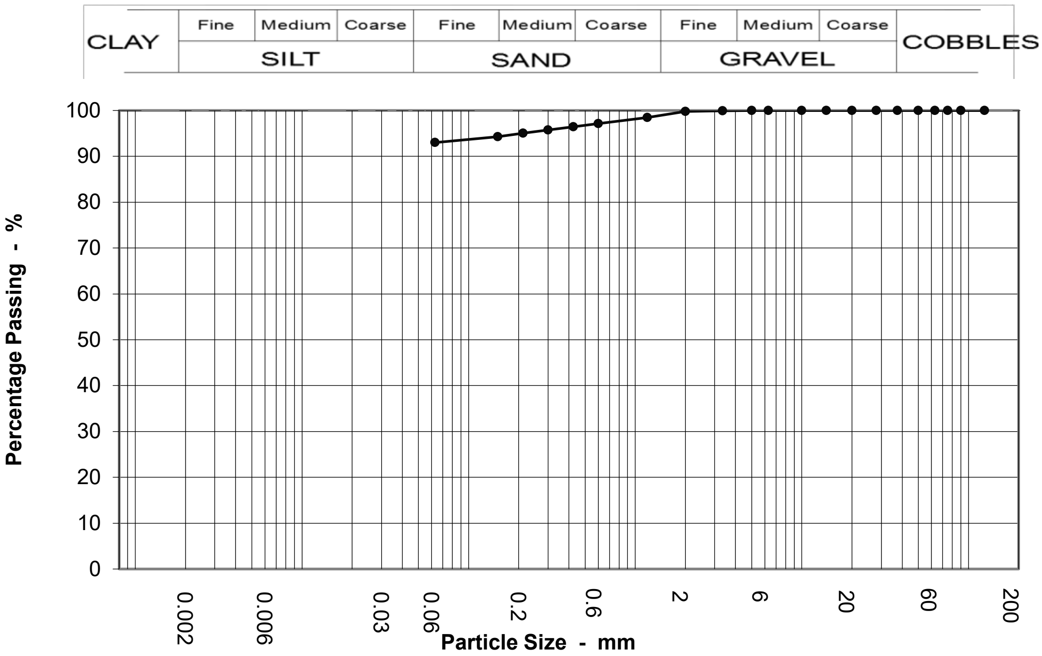
Sieving		**Sedimentation**	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	96		
37.5	96		
28	96		
20	95		
14	94		
10	92		
6.3	91		
5	90		
3.35	90		
2	89		
1.18	88		
0.6	87		
0.425	86		
0.3	86		
0.212	86		
0.15	85		
0.063	83		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	11.0
Sand	6.0
Silt & Clay	83.0

Grading Analysis	
D100	63.00
D60	
D10	
Uniformity Coefficient	

pgl priority geotechnical	# PARTICLE SIZE DISTRIBUTION **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P22156**
		Borehole / Pit No	BH10
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	6
		Depth	5.20 m
Soil Description	Slightly sandy SILT	Sample type	B



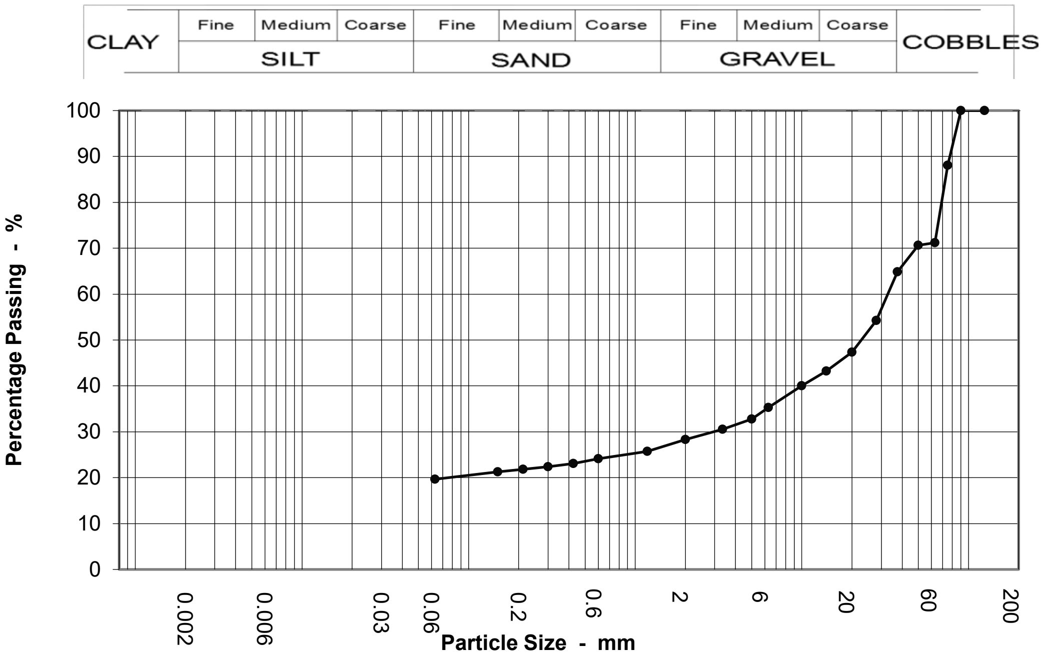
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	98		
0.6	97		
0.425	96		
0.3	96		
0.212	95		
0.15	94		
0.063	93		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	7.0
Silt & Clay	93.0

Grading Analysis	
D100	5.00
D60	
D10	
Uniformity Coefficient	

pgl priority geotechnical	# PARTICLE SIZE DISTRIBUTION **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P22156**
		Borehole / Pit No	BH10
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	7
		Depth	6.20 m
Soil Description	Sandy very silty GRAVEL with high cobble content	Sample type	B



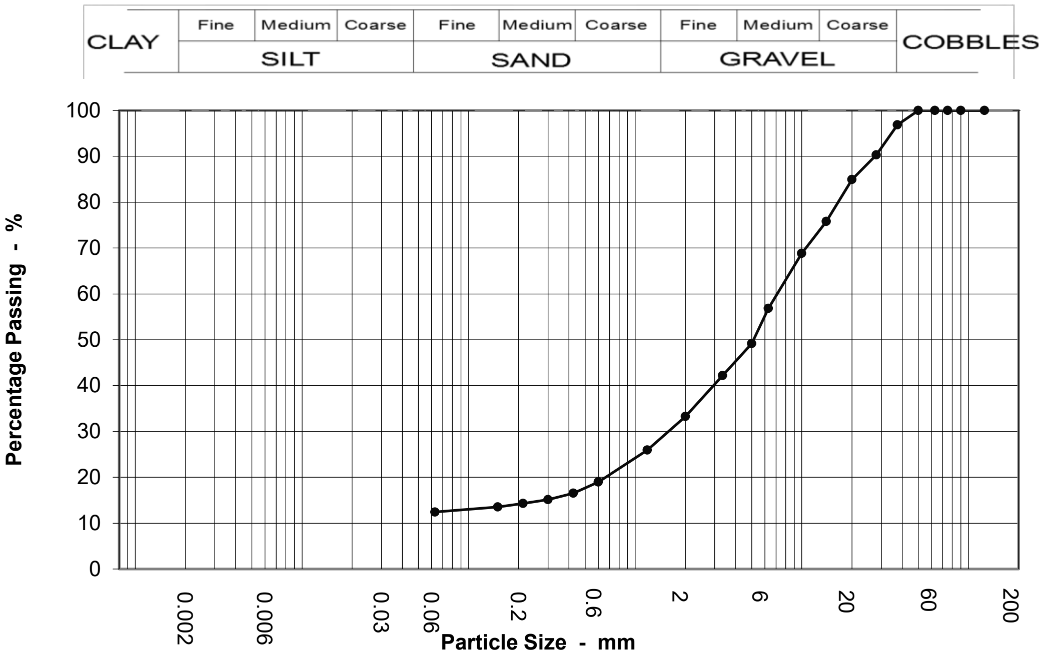
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	88		
63	71		
50	71		
37.5	65		
28	54		
20	47		
14	43		
10	40		
6.3	35		
5	33		
3.35	31		
2	28		
1.18	26		
0.6	24		
0.425	23		
0.3	22		
0.212	22		
0.15	21		
0.063	20		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	29.0
Gravel	43.0
Sand	9.0
Silt & Clay	20.0

Grading Analysis	
D100	90.00
D60	32.80
D10	
Uniformity Coefficient	

pgl priority geotechnical	**PARTICLE SIZE DISTRIBUTION** **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P22156**
		Borehole / Pit No	BH10
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	9
		Depth	8.00 m
Soil Description	Silty very sandy GRAVEL	Sample type	B



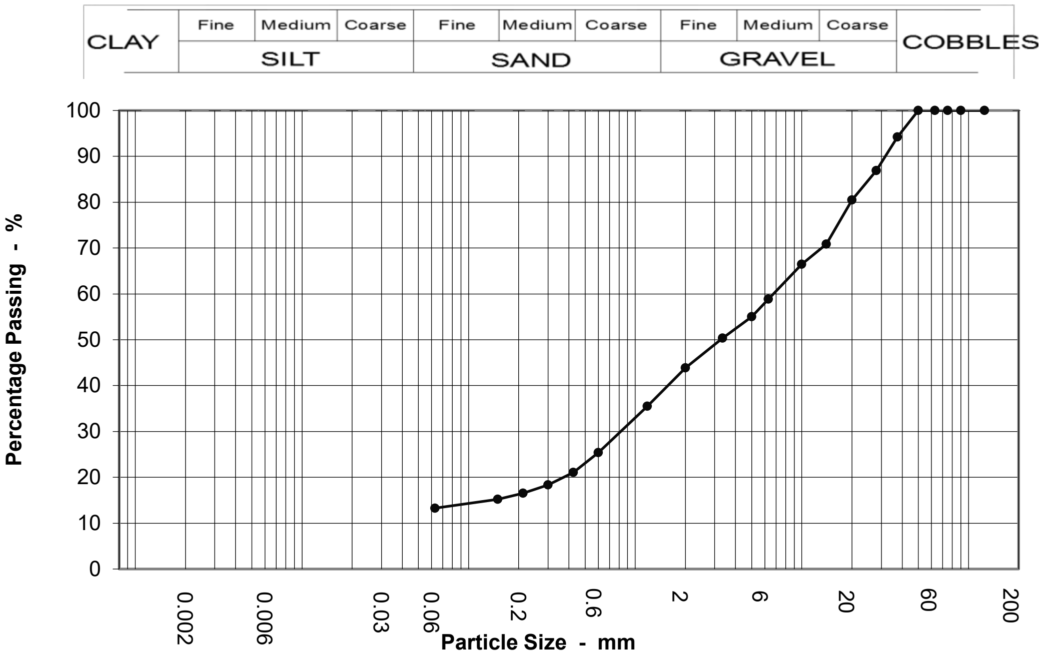
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	97		
28	90		
20	85		
14	76		
10	69		
6.3	57		
5	49		
3.35	42		
2	33		
1.18	26		
0.6	19		
0.425	17		
0.3	15		
0.212	14		
0.15	14		
0.063	12		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	67.0
Sand	21.0
Silt & Clay	12.0

Grading Analysis	
D100	50.00
D60	7.12
D10	
Uniformity Coefficient	

pgl priority geotechnical	**PARTICLE SIZE DISTRIBUTION** **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P22156**
		Borehole / Pit No	BH10
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	10
		Depth	9.00 m
Soil Description	Silty very sandy GRAVEL	Sample type	B



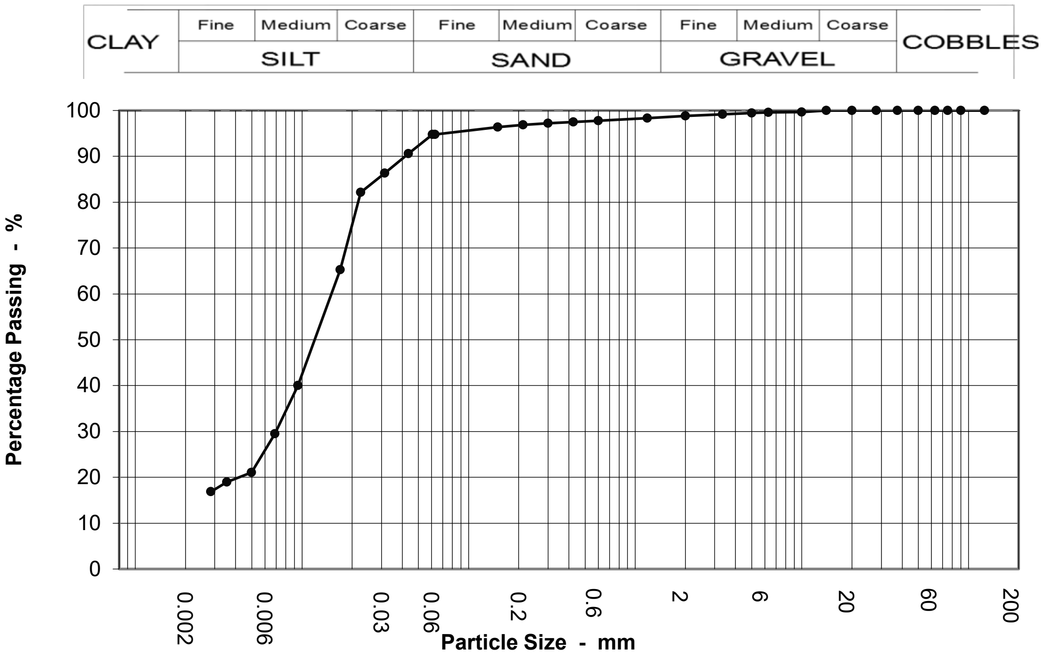
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	94		
28	87		
20	80		
14	71		
10	66		
6.3	59		
5	55		
3.35	50		
2	44		
1.18	36		
0.6	25		
0.425	21		
0.3	18		
0.212	17		
0.15	15		
0.063	13		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	56.0
Sand	31.0
Silt & Clay	13.0

Grading Analysis	
D100	50.00
D60	6.75
D10	
Uniformity Coefficient	

	PARTICLE SIZE DISTRIBUTION **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P22156**
		Borehole / Pit No	RC05
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	4
		Depth	4.20 m
Soil Description	Slightly gravelly slightly sandy SILT	Sample type	B



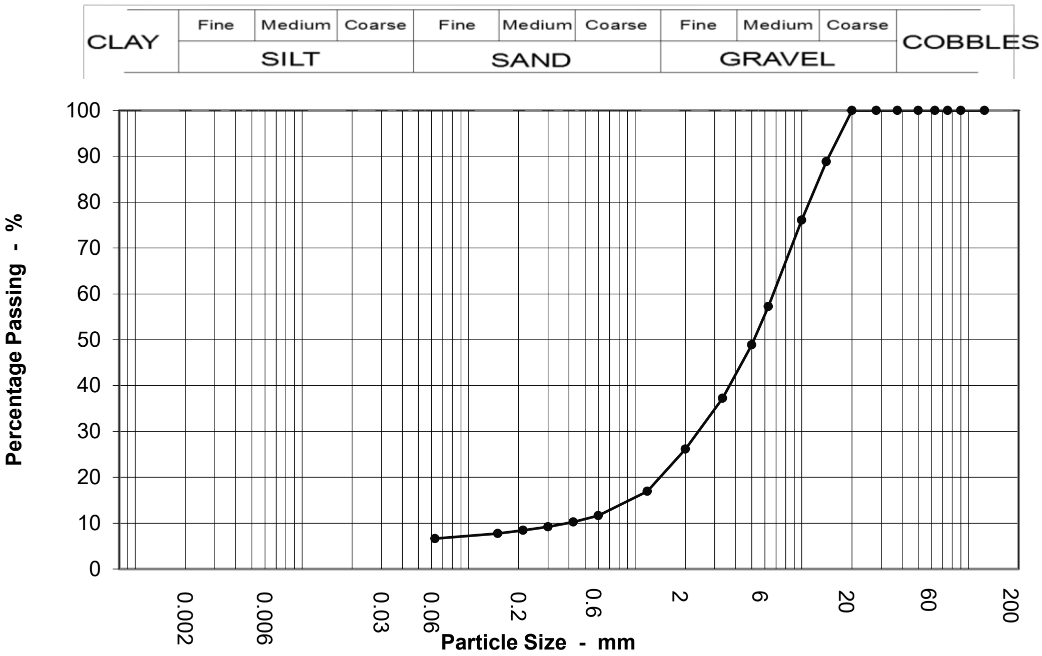
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.061	95
90	100	0.044	91
75	100	0.031	86
63	100	0.023	82
50	100	0.017	65
37.5	100	0.009	40
28	100	0.007	29
20	100	0.005	21
14	100	0.004	19
10	100	0.003	17
6.3	100	0.002	13
5	99		
3.35	99		
2	99		
1.18	98		
0.6	98		
0.425	97		
0.3	97		
0.212	97		
0.15	96		
0.063	95		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

Sample Proportions	
Cobbles	0.0
Gravel	1.0
Sand	4.0
Silt	80.0
Clay	14.0

Grading Analysis	
D100	14.00
D60	0.02
D10	
Uniformity Coefficient	

priority geotechnical	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	**Job Ref**	**P22156**
Location	**N25 LI Pedestrian & Cycle Bridge**	Borehole / Pit No	RC05
		Sample No	8
Soil Description	Slightly silty very sandy GRAVEL	Depth	10.20 m
		Sample type	B



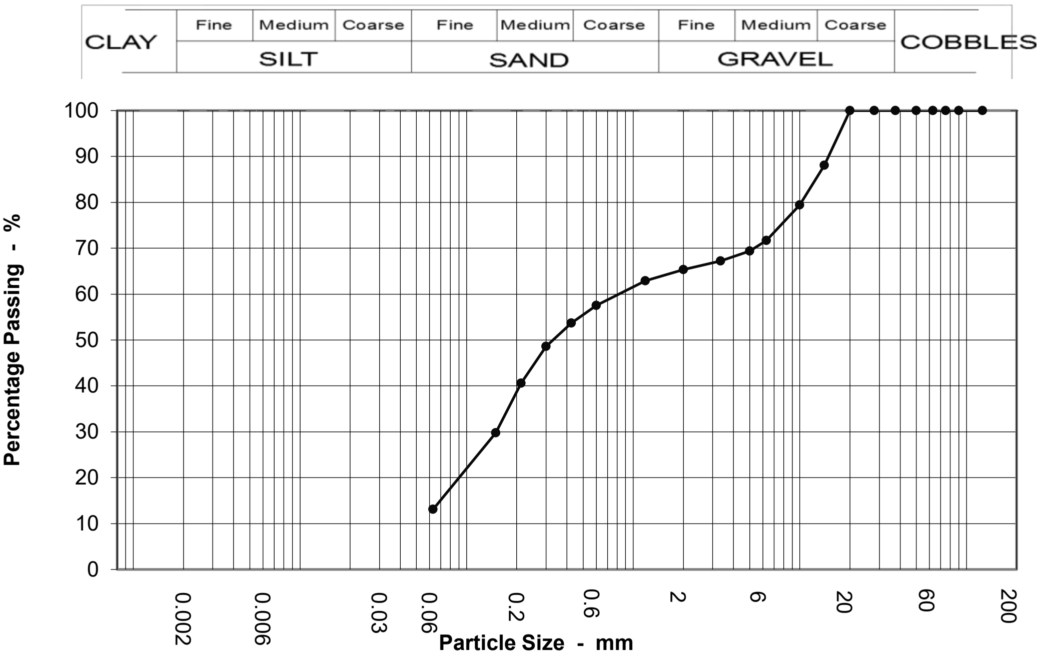
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	89		
10	76		
6.3	57		
5	49		
3.35	37		
2	26		
1.18	17		
0.6	12		
0.425	10		
0.3	9		
0.212	8		
0.15	8		
0.063	7		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	74.0
Sand	20.0
Silt & Clay	7.0

Grading Analysis	
D100	20.00
D60	6.74
D10	0.39
Uniformity Coefficient	17.00

pgl priority geotechnical	**PARTICLE SIZE DISTRIBUTION** **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P22156**
		Borehole / Pit No	RC05
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	14
		Depth	19.20 m
Soil Description	Clayey very gravelly SAND	Sample type	B



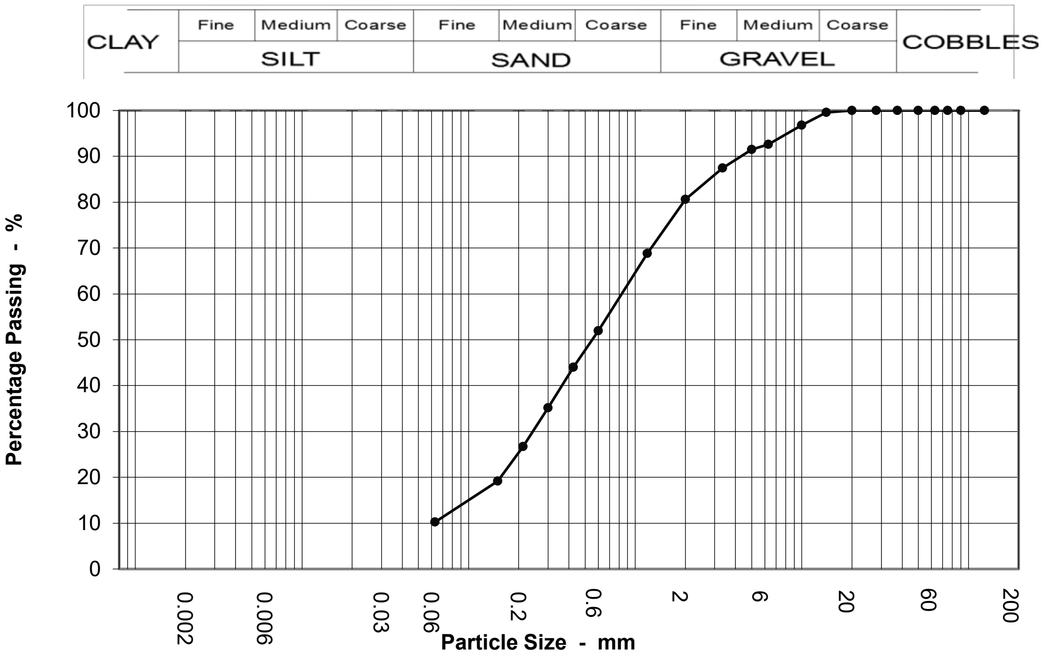
Sieving		**Sedimentation**	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	88		
10	79		
6.3	72		
5	69		
3.35	67		
2	65		
1.18	63		
0.6	58		
0.425	54		
0.3	49		
0.212	41		
0.15	30		
0.063	13		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	35.0
Sand	52.0
Silt & Clay	13.0

Grading Analysis	
D100	20.00
D60	0.82
D10	
Uniformity Coefficient	

	# PARTICLE SIZE DISTRIBUTION **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P22156**
		Borehole / Pit No	RC05
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	17
		Depth	23.70 m
Soil Description	Clayey gravelly SAND	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	97		
6.3	93		
5	92		
3.35	87		
2	81		
1.18	69		
0.6	52		
0.425	44		
0.3	35		
0.212	27		
0.15	19		
0.063	10		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

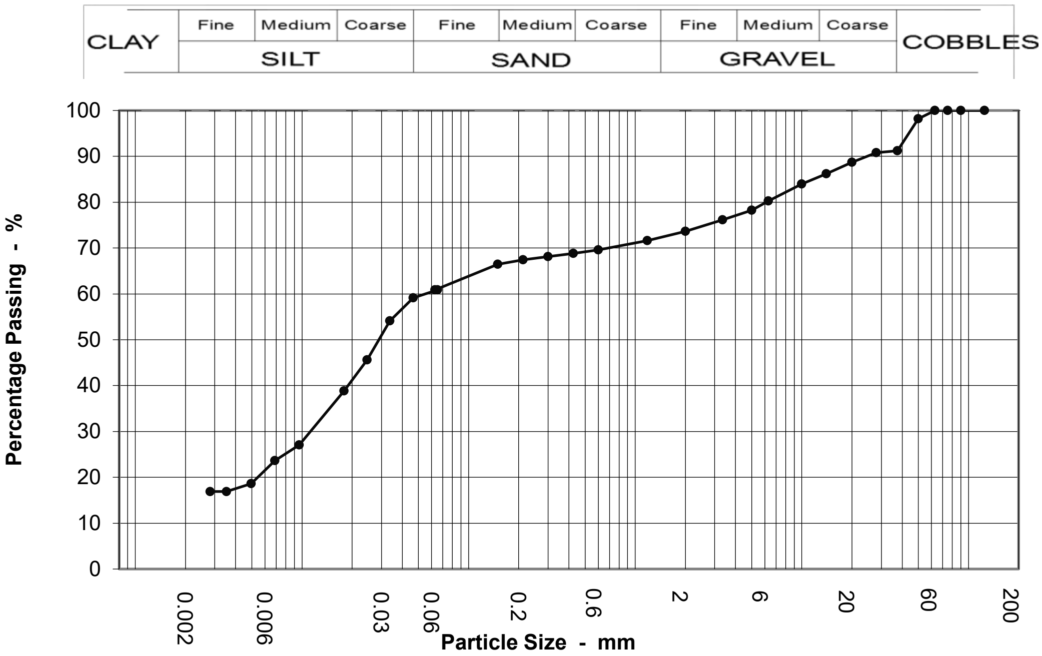
Sample Proportions	
Cobbles	0.0
Gravel	19.0
Sand	70.0
Silt & Clay	10.0

Grading Analysis	
D100	20.00
D60	0.83
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P22156**
		Borehole / Pit No	TP03
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	3
		Depth	1.00 m
Soil Description	Slightly sandy slightly gravelly SILT	Sample type	B



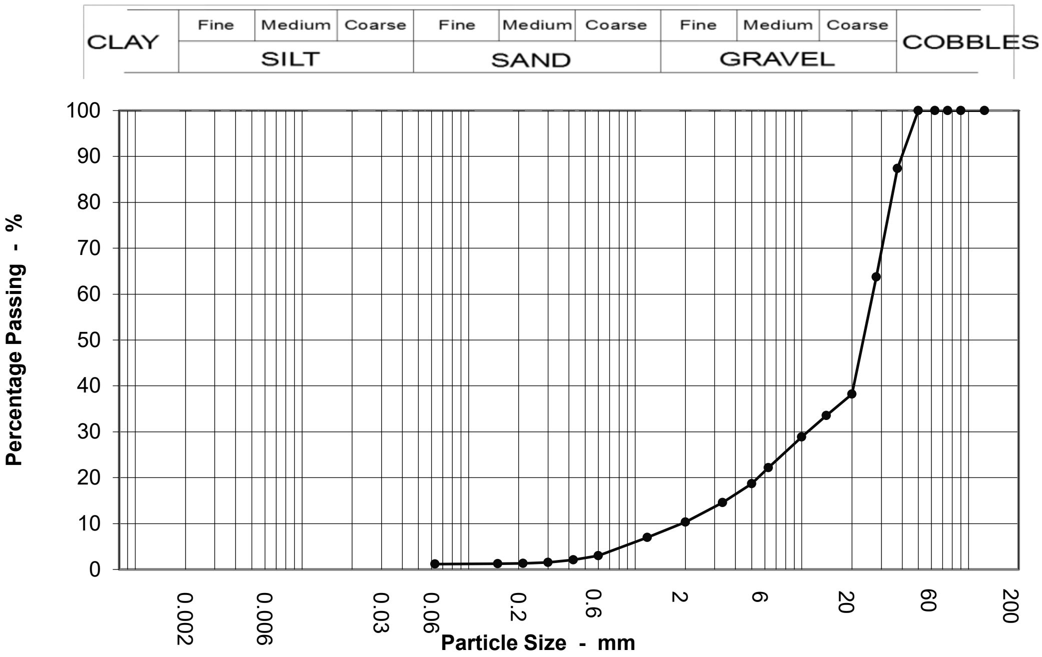
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.065	61
90	100	0.047	59
75	100	0.034	54
63	100	0.025	46
50	98	0.018	39
37.5	91	0.010	27
28	91	0.007	24
20	89	0.005	19
14	86	0.004	17
10	84	0.003	17
6.3	80	0.002	15
5	78		
3.35	76		
2	74		
1.18	72		
0.6	70		
0.425	69		
0.3	68		
0.212	67		
0.15	66		
0.063	61		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

Sample Proportions	
Cobbles	0.0
Gravel	26.0
Sand	13.0
Silt	45.0
Clay	16.0

Grading Analysis	
D100	63.00
D60	0.05
D10	
Uniformity Coefficient	

pgl priority geotechnical	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Job Ref	P22156
		Borehole / Pit No	TP05
Location	**N25 LI Pedestrian & Cycle Bridge**	Sample No	5
		Depth	0.40 m
Soil Description	Slightly silty slightly sandy GRAVEL	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	87		
28	64		
20	38		
14	34		
10	29		
6.3	22		
5	19		
3.35	15		
2	10		
1.18	7		
0.6	3		
0.425	2		
0.3	2		
0.212	1		
0.15	1		
0.063	1		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	90.0
Sand	9.0
Silt & Clay	1.0

Grading Analysis	
D100	50.00
D60	26.70
D10	1.91
Uniformity Coefficient	14.00

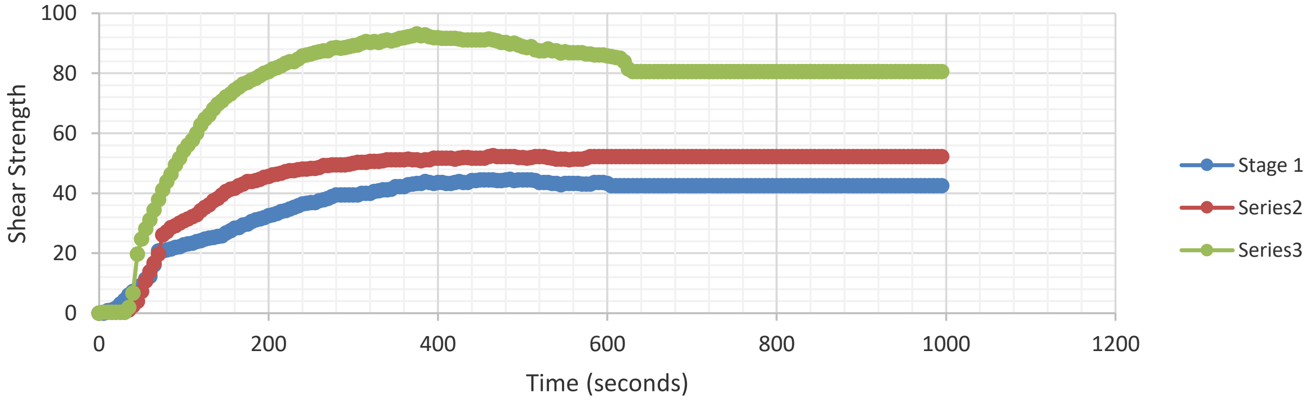
Determination of shear strength using the Small Direct Shearbox Apparatus

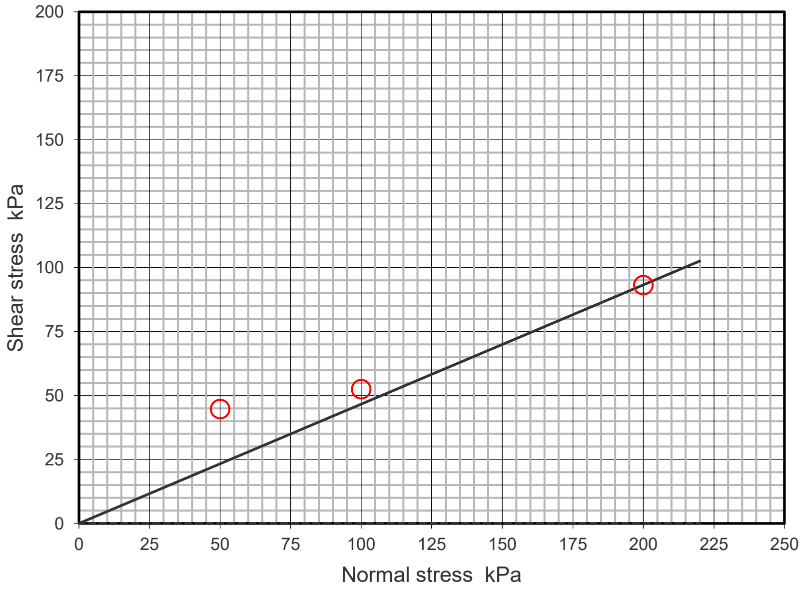
		Job Ref	P22156
		Borehole/Pit No.	BH02A
Site Name	N25 LI Pedestrian & Cycle Bridge	Sample No	6
Soil Description	Slightly silty slightly sandy GRAVEL	Depth m	5
		Sample Type	B
Test Method	BS1377 : Part 7 : 1990, clause 4	KeyLAB ID	PGL120230330330

Preparation Details

Specimen Details

	Test No.	1	2	3				
Initial	Height							mm
	Bulk Density	1.61	1.59	1.55				Mg/m³
	Moisture Content	6.4	6.4	6.4				%
	Dry density	1.51	1.49	1.46				Mg/m³
	Voids ratio	0.755	0.779	0.815				
	Degree of Saturation	22	22	21				%
Consolidation	Consolidation / Normal Stress applied	**50**	**100**	**200**				kPa
	Change in height during consolidation*							mm
	Voids ratio after consolidation							
After test	Final Moisture content	6.6	6.3	6.2				





Shear Strength Parameters

Peak strength, (o)		Regression	Manual
c '	kPa	[24]	0
Ø '	degrees	[18.5]	25

Residual strength, (x)

c'_R	kPa	[0.0]	-
$Ø'_R$	degrees	[ ]	-

Remarks :

Lab Sheet Reference :		Date printed	Fig No. 1
		19/07/2023 12:55	sheet 1 of 2

UKAS TESTING
2183

eurofins | Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.: 23-23585-1

Initial Date of Issue: 21-Jul-2023

Re-Issue Details:

Client Priority Geotechnical Ltd

Client Address:
Unit 12
Owenacurra Business Park
Midleton
County Cork
Ireland

Contact(s): Colette Kelly

Project P22156 N25

Quotation No.:

Date Received: 12-Jul-2023

Order No.: 15149

Date Instructed: 12-Jul-2023

No. of Samples: 3

Turnaround (Wkdays): 5

Results Due: 18-Jul-2023

Date Approved: 21-Jul-2023

Approved By:

Details: Stuart Henderson, Technical Manager

Results - Water

Project: P22156 N25

Client: Priority Geotechnical Ltd				**Chemtest Job No.:**	23-23585	23-23585	23-23585
Quotation No.:				**Chemtest Sample ID.:**	1672991	1672992	1672993
				Sample Location:	BH03	BH09	BH10
				Sample Type:	WATER	WATER	WATER
				Date Sampled:	10-Jul-2023	10-Jul-2023	10-Jul-2023
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Suspended Solids At 105C	U	1030	mg/l	5.0	< 5.0	5.0	22
Total Dissolved Solids	N	1020	mg/l	1.0	290	300	520
Biochemical Oxygen Demand	N	1090	mg O2/l	4.0	< 4.0	< 4.0	< 4.0
Chemical Oxygen Demand	U	1100	mg O2/l	10	< 10	< 10	< 10
Alkalinity (Total)	U	1220	mg/l	10	150	99	160
Chloride	U	1220	mg/l	1.0	36	50	170
Ammoniacal Nitrogen	U	1220	mg/l	0.050	0.093	0.061	0.086
Nitrate as NO3	U	1220	mg/l	0.50	15	19	3.3
Phosphate	U	1220	mg/l	0.200	< 0.20	< 0.20	< 0.20
Sulphate	U	1220	mg/l	1.0	21	45	27
Calcium (Dissolved)	U	1455	mg/l	2.00	30	33	17
Potassium (Dissolved)	U	1455	mg/l	0.50	4.0	2.8	6.0
Magnesium (Dissolved)	U	1455	mg/l	0.20	15	17	17
Sodium (Dissolved)	U	1455	mg/l	1.50	36	32	120
Arsenic (Dissolved)	U	1455	µg/l	0.20	0.36	< 0.20	2.0
Barium (Dissolved)	U	1455	µg/l	5.00	61	94	53
Cadmium (Dissolved)	U	1455	µg/l	0.11	< 0.11	< 0.11	< 0.11
Copper (Dissolved)	U	1455	µg/l	0.50	1.2	1.0	< 0.50
Iron (Dissolved)	N	1455	µg/l	5.0	< 5.0	< 5.0	< 5.0
Manganese (Dissolved)	U	1455	µg/l	0.50	150	14	990
Molybdenum (Dissolved)	U	1455	µg/l	0.20	2.2	< 0.20	2.0
Nickel (Dissolved)	U	1455	µg/l	0.50	< 0.50	< 0.50	1.7
Lead (Dissolved)	U	1455	µg/l	0.50	< 0.50	< 0.50	< 0.50
Antimony (Dissolved)	U	1455	µg/l	0.50	< 0.50	< 0.50	< 0.50
Selenium (Dissolved)	U	1455	µg/l	0.50	0.92	1.2	< 0.50
Zinc (Dissolved)	U	1455	µg/l	2.5	5.6	2.6	3.8
Mercury Low Level	U	1460	µg/l	0.010	< 0.010	< 0.010	< 0.010
Chromium (Trivalent)	N	1490	µg/l	20	< 20		
Chromium (Hexavalent)	U	1490	µg/l	20			< 20
Low-Level Chromium (Hexavalent)	U	1495	µg/l	0.10	0.23	< 0.10	< 0.10
Chromium (Trivalent) LL	N	1450	µg/l	1	< 1	< 1	< 1
Mineral Oil (TPH Calculation)	N	1670	µg/l	10	< 10	< 10	< 10
Aliphatic TPH >C5-C6	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C6-C8	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0

Results - Water

Project: P22156 N25

Client: Priority Geotechnical Ltd	**Chemtest Job No.:**				23-23585	23-23585	23-23585
Quotation No.:	**Chemtest Sample ID.:**				1672991	1672992	1672993
	Sample Location:				BH03	BH09	BH10
	Sample Type:				WATER	WATER	WATER
	Date Sampled:				10-Jul-2023	10-Jul-2023	10-Jul-2023
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Aromatic TPH >C5-C7	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C7-C8	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Aromatic Hydrocarbons	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	1675	µg/l	10	< 10	< 10	< 10
Dichlorodifluoromethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Chloromethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride	N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Bromomethane	U	1760	µg/l	5	< 5	< 5	< 5
Chloroethane	U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0
Trichlorofluoromethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Trans 1,2-Dichloroethene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
cis 1,2-Dichloroethene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	U	1760	µg/l	5	< 5	< 5	< 5
Trichloromethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Tetrachloromethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Benzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0
Trichloroethene	N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Dibromomethane	U	1760	µg/l	10	< 10	< 10	< 10
Bromodichloromethane	U	1760	µg/l	5	< 5	< 5	< 5
cis-1,3-Dichloropropene	N	1760	µg/l	10	< 10	< 10	< 10
Toluene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Trans-1,3-Dichloropropene	N	1760	µg/l	10	< 10	< 10	< 10
1,1,2-Trichloroethane	U	1760	µg/l	10	< 10	< 10	< 10
Tetrachloroethene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0
Dibromochloromethane	U	1760	µg/l	10	< 10	< 10	< 10
1,2-Dibromoethane	U	1760	µg/l	5	< 5	< 5	< 5
Chlorobenzene	N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane	U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0

Results - Water

Project: P22156 N25

Client: Priority Geotechnical Ltd				**Chemtest Job No.:**	23-23585	23-23585	23-23585
Quotation No.:				**Chemtest Sample ID.:**	1672991	1672992	1672993
				Sample Location:	BH03	BH09	BH10
				Sample Type:	WATER	WATER	WATER
				Date Sampled:	10-Jul-2023	10-Jul-2023	10-Jul-2023
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Ethylbenzene	U	1760	µg/l	1.0	11	14	1.2
m & p-Xylene	U	1760	µg/l	1.0	6.9	12	3.5
o-Xylene	U	1760	µg/l	1.0	2.6	3.2	3.5
Styrene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Tribromomethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Bromobenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane	N	1760	µg/l	50	< 50	< 50	< 50
N-Propylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
2-Chlorotoluene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
4-Chlorotoluene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Tert-Butylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Sec-Butylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
4-Isopropyltoluene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
N-Butylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-Chloropropane	U	1760	µg/l	50	< 50	< 50	< 50
1,2,4-Trichlorobenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0
Methyl Tert-Butyl Ether	N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0

Test Methods

SOP	Title	Parameters included	Method summary
1010	pH Value of Waters	pH	pH Meter
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1030	Total Suspended Solids	Total suspended solids	Filtration of a mixed sample through a standard glass fibre filter and determination of the mass of residue retained dried at 105°C.
1090	Biochemical Oxygen Demand	Biochemical Oxygen demand (BOD)	Colorimetric determination of dissolved oxygen in seeded sample after 5 days incubation at 20°C.
1100	Chemical Oxygen Demand	Chemical Oxygen demand (COD)	Dichromate oxidation of organic matter in sample followed by colorimetric determination of residual Cr[VI].
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1460	Mercury low-level in Waters by AFS	Mercury	Atomic Fluorescence Spectrometry, with collimated UV source, wavelength 253.7 nm.
1490	Hexavalent Chromium in Waters	Chromium [VI]	Automated colorimetric analysis by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
1495	Low Level Hexavalent Chromium in Waters	Chromium [VI]	Colorimetric determination of hexavalent chromium expressed as Cr (VI) µg/l in water, using Ion Chromatography and UV-visible spectrophotometry.
1670	Total Petroleum Hydrocarbons (TPH) in Waters by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO	Pentane extraction / GC FID detection
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection
1760	Volatile Organic Compounds (VOCs) in Waters by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics. (cf. USEPA Method 8260)	Automated headspace gas chromatographic (GC) analysis of water samples with mass spectrometric (MS) detection of volatile organic compounds.

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	23-23022-1		
Initial Date of Issue:	12-Jul-2023		
Re-Issue Details:			
Client	Priority Geotechnical Ltd		
Client Address:	Unit 12 Owenacurra Business Park Midleton County Cork Ireland		
Contact(s):	Colette Kelly		
Project	P22156 N25		
Quotation No.:	Q22-29841	**Date Received:**	06-Jul-2023
Order No.:	15149	**Date Instructed:**	06-Jul-2023
No. of Samples:	3		
Turnaround (Wkdays):	5	**Results Due:**	12-Jul-2023
Date Approved:	12-Jul-2023		
Approved By:			
Details:	Stuart Henderson, Technical Manager		

Results - Leachate

Project: P22156 N25

Client: Priority Geotechnical Ltd					**Chemtest Job No.:**	23-23022	23-23022	23-23022
Quotation No.: Q22-29841					**Chemtest Sample ID.:**	1670192	1670193	1670194
					Sample Location:	TP04	TP05	TP05
					Sample Type:	SOIL	SOIL	SOIL
					Top Depth (m):	0.10	0.10	0.30
					Date Sampled:	29-Jun-2023	29-Jun-2023	29-Jun-2023
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**			
Ammonium	U	1220	10:1	mg/l	0.050	< 0.050	< 0.050	0.13
Ammonium	N	1220	10:1	mg/kg	0.10	0.72	0.66	1.5

Results - Soil

Project: P22156 N25

Client: Priority Geotechnical Ltd				**Chemtest Job No.:**	23-23022	23-23022	23-23022
Quotation No.: Q22-29841				**Chemtest Sample ID.:**	1670192	1670193	1670194
				Sample Location:	TP04	TP05	TP05
				Sample Type:	SOIL	SOIL	SOIL
				Top Depth (m):	0.10	0.10	0.30
				Date Sampled:	29-Jun-2023	29-Jun-2023	29-Jun-2023
				Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
ACM Type	U	2192		N/A	-	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	3.8	2.8	4.8
pH	M	2010		4.0	9.0	8.8	8.7
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	3.9	3.8	< 0.40
Sulphur (Elemental)	M	2180	mg/kg	1.0	1.3	1.7	< 1.0
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50	1.5	1.4	1.6
Sulphate (Total)	U	2430	%	0.010	< 0.010	0.038	0.026
Arsenic	M	2455	mg/kg	0.5	2.7	2.8	8.5
Barium	M	2455	mg/kg	0	9	16	64
Cadmium	M	2455	mg/kg	0.10	0.30	0.48	1.4
Chromium	M	2455	mg/kg	0.5	4.9	10	14
Molybdenum	M	2455	mg/kg	0.5	< 0.5	< 0.5	1.8
Antimony	N	2455	mg/kg	2.0	< 2.0	< 2.0	< 2.0
Copper	M	2455	mg/kg	0.50	4.2	5.0	18
Mercury	M	2455	mg/kg	0.05	< 0.05	< 0.05	0.06
Nickel	M	2455	mg/kg	0.50	7.6	18	36
Lead	M	2455	mg/kg	0.50	9.6	16	17
Selenium	M	2455	mg/kg	0.25	< 0.25	< 0.25	0.60
Zinc	M	2455	mg/kg	0.50	22	57	130
Chromium (Trivalent)	N	2490	mg/kg	1.0	4.9	10	14
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Aliphatic VPH >C5-C6	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C7	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C7-C8	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C8 (Sum)	N	2780	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Total Aliphatic VPH >C5-C10	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25
Aliphatic EPH >C10-C12	M	2690	mg/kg	2.00	4.1	3.8	4.1
Aliphatic VPH >C8-C10	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aliphatic EPH >C12-C16	M	2690	mg/kg	1.00	1.8	1.6	2.2
Aliphatic EPH >C16-C21	M	2690	mg/kg	2.00	< 2.0	< 2.0	< 2.0
Aliphatic EPH >C21-C35	M	2690	mg/kg	3.00	< 3.0	< 3.0	< 3.0
Aliphatic EPH >C35-C40	N	2690	mg/kg	10.00	< 10	< 10	11
Total Aliphatic EPH >C10-C35	M	2690	mg/kg	5.00	8.1	8.2	8.4
Aromatic VPH >C5-C7	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C7-C8	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C8-C10	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05

Results - Soil

Project: P22156 N25

Client: Priority Geotechnical Ltd	**Chemtest Job No.:**				23-23022	23-23022	23-23022
Quotation No.: Q22-29841	**Chemtest Sample ID.:**				1670192	1670193	1670194
	Sample Location:				TP04	TP05	TP05
	Sample Type:				SOIL	SOIL	SOIL
	Top Depth (m):				0.10	0.10	0.30
	Date Sampled:				29-Jun-2023	29-Jun-2023	29-Jun-2023
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Total Aromatic VPH >C5-C10	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25
Aromatic EPH >C10-C12	U	2690	mg/kg	1.00	< 1.0	< 1.0	< 1.0
Aromatic EPH >C12-C16	U	2690	mg/kg	1.00	< 1.0	< 1.0	< 1.0
Aromatic EPH >C16-C21	U	2690	mg/kg	2.00	3.5	3.1	3.1
Aromatic EPH >C21-C35	U	2690	mg/kg	2.00	10	7.5	8.8
Aromatic EPH >C35-C40	N	2690	mg/kg	1.00	3.3	1.9	2.3
Total Aromatic EPH >C10-C35	U	2690	mg/kg	5.00	14	11	12
Total VPH >C5-C10	U	2780	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Total EPH >C10-C35	U	2690	mg/kg	10.00	22	19	20
Total Organic Carbon	M	2625	%	0.20	4.3	0.70	2.2
Mineral Oil (TPH Calculation)	N	2670	mg/kg	10	< 10	< 10	17
Benzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Toluene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
o-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Naphthalene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.17
Fluorene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.14
Phenanthrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	1.7
Anthracene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.30
Fluoranthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	3.0
Pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	2.3
Benzo[a]anthracene	M	2800	mg/kg	0.10	< 0.10	< 0.10	1.2
Chrysene	M	2800	mg/kg	0.10	< 0.10	< 0.10	1.2
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	1.6
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.54
Benzo[a]pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	1.1
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.84
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.65
Coronene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2800	mg/kg	2.0	< 2.0	< 2.0	15
PCB 28	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010
PCB 52	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010
PCB 90+101	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010
PCB 118	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010

Results - Soil

Project: P22156 N25

Client: Priority Geotechnical Ltd				**Chemtest Job No.:**	23-23022	23-23022	23-23022
Quotation No.: Q22-29841				**Chemtest Sample ID.:**	1670192	1670193	1670194
				Sample Location:	TP04	TP05	TP05
				Sample Type:	SOIL	SOIL	SOIL
				Top Depth (m):	0.10	0.10	0.30
				Date Sampled:	29-Jun-2023	29-Jun-2023	29-Jun-2023
				Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
PCB 153	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010
PCB 138	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010
PCB 180	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010
Total PCBs (7 Congeners)	U	2815	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Total Phenols	M	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10

Results - Single Stage WAC

Project: P22156 N25

Chemtest Job No:	23-23022				**Landfill Waste Acceptance Criteria Limits**		
Chemtest Sample ID:	1670192						
Sample Ref:							
Sample ID:							
Sample Location:	TP04						
Top Depth(m):	0.10						
Bottom Depth(m):							
Sampling Date:	29-Jun-2023				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	M	%	4.3	3	5	6
Loss On Ignition	2610	M	%	0.42	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	M		9.0	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.019	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	0.0003	0.0026	0.5	2	25
Barium	1455	U	< 0.005	< 0.050	20	100	300
Cadmium	1455	U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0050	0.5	10	70
Copper	1455	U	0.0011	0.011	2	50	100
Mercury	1455	U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455	U	< 0.0002	< 0.0020	0.5	10	30
Nickel	1455	U	< 0.0005	< 0.0050	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455	U	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455	U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455	U	0.008	0.077	4	50	200
Chloride	1220	U	2.0	20	800	15000	25000
Fluoride	1220	U	0.12	1.2	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	36	360	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	3.2	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	3.8

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P22156 N25

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	23-23022						
Chemtest Sample ID:	1670193						
Sample Ref:							
Sample ID:							
Sample Location:	TP05						
Top Depth(m):	0.10						
Bottom Depth(m):							
Sampling Date:	29-Jun-2023				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	M	%	0.70	3	5	6
Loss On Ignition	2610	M	%	0.75	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.8	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.021	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	0.0006	0.0064	0.5	2	25
Barium	1455	U	< 0.005	< 0.050	20	100	300
Cadmium	1455	U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0050	0.5	10	70
Copper	1455	U	0.0008	0.0083	2	50	100
Mercury	1455	U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455	U	0.0009	0.0087	0.5	10	30
Nickel	1455	U	< 0.0005	< 0.0050	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455	U	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455	U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455	U	0.012	0.12	4	50	200
Chloride	1220	U	1.4	14	800	15000	25000
Fluoride	1220	U	0.13	1.3	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	44	440	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	7.9	79	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	2.8

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P22156 N25

Chemtest Job No:	23-23022				**Landfill Waste Acceptance Criteria Limits**		
Chemtest Sample ID:	1670194						
Sample Ref:							
Sample ID:							
Sample Location:	TP05						
Top Depth(m):	0.30						
Bottom Depth(m):							
Sampling Date:	29-Jun-2023						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%	2.2	3	5	6
Loss On Ignition	2610	M	%	2.2	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	15	100	--	--
pH	2010	M		8.7	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.021	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	< 0.0002	< 0.0020	0.5	2	25
Barium	1455	U	< 0.005	< 0.050	20	100	300
Cadmium	1455	U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455	U	0.0009	0.0089	0.5	10	70
Copper	1455	U	0.0009	0.0091	2	50	100
Mercury	1455	U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455	U	0.0003	0.0026	0.5	10	30
Nickel	1455	U	0.0006	0.0058	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455	U	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455	U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455	U	< 0.003	< 0.025	4	50	200
Chloride	1220	U	1.6	16	800	15000	25000
Fluoride	1220	U	0.16	1.6	10	150	500
Sulphate	1220	U	2.0	20	1000	20000	50000
Total Dissolved Solids	1020	N	88	880	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	13	130	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	4.8

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Test Methods

SOP	Title	Parameters included	Method summary
1010	pH Value of Waters	pH	pH Meter
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2015	Acid Neutralisation Capacity	Acid Reserve	Titration
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2180	Sulphur (Elemental) in Soils by HPLC	Sulphur	Dichloromethane extraction / HPLC with UV detection
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N–dimethyl-p-phenylenediamine.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2690	EPH A/A Split	Aliphatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40 Aromatics: >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C40	Acetone/Heptane extraction / GCxGC FID detection

Test Methods

SOP	Title	Parameters included	Method summary
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2780	VPH A/A Split	Aliphatics: >C5–C6, >C6–C7,>C7–C8,>C8-C10 Aromatics: >C5–C7,>C7-C8,>C8–C10	Water extraction / Headspace GCxGC FID detection
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

UKAS
TESTING
2183

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	23-18379-1		
Initial Date of Issue:	07-Jun-2023		
Re-Issue Details:			
Client	Priority Geotechnical Ltd		
Client Address:	Unit 12 Owenacurra Business Park Midleton County Cork Ireland		
Contact(s):	Colette Kelly		
Project	P22156 25		
Quotation No.:	Q22-29444	**Date Received:**	01-Jun-2023
Order No.:	15149	**Date Instructed:**	01-Jun-2023
No. of Samples:	4		
Turnaround (Wkdays):	5	**Results Due:**	07-Jun-2023
Date Approved:	07-Jun-2023		
Approved By:			
Details:	Stuart Henderson, Technical Manager		

Results - Soil

Project: P22156 25

Client: Priority Geotechnical Ltd	**Chemtest Job No.:**				23-18379	23-18379	23-18379	23-18379
Quotation No.: Q22-29444	**Chemtest Sample ID.:**				1648983	1648984	1648985	1648986
	Sample Location:				BH02	BH02A	BH02A	BH06
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				2.0	0	2.0	1.2
	Date Sampled:				30-May-2023	30-May-2023	30-May-2023	30-May-2023
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
Moisture	N	2030	%	0.020	20	19	31	7.5
pH (2.5:1)	N	2010		4.0	7.6		7.8	8.6
Magnesium (Water Soluble)	N	2120	g/l	0.010	0.012		< 0.010	< 0.010
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.43		0.13	< 0.010
Total Sulphur	U	2175	%	0.010	0.17		0.12	< 0.010
Chloride (Water Soluble)	U	2220	g/l	0.010	0.010		0.013	< 0.010
Nitrate (Water Soluble)	N	2220	g/l	0.010	< 0.010		< 0.010	< 0.010
Sulphate (Acid Soluble)	U	2430	%	0.010	0.12		0.063	0.015
LOI	U	2610	%	0.10		3.8		
Organic Matter	U	2625	%	0.40		< 0.40		

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2220	Water soluble Chloride in Soils	Chloride	Aqueous extraction and measuremernt by 'Aquakem 600' Discrete Analyser using ferric nitrate / mercuric thiocyanate.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.

Report Information

Key	
U	UKAS accredited
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N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

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eurofins
Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	23-17502-1		
Initial Date of Issue:	01-Jun-2023		
Re-Issue Details:			
Client	Priority Geotechnical Ltd		
Client Address:	Unit 12 Owenacurra Business Park Midleton County Cork Ireland		
Contact(s):	Colette Kelly		
Project	P22156 N25		
Quotation No.:	Q22-29444	**Date Received:**	25-May-2023
Order No.:	15149	**Date Instructed:**	25-May-2023
No. of Samples:	2		
Turnaround (Wkdays):	5	**Results Due:**	01-Jun-2023
Date Approved:	01-Jun-2023		
Approved By:			
Details:	Stuart Henderson, Technical Manager		

Results - Soil

Project: P22156 N25

Client: Priority Geotechnical Ltd	**Chemtest Job No.:**				23-17502	23-17502
Quotation No.: Q22-29444	**Chemtest Sample ID.:**				1645540	1645541
	Sample Location:				BH01	BH08
	Sample Type:				SOIL	SOIL
	Top Depth (m):				2.20	1.20
	Date Sampled:				19-May-2023	19-May-2023
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Moisture	N	2030	%	0.020	9.8	7.4
pH (2.5:1)	N	2010		4.0	8.3	8.6
Magnesium (Water Soluble)	N	2120	g/l	0.010	< 0.010	< 0.010
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.19	0.048
Total Sulphur	U	2175	%	0.010	0.095	0.035
Chloride (Water Soluble)	U	2220	g/l	0.010	0.013	0.018
Nitrate (Water Soluble)	N	2220	g/l	0.010	< 0.010	< 0.010
Sulphate (Acid Soluble)	U	2430	%	0.010	0.034	0.040

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2220	Water soluble Chloride in Soils	Chloride	Aqueous extraction and measuremernt by 'Aquakem 600' Discrete Analyser using ferric nitrate / mercuric thiocyanate.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.

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eurofins
Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	23-03242-1		
Initial Date of Issue:	07-Feb-2023		
Client	Priority Geotechnical Ltd		
Client Address:	Unit 12 Owenacurra Business Park Midleton County Cork Ireland		
Contact(s):	Colette Kelly		
Project	P22156 N25 Pedestrian Bridge		
Quotation No.:	Q22-29444	**Date Received:**	01-Feb-2023
Order No.:	14149	**Date Instructed:**	01-Feb-2023
No. of Samples:	1		
Turnaround (Wkdays):	5	**Results Due:**	07-Feb-2023
Date Approved:	07-Feb-2023		
Approved By:			
Details:	Stuart Henderson, Technical Manager		

Results - Soil

Project: P22156 N25 Pedestrian Bridge

Client: Priority Geotechnical Ltd				**Chemtest Job No.:**	23-03242
Quotation No.: Q22-29444				**Chemtest Sample ID.:**	1582979
				Sample Location:	TP03
				Sample Type:	SOIL
				Top Depth (m):	1.0
				Date Sampled:	30-Jan-2023
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Moisture	N	2030	%	0.020	21
pH (2.5:1)	N	2010		4.0	8.3
Magnesium (Water Soluble)	N	2120	g/l	0.010	< 0.010
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.32
Total Sulphur	U	2175	%	0.010	0.089
Chloride (Water Soluble)	U	2220	g/l	0.010	< 0.010
Nitrate (Water Soluble)	N	2220	g/l	0.010	0.011
Sulphate (Acid Soluble)	U	2430	%	0.010	0.088
LOI	U	2610	%	0.10	3.3
Organic Matter	U	2625	%	0.40	1.4

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2220	Water soluble Chloride in Soils	Chloride	Aqueous extraction and measuremernt by 'Aquakem 600' Discrete Analyser using ferric nitrate / mercuric thiocyanate.
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2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
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Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

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Final Report

Report No.:	22-48818-1		
Initial Date of Issue:	18-Jan-2023		
Client	Priority Geotechnical Ltd		
Client Address:	Unit 12 Owenacurra Business Park Midleton County Cork Ireland		
Contact(s):	Colette Kelly		
Project	P22156 N25 LI Pedestrian Bridge		
Quotation No.:	Q22-29841	**Date Received:**	22-Dec-2022
Order No.:	15149	**Date Instructed:**	22-Dec-2022
No. of Samples:	6		
Turnaround (Wkdays):	10	**Results Due:**	11-Jan-2023
Date Approved:	18-Jan-2023		
Approved By:			
Details:	Stuart Henderson, Technical Manager		

Results - Leachate

Project: P22156 N25 LI Pedestrian Bridge

Client: Priority Geotechnical Ltd					**Chemtest Job No.:**	22-48818	22-48818	22-48818	22-48818	22-48818	22-48818
Quotation No.: Q22-29841					**Chemtest Sample ID.:**	1568057	1568058	1568059	1568060	1568061	1568062
					Sample Location:	TP01	TP01	TP02	TP02	TP03	TP03
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	0.5	1.3	0.5	1.3	0.5	1.0
					Date Sampled:	12-Dec-2022	12-Dec-2022	12-Dec-2022	12-Dec-2022	12-Dec-2022	12-Dec-2022
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**						
Ammonium	U	1220	10:1	mg/l	0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Ammonium	N	1220	10:1	mg/kg	0.10	0.51	0.34	0.13	< 0.10	< 0.10	0.11

Results - Soil

Project: P22156 N25 LI Pedestrian Bridge

Client: Priority Geotechnical Ltd	**Chemtest Job No.:**				22-48818	22-48818	22-48818	22-48818	22-48818	22-48818
Quotation No.: Q22-29841	**Chemtest Sample ID.:**				1568057	1568058	1568059	1568060	1568061	1568062
	Sample Location:				TP01	TP01	TP02	TP02	TP03	TP03
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.5	1.3	0.5	1.3	0.5	1.0
	Date Sampled:				12-Dec-2022	12-Dec-2022	12-Dec-2022	12-Dec-2022	12-Dec-2022	12-Dec-2022
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
ACM Type	U	2192		N/A	-	-	-	-	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	7.5	11	13	14	11	19
pH	M	2010		4.0	8.4	8.3	8.2	8.5	8.0	8.1
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	0.60	0.45	0.58	0.45	0.62	1.6
Sulphur (Elemental)	M	2180	mg/kg	1.0	< 1.0	16	< 1.0	< 1.0	< 1.0	< 1.0
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50	0.61	1.1	3.4	2.6	1.8	3.7
Sulphate (Total)	U	2430	%	0.010	0.028	0.043	0.044	0.049	0.060	0.22
Arsenic	M	2455	mg/kg	0.5	14	4.6	6.6	6.2	6.7	4.8
Barium	M	2455	mg/kg	0	31	25	40	34	32	20
Cadmium	M	2455	mg/kg	0.10	0.22	0.22	0.19	0.14	0.24	< 0.10
Chromium	M	2455	mg/kg	0.5	8.5	8.9	14	14	13	12
Molybdenum	M	2455	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Antimony	N	2455	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Copper	M	2455	mg/kg	0.50	14	12	11	9.6	11	7.8
Mercury	M	2455	mg/kg	0.05	< 0.05	< 0.05	0.06	0.05	0.06	< 0.05
Nickel	M	2455	mg/kg	0.50	13	12	13	13	15	14
Lead	M	2455	mg/kg	0.50	29	18	23	19	25	14
Selenium	M	2455	mg/kg	0.25	0.50	0.49	0.79	0.62	0.59	0.47
Zinc	M	2455	mg/kg	0.50	58	35	39	37	44	32
Chromium (Trivalent)	N	2490	mg/kg	1.0	8.5	8.9	14	14	13	12
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Aliphatic VPH >C5-C6	N	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C7	N	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C7-C8	N	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C8-C10	N	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Total Aliphatic VPH >C5-C10	N	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25
Aliphatic EPH >C10-C12	N	2690	mg/kg	2.00	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Aliphatic EPH >C12-C16	N	2690	mg/kg	1.00	1.9	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic EPH >C16-C21	N	2690	mg/kg	2.00	3.7	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Aliphatic EPH >C21-C35	N	2690	mg/kg	3.00	9.2	< 3.0	3.3	< 3.0	< 3.0	< 3.0
Aliphatic EPH >C35-C40	N	2690	mg/kg	1.00	1.6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic EPH >C10-C35	N	2690	mg/kg	5.00	16	< 5.0	5.7	< 5.0	< 5.0	< 5.0
Aromatic VPH >C5-C7	N	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C7-C8	N	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C8-C10	N	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Total Aromatic VPH >C5-C10	N	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25

Results - Soil

Project: P22156 N25 LI Pedestrian Bridge

Client: Priority Geotechnical Ltd	**Chemtest Job No.:**				22-48818	22-48818	22-48818	22-48818	22-48818	22-48818
Quotation No.: Q22-29841	**Chemtest Sample ID.:**				1568057	1568058	1568059	1568060	1568061	1568062
	Sample Location:				TP01	TP01	TP02	TP02	TP03	TP03
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.5	1.3	0.5	1.3	0.5	1.0
	Date Sampled:				12-Dec-2022	12-Dec-2022	12-Dec-2022	12-Dec-2022	12-Dec-2022	12-Dec-2022
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
Aromatic EPH >C10-C12	N	2690	mg/kg	1.00	1.6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic EPH >C12-C16	N	2690	mg/kg	1.00	32	1.6	1.4	1.4	1.1	1.5
Aromatic EPH >C16-C21	N	2690	mg/kg	2.00	200	11	6.9	5.9	8.0	5.5
Aromatic EPH >C21-C35	N	2690	mg/kg	2.00	160	19	20	11	16	9.7
Aromatic EPH >C35-C40	N	2690	mg/kg	1.00	14	5.0	4.9	3.3	3.1	3.4
Total Aromatic EPH >C10-C35	N	2690	mg/kg	5.00	400	31	28	19	25	17
Total VPH >C5-C10	N	2780	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Total EPH >C10-C35	N	2690	mg/kg	10.00	420	35	34	23	29	21
Total Organic Carbon	M	2625	%	0.20	1.8	1.3	2.3	1.3	1.8	0.91
Mineral Oil (TPH Calculation)	N	2670	mg/kg	10	< 10	< 10	< 10	< 10	< 10	< 10
Benzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Naphthalene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.13
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	M	2800	mg/kg	0.10	< 0.10	0.43	< 0.10	0.21	0.37	< 0.10
Anthracene	M	2800	mg/kg	0.10	< 0.10	0.11	< 0.10	0.12	< 0.10	< 0.10
Fluoranthene	M	2800	mg/kg	0.10	0.26	1.4	0.11	0.33	0.57	< 0.10
Pyrene	M	2800	mg/kg	0.10	0.29	1.3	0.17	0.29	0.50	< 0.10
Benzo[a]anthracene	M	2800	mg/kg	0.10	0.19	0.73	< 0.10	< 0.10	0.19	< 0.10
Chrysene	M	2800	mg/kg	0.10	0.13	0.70	< 0.10	< 0.10	0.14	< 0.10
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	0.20	1.1	< 0.10	< 0.10	0.19	< 0.10
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	< 0.10	0.40	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	M	2800	mg/kg	0.10	0.21	0.85	< 0.10	< 0.10	0.24	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	0.23	0.88	< 0.10	< 0.10	0.25	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	0.15	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	0.20	0.84	< 0.10	< 0.10	0.23	< 0.10
Coronene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2800	mg/kg	2.0	< 2.0	8.9	< 2.0	< 2.0	2.7	< 2.0
PCB 28	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 52	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 90+101	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 118	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 153	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Results - Soil

Project: P22156 N25 LI Pedestrian Bridge

Client: Priority Geotechnical Ltd				**Chemtest Job No.:**	22-48818	22-48818	22-48818	22-48818	22-48818	22-48818
Quotation No.: Q22-29841				**Chemtest Sample ID.:**	1568057	1568058	1568059	1568060	1568061	1568062
				Sample Location:	TP01	TP01	TP02	TP02	TP03	TP03
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.5	1.3	0.5	1.3	0.5	1.0
				Date Sampled:	12-Dec-2022	12-Dec-2022	12-Dec-2022	12-Dec-2022	12-Dec-2022	12-Dec-2022
				Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
PCB 138	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 180	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total PCBs (7 Congeners)	U	2815	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Phenols	M	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

Results - Single Stage WAC

Project: P22156 N25 LI Pedestrian Bridge

Chemtest Job No:	22-48818				**Landfill Waste Acceptance Criteria Limits**		
Chemtest Sample ID:	1568057						
Sample Ref:					**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Sample ID:							
Sample Location:	TP01						
Top Depth(m):	0.5						
Bottom Depth(m):							
Sampling Date:	12-Dec-2022						
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	M	%	1.8	3	5	6
Loss On Ignition	2610	M	%	38	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	M	mg/kg	58	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.4	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.021	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	< 0.0002	< 0.0020	0.5	2	25
Barium	1455	U	< 0.005	< 0.050	20	100	300
Cadmium	1455	U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0050	0.5	10	70
Copper	1455	U	< 0.0005	< 0.0050	2	50	100
Mercury	1455	U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455	U	< 0.0002	< 0.0020	0.5	10	30
Nickel	1455	U	< 0.0005	< 0.0050	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455	U	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455	U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455	U	< 0.003	< 0.025	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.098	< 1.0	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	31	310	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	< 2.5	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	7.5

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P22156 N25 LI Pedestrian Bridge

Chemtest Job No:	22-48818				**Landfill Waste Acceptance Criteria Limits**		
Chemtest Sample ID:	1568058						
Sample Ref:					**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Sample ID:							
Sample Location:	TP01						
Top Depth(m):	1.3						
Bottom Depth(m):							
Sampling Date:	12-Dec-2022						
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	M	%	1.3	3	5	6
Loss On Ignition	2610	M	%	27	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	M	mg/kg	50	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	8.9	100	--	--
pH	2010	M		8.3	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.031	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	0.0004	0.0039	0.5	2	25
Barium	1455	U	< 0.005	< 0.050	20	100	300
Cadmium	1455	U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0050	0.5	10	70
Copper	1455	U	< 0.0005	< 0.0050	2	50	100
Mercury	1455	U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455	U	0.0005	0.0052	0.5	10	30
Nickel	1455	U	< 0.0005	< 0.0050	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455	U	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455	U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455	U	< 0.003	< 0.025	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.10	1.0	10	150	500
Sulphate	1220	U	4.6	46	1000	20000	50000
Total Dissolved Solids	1020	N	55	550	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	< 2.5	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	11

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P22156 N25 LI Pedestrian Bridge

Chemtest Job No:	22-48818				**Landfill Waste Acceptance Criteria Limits**		
Chemtest Sample ID:	1568059						
Sample Ref:							
Sample ID:							
Sample Location:	TP02						
Top Depth(m):	0.5						
Bottom Depth(m):							
Sampling Date:	12-Dec-2022				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	M	%	2.3	3	5	6
Loss On Ignition	2610	M	%	3.0	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.2	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.012	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	< 0.0002	< 0.0020	0.5	2	25
Barium	1455	U	< 0.005	< 0.050	20	100	300
Cadmium	1455	U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0050	0.5	10	70
Copper	1455	U	< 0.0005	< 0.0050	2	50	100
Mercury	1455	U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455	U	< 0.0002	< 0.0020	0.5	10	30
Nickel	1455	U	< 0.0005	< 0.0050	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455	U	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455	U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455	U	< 0.003	< 0.025	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.13	1.3	10	150	500
Sulphate	1220	U	1.9	19	1000	20000	50000
Total Dissolved Solids	1020	N	28	280	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	2.7	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	13

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P22156 N25 LI Pedestrian Bridge

Chemtest Job No:	22-48818				**Landfill Waste Acceptance Criteria Limits**		
Chemtest Sample ID:	1568060				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Sample Ref:							
Sample ID:							
Sample Location:	TP02						
Top Depth(m):	1.3						
Bottom Depth(m):							
Sampling Date:	12-Dec-2022						
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	M	%	1.3	3	5	6
Loss On Ignition	2610	M	%	4.5	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.5	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.011	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	0.0006	0.0058	0.5	2	25
Barium	1455	U	< 0.005	< 0.050	20	100	300
Cadmium	1455	U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0050	0.5	10	70
Copper	1455	U	0.0010	0.0098	2	50	100
Mercury	1455	U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455	U	0.0005	0.0046	0.5	10	30
Nickel	1455	U	< 0.0005	< 0.0050	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455	U	0.0007	0.0074	0.06	0.7	5
Selenium	1455	U	0.0010	0.010	0.1	0.5	7
Zinc	1455	U	0.003	0.025	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.10	1.0	10	150	500
Sulphate	1220	U	1.2	12	1000	20000	50000
Total Dissolved Solids	1020	N	36	360	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	2.9	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	14

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P22156 N25 LI Pedestrian Bridge

Chemtest Job No:	22-48818				**Landfill Waste Acceptance Criteria Limits**		
Chemtest Sample ID:	1568061						
Sample Ref:					**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Sample ID:							
Sample Location:	TP03						
Top Depth(m):	0.5						
Bottom Depth(m):							
Sampling Date:	12-Dec-2022						
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	M	%	1.8	3	5	6
Loss On Ignition	2610	M	%	4.4	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	M	mg/kg	75	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	2.7	100	--	--
pH	2010	M		8.0	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.010	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	0.0004	0.0036	0.5	2	25
Barium	1455	U	< 0.005	< 0.050	20	100	300
Cadmium	1455	U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0050	0.5	10	70
Copper	1455	U	0.0009	0.0091	2	50	100
Mercury	1455	U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455	U	0.0005	0.0047	0.5	10	30
Nickel	1455	U	< 0.0005	< 0.0050	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455	U	0.0006	0.0057	0.06	0.7	5
Selenium	1455	U	0.0008	0.0085	0.1	0.5	7
Zinc	1455	U	0.003	0.030	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.14	1.4	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	38	380	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	< 2.5	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	11

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: P22156 N25 LI Pedestrian Bridge

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	22-48818						
Chemtest Sample ID:	1568062						
Sample Ref:							
Sample ID:							
Sample Location:	TP03						
Top Depth(m):	1.0						
Bottom Depth(m):							
Sampling Date:	12-Dec-2022				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	M	%	0.91	3	5	6
Loss On Ignition	2610	M	%	3.0	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.1	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.0090	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	0.0005	0.0046	0.5	2	25
Barium	1455	U	0.006	0.058	20	100	300
Cadmium	1455	U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0050	0.5	10	70
Copper	1455	U	0.0006	0.0061	2	50	100
Mercury	1455	U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455	U	0.0004	0.0036	0.5	10	30
Nickel	1455	U	< 0.0005	< 0.0050	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455	U	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455	U	0.0019	0.019	0.1	0.5	7
Zinc	1455	U	0.004	0.037	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.098	< 1.0	10	150	500
Sulphate	1220	U	54	540	1000	20000	50000
Total Dissolved Solids	1020	N	110	1100	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	< 2.5	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	19

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Test Methods

SOP	Title	Parameters included	Method summary
1010	pH Value of Waters	pH	pH Meter
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using ‘Aquakem 600’ Discrete Analyser.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2015	Acid Neutralisation Capacity	Acid Reserve	Titration
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2180	Sulphur (Elemental) in Soils by HPLC	Sulphur	Dichloromethane extraction / HPLC with UV detection
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by ‘Aquakem 600’ Discrete Analyser, using N,N–dimethyl-p-phenylenediamine.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by ‘Aquakem 600’ Discrete Analyser using 1,5-diphenylcarbazide.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2690	EPH A/A Split	Aliphatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40 Aromatics: >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35–C40	Acetone/Heptane extraction / GCxGC FID detection

Test Methods

SOP	Title	Parameters included	Method summary
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2780	VPH A/A Split	Aliphatics: >C5–C6, >C6–C7,>C7–C8,>C8-C10 Aromatics: >C5–C7,>C7-C8,>C8–C10	Water extraction / Headspace GCxGC FID detection
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

N25 Little Island Pedestrian and Cyclist Bridge
Environmental Impact Assessment Report

Appendix 17.3

Historic Ground Investigation

Our Ref: JMS/Rp/P19248 + attachments (*.pdf)

29th June, 2020

Messrs. Cork County Council,
County Hall,
Carrigrohane Road,
Cork,
Ireland.

Re: Dunkettle Advance ITS Works Ground Investigation– Factual Report.

Introduction

In December 2019, Priority Geotechnical (PGL) were requested by Cork County Council acting on behalf of Transport Infrastructure Ireland (TII) to undertake a site investigation as part of the Dunkettle Advance ITS Works Ground Investigation project. Atkins were acting as consulting engineers for the project.

The site is located along the following roads:

- M8 – Between junction 18 and Dunkettle Interchange
- N8 – Near Dunkettle Roundabout
- R639 – Near Dunkettle Roundabout
- N25 – Between junction 2 and Dunkettle Interchange
- N40 – Between Jack Lynch Tunnel and interchange with N28
- N28 – At R610 exit

The topography of the site is varied. The majority of exploratory holes are situated on grass verges of roadways, which vary between flat and steeply sloping surfaces. All areas of the site are currently in use as active roadways of regional, national and motorway grade. The portion of the site on the N25 was formerly the site of a small stream, which still exists nearby but has since changed course.

A portion of the N40 section is composed of reclaimed land, nearest the Jack Lynch Tunnel, and on the other end adjacent to the Douglas river. This was mostly mud flats before the reclamation efforts. The rest of the site was used for agricultural purposes before the construction of the roads.

The proposed development at the site includes: Installation of VMS to facilitate the flow of traffic at the Dunkettle Interchange. These VMS will consist of screens displaying traffic information for drivers approaching the interchange. The screens will be installed on large gantries overhanging the roadways, which require new foundations to be built and potential reuse of existing foundations at some locations. The ground investigation that is the subject of this specification is the main intrusive geotechnical investigation of the site.

Scope of works

The original scope of works, which was specified by Arup, comprised of;

- Drilling of 25nr. cable percussive boreholes with rotary core follow-on, to an expected maximum depth of 30m;
- Excavation of 4nr. foundation inspection pits to approximately 3m to gather information on existing foundations;
- Excavation of 42nr. slit trenches to typically 1.2m depth;
- All associated sampling and
- Factual reporting.

The scope was altered during the period of works. Quantities and details of works carried out are outlined, herein. This factual report presents the fieldworks records and data obtained with regard to the ground investigation for the Dunkettle Advance ITS Works Ground Investigation project and should be read in conjunction with the exploratory and photographic records and laboratory test data accompanying this factual report (attached).

Site Works

This investigation was carried out in accordance with Eurocode 7- Geotechnical Design Part 2, ground investigation and testing (BS EN 1997-2: 2007) and the relevant British Standards (BS 5930 (2015) Code of Practice for Site Investigation and BS 1377, Method of Tests for Soil for Civil Engineering Purposes, *in situ* Tests Parts 1 to 9).

The fieldworks were undertaken between the 12th of December 2019 and the 20th of May, 2020 under the supervision of PGL's, Engineering Geologist. Details of the plant and equipment used are detailed on the relevant exploratory records, attached herein.

Cable Percussion Boreholes

A total of eighteen (18) cable percussion boreholes were advanced to depths of between 0.5m below existing ground level (bgl) and 6.2m bgl using PGL's Dando 2000 light cable percussion rig and 200mm diameter casing. Boreholes terminated after chiselling without progress. The records are attached, herein.

Location	Depth (m bgl)	Date (dd/mm/yyyy)
BH901	1.4	20/12/2019
BH902	4.7	17/01/2020
BH905	0.8	09/01/2020
BH906	1.3	09/01/2020
BH908	0.8	09/01/2020
BH911	2.3	07/01/2020
BH915	0.5	20/01/2020
BH916	5.1	10/01/2020
BH917	2.6	13/01/2020
BH918	5.6	16/01/2020
BH919	4.2	15/01/2020
BH920	3.8	20/01/2020
BH921	6.2	14/01/2020
BH923	3.4	22/01/2020
BH925	3.5	21/01/2020
BH926	2.3	27/01/2020
BH927	4.8	24/01/2020
BHDA34	2.1	18/05/2020

Location	Chiselling		Duration (hh:mm)	Tool
	Depth Top (m bgl)	Depth Base (m bgl)		
BH901	0.8	0.95	03:00	Chisel.
BH901	1.4	1.45	01:00	Chisel.
BH902	1.2	1.36	00:30	Chisel.
BH902	2.4	2.57	00:30	Chisel.
BH902	4.7	4.7	01:00	Chisel.
BH905	0.8	0.8	01:00	Chisel.
BH906	1.3	1.3	01:00	Chisel.
BH908	0.8	0.8	01:00	Chisel.
BH911	1.5	1.65	00:30	Chisel.
BH911	2.0	2.17	00:30	Chisel.
BH911	2.3	2.3	01:00	Chisel.
BH915	0.5	0.5	01:00	Chisel.
BH916	4.3	4.47	00:30	Chisel.
BH916	5.0	5.1	01:00	Chisel.
BH916	5.1	5.1	01:00	Chisel.
BH917	1.4	1.57	00:30	Chisel.
BH917	1.8	1.97	00:30	Chisel.
BH917	2.3	2.48	00:30	Chisel.
BH917	2.6	2.6	01:00	Chisel.
BH918	2.6	2.76	00:30	Chisel.
BH918	5.6	5.6	01:00	Chisel.
BH919	3.3	3.45	00:30	Chisel.
BH919	4.2	4.2	01:00	Chisel.
BH920	1.2	1.38	00:30	Chisel.
BH920	3.8	3.8	01:00	Chisel.
BH921	3.4	3.57	00:30	Chisel.
BH921	5.7	5.88	00:30	Chisel.
BH921	6.2	6.2	01:00	Chisel.
BH923	2.6	2.79	00:30	Chisel.
BH923	3.4	3.4	01:00	Chisel.
BH925	1.2	1.37	00:30	Chisel.
BH925	3.5	3.5	01:00	Chisel.
BH926	1.2	1.37	00:30	Chisel.
BH926	2.3	2.3	01:00	Chisel.
BH927	1.8	1.97	00:30	Chisel.
BH927	3.8	3.96	00:30	Chisel.
BH927	4.8	4.8	01:00	Chisel.
BHDA34	1.3	1.46	00:30	Chisel.

Location	Chiselling		Duration (hh:mm)	Tool
BHDA34	1.7	1.85	00:30	Chisel.
BHDA34	2.1	2.1	02:00	Chisel.

Rotary Boreholes

Nineteen (19) rotary boreholes were drilled to depths between 5.5m bgl and 27.0m bgl using PGL's Soilmec PSM rotary rig. Open hole boring and T6H methods were utilised during the investigation. The exploratory records are attached, herein.

Location	Depth (m bgl)	Date (dd/mm/yyyy)
RC901	12.3	30/01/2020
RC902	13.7	31/01/2020
RC905	5.5	16/01/2020
RC906	6.0	16/01/2020
RC908	6.2	16/01/2020
RC911	24.0	04/02/2020
RC915	22.5	24/01/2020
RC916	22.5	22/01/2020
RC917	27.0	17/01/2020
RC918	16.8	20/01/2020
RC919	27.0	21/01/2020
RC920	25.5	14/02/2020
RC921	25.5	03/02/2020
RC923	19.8	23/01/2020
RC925	25.5	29/01/2020
RC926	24.0	28/01/2020
RC927	25.5	27/01/2020
RCDA34(01)	25.5	19/05/2020
RCDA34(02)	25.5	20/05/2020

Slit trenches

A total of forty four (44) number slit trenches were excavated to depths of between 0.6m bgl and 1.7m bgl using tracked excavators. The slit trench exploratory records are attached, herein.

Location	Depth (m bgl)	Date (dd/mm/yyyy)
ST901	1.6	17/12/2019
ST902	0.6	12/12/2019
ST905	1.15	09/01/2020
ST906	1.0	19/12/2019

Location	Depth (m bgl)	Date (dd/mm/yyyy)
ST907	0.9	19/12/2019
ST908A	1.0	19/12/2019
ST908-E	1.0	19/12/2019
ST908-V	1.3	19/12/2019
ST909	1.15	09/01/2020
ST910	1.05	19/12/2019
ST913	1.5	07/01/2020
ST914	1.5	06/01/2020
ST914A	1.4	23/01/2020
ST915	1.3	06/01/2020
ST916	1.4	06/01/2020
ST917	1.4	07/01/2020
ST918	0.6	19/12/2019
ST918A	1.4	23/01/2020
ST919	1.4	07/01/2020
ST920	1.2	08/01/2020
ST921	1.3	08/01/2020
ST921A	1.3	21/01/2020
ST922	1.3	08/01/2020
ST923	1.4	14/01/2020
ST924	1.6	10/01/2020
ST925	1.5	09/01/2020
ST926	1.3	14/01/2020
ST927	1.5	14/01/2020
ST928	1.3	13/01/2020
ST929	1.5	13/01/2020
ST930	1.5	13/01/2020
ST931	1.6	21/01/2020
ST932	1.5	21/01/2020
ST933	1.6	21/01/2020
ST938	1.5	07/01/2020
ST940	1.3	22/01/2020
ST941	0.7	22/01/2020
ST942	1.5	22/01/2020
ST950	1.3	18/05/2020
ST951	1.7	18/05/2020
ST952	1.3	18/05/2020
ST953	1.6	18/05/2020
STDA34(01)	1.3	18/05/2020
STDA34(02)	1.2	18/05/2020

Foundation pits

Four (4) number foundation pits were excavated to depths of between 0.9m bgl and 2.4m bgl using a 3t tracked excavator. The foundation pit exploratory records are attached, herein.

Location	Depth (m bgl)	Date (dd/mm/yyyy)
FIP901	0.9	17/12/2019
FIP902	1.5	22/01/2020
FIP903	2.4	08/01/2020
FIP904	1.5	14/01/2020

Survey and Drawings

A manhole survey was undertaken by PGL to identify the existing structure and services present. The findings are presented in this factual report. Upon completion of the fieldworks, the 'as built' exploration locations were surveyed using Trimble 5700/5800 GPS equipment to the Ordinance Survey Irish Trans Mercator system of co-ordinates (ITM) and elevations to Malin Head datum. The exploratory locations are summarised below and shown on the Exploratory Location layout and Plan (P19248-SI-A, P19248-SI-01 to P19248-SI-13) attached.

Location	Easting	Northing	Ground Level (mOD)	Final Depth (m bgl)	Date Start (dd/mm/yyyy)
BH901	571998.9	572677.1	2.88	1.4	20/12/2019
BH902	572568.4	573067.3	3.29	4.7	17/01/2020
BH905	573739.2	573883.2	56.61	0.8	09/01/2020
BH906	573832.9	573583.4	51.44	1.3	09/01/2020
BH908	573831.2	573328.4	44.1	0.8	09/01/2020
BH911	575227.7	572800.0	3.85	2.3	07/01/2020
BH915	575736.3	572857.2	3.46	0.5	20/01/2020
BH916	571582.7	569358.7	14.1	5.1	10/01/2020
BH917	571457.0	569975.3	6.65	2.6	13/01/2020
BH918	571818.9	570100.5	3.88	5.6	16/01/2020
BH919	571799.2	570061.7	3.78	4.2	15/01/2020
BH920	572471.7	570459.6	8.83	3.8	20/01/2020
BH921	572624.8	570212	13.34	6.2	14/01/2020
BH923	573072.9	570750.3	4.65	3.4	22/01/2020
BH925	573013.4	571294.1	4.6	3.5	21/01/2020
BH926	572958.4	571332.8	4.82	2.3	27/01/2020
BH927	572914.7	571453.3	5.34	4.8	24/01/2020
BHDA34	576123.4	573014.6	5.55	2.1	18/05/2020
FIP901	572558.7	573079.9	1.32	0.9	17/12/2019

Location	Easting	Northing	Ground Level (mOD)	Final Depth (m bgl)	Date Start (dd/mm/yyyy)
FIP902	571586.7	569369.9	15.46	1.5	22/01/2020
FIP903	571780.1	570096	4.86	2.4	08/01/2020
FIP904	571792.2	570061.8	4.86	1.5	14/01/2020
RC901	571998.9	572677.1	2.88	12.3	30/01/2020
RC902	572568.4	573067.3	3.29	13.7	31/01/2020
RC905	573739.2	573883.2	56.61	5.5	16/01/2020
RC906	573832.9	573583.4	51.44	6	16/01/2020
RC908	573831.2	573328.4	44.1	6.2	16/01/2020
RC911	575207	572798.1	3.85	24	04/02/2020
RC915	575736.3	572857.2	3.46	22.5	24/01/2020
RC916	571582.7	569358.7	14.1	22.5	22/01/2020
RC917	571457	569975.3	6.65	27	17/01/2020
RC918	571818.9	570100.5	3.88	16.8	20/01/2020
RC919	571799.2	570061.7	3.78	27	21/01/2020
RC920	572471.7	570459.6	8.83	25.5	14/02/2020
RC921	572624.8	570212	13.34	25.5	03/02/2020
RC923	573072.9	570750.3	4.65	19.8	23/01/2020
RC925	573013.4	571294.1	4.6	25.5	29/01/2020
RC926	572958.4	571332.8	4.82	24	28/01/2020
RC927	572914.7	571453.3	5.34	25.5	27/01/2020
RCDA34(01)	576130.1	572999.5	5.11	25.5	19/05/2020
RCDA34(02)	576118.8	573019.3	5.3	25.5	20/05/2020
ST901	571994.8	572672.2	2.88	1.6	17/12/2019
ST902	572567.3	573066.1	3.18	0.6	12/12/2019
ST905	573726.4	573853.9	56.4	1.15	09/01/2020
ST906	573737.8	573880.7	56.55	1	19/12/2019
ST907	573794.3	573713.3	54.09	0.9	19/12/2019
ST908A	573832.3	573577.7	51.38	1	19/12/2019
ST908-E	573831.7	573580.3	51.4	1	19/12/2019
ST908-V	573831.7	573580.3	51.4	1.3	19/12/2019
ST909	573819.1	573333.6	43.54	1.15	09/01/2020
ST910	573829.4	573330.8	44.08	1.05	19/12/2019
ST913	575227.8	572797	3.62	1.5	07/01/2020
ST914	575226.1	572784.1	3.99	1.5	06/01/2020
ST914A	575199.3	572782.8	4.01	1.4	23/01/2020
ST915	575460.7	572801.9	4.12	1.3	06/01/2020
ST916	575616.5	572828.4	4.08	1.4	06/01/2020
ST917	575725.4	572874	3.45	1.4	07/01/2020
ST918	575730.8	572863.7	3.6	0.6	19/12/2019
ST918A	575760.2	572873.8	3.5	1.4	23/01/2020

Location	Easting	Northing	Ground Level (mOD)	Final Depth (m bgl)	Date Start (dd/mm/yyyy)
ST919	571581.4	569379.4	14.21	1.4	07/01/2020
ST920	571205.4	569870.2	4.21	1.2	08/01/2020
ST921	571460.9	569972.3	6.8	1.3	08/01/2020
ST921A	571488.9	569988.5	6.91	1.3	21/01/2020
ST922	571819	570100.3	3.99	1.3	08/01/2020
ST923	571798.6	570066.3	3.61	1.4	14/01/2020
ST924	572455.9	570460.2	8.99	1.6	10/01/2020
ST925	572473.7	570452.6	9.43	1.5	09/01/2020
ST926	572514.7	570256.9	12.6	1.3	14/01/2020
ST927	572615.5	570294.4	14.8	1.5	14/01/2020
ST928	572638.4	570294.2	13.65	1.3	13/01/2020
ST929	572622.8	570208.7	13.29	1.5	13/01/2020
ST930	572609.8	570132.2	11.43	1.5	13/01/2020
ST931	572968.8	570511.2	5.82	1.6	21/01/2020
ST932	573077	570751.7	4.13	1.5	21/01/2020
ST933	573086.6	570740.9	4.53	1.6	21/01/2020
ST938	573008.9	571292.3	4.61	1.5	07/01/2020
ST940	572962.2	571334.4	4.64	1.3	22/01/2020
ST941	572971.5	571339.5	4.59	0.7	22/01/2020
ST942	572919.4	571454.4	5.34	1.5	22/01/2020
ST950	573712.7	572386.1	7.39	1.3	18/05/2020
ST951	573993	572389.7	4.1	1.7	18/05/2020
ST952	574324.2	572533.2	3.54	1.3	18/05/2020
ST953	574613.5	572688.3	5.44	1.6	18/05/2020
STDA34(01)	576125.7	573003.1	5.16	1.3	18/05/2020
STDA34(02)	576121.5	573013.2	5.66	1.2	18/05/2020

Sampling

A total of one hundred and forty six (146) bulk disturbed samples (B), twenty five (25) small disturbed samples (D), two (02) undisturbed samples (U), twenty seven (27) push in window samples (WS) and rotary core were recovered from the exploratory holes in accordance with Geotechnical Investigation and Sampling– Sampling Methods and Groundwater Measurements (EN ISO 22475-1:2006).

Thirty three (33) environmental samples (ENV) were taken at 0.4m bgl to 1.2m bgl at exploratory locations. These were placed immediately in air-tight containers, which were filled to the top of the sample container. The sample suite consisted of: 2No. small disturbed samples (D) not less than 1.0kg, 2No. 250g amber glass sample containers and 2No. 60g amber glass sample containers.

The preparation for and methods of taking environmental samples, together with their size, preservation and handling was in accordance with British Standard BS 5930: 1981-Code of Practice for Site investigation, the contract documents and the Association of Geotechnical and Geoenvironmental Specialists (AGS) guide to environmental sampling, September 2010.

In-Situ Testing

Standard Penetration Test

Standard Penetration Tests, N values, were typically carried out in the boreholes using the 60° solid cone in place of the standard split barrel sampler. The Standard Penetration Test was carried out in accordance with Geotechnical Investigation and Testing, Part 3 Standard penetration test, BS EN ISO 22476-3:2005+A1:2011. Fifty seven (57) SPT's were carried out in cable percussion boreholes and two hundred and eleven (211) in rotary holes. The data is presented on the exploratory logs accompanying this factual report.

Laboratory Testing

Laboratory testing was scheduled by Atkins and carried out by PGL in accordance with BS1377 (1990), Methods of test for soils for civil engineering purposes and the ISRM suggested methods for rock characterisation, testing and monitoring. Specialist environmental testing was carried out by Chemtest UK Ltd. on behalf of PGL. Test results are summarised below and accompany this factual report.

Please note that all samples shall be retained for a period no longer than 28 days from the date of this report. Thereafter all remaining samples shall be appropriately disposed of unless a written instruction to the contrary is received by PGL prior to the date of this reporting and within the 28 day period outlined above. Laboratory testing will result in a reduction of sample quantity and in some cased the use of the full sample mass. Samples already tested may not be suitable or available for further testing.

SUMMARY OF LABORATORY TESTSING

Soil		
Type	**Nr.**	**Remarks**
Natural Moisture Content	145	4% to 110%
Atterberg Limits	80	Liquid Limit, LL 21% to 177% Plastic Limit, PL 13% to 116% incl. non plastic soils Plasticity Index, PI 6 to 61 incl. non plastic soils
Particle Size Distribution	45	28Nr. hydrometer analysis on fine soils
pH	46	7.2 to 10.2
Sulphate (water soluble as SO_4)	46	<0.010g/l to 0.78g/l
Dry Density/ Moisture Content Relationship	01	RC919 4.5m. **Maximum dry density**: 2.18Mg/m^3 **Optimum moisture content**: 9.9%
One dimensional consolidation test	09	RC911 4.5m, RC911 7.5m, RC917 7.5m, RC925 6.0m, RC926 6.0m, RCDA34(01) 6.0m, RCDA34(01) 12.0m, RCDA34(02) 7.5m and RCDA34(02) 12.0m.
Moisture Condition Value (MCV)	01	BH921 1.5m. **MCV**: 2.4
Unconsolidated Undrained Triaxial	11	BH920 2.0m, BH927 3.0m, RC911 3.0m, RC915 3.0m, RC915 4.5m, RC915 6.0m, RC917 9.0m, RC926 4.5m, RCDA34(01) 9.0m, RCDA34(02) 6.0m and RCDA34(02) 10.5m.
Environmental Suite D	14	See attached results
Environmental Suite E	24	See attached results

Rock		
Point Loads	12	0.1MPa to 3.8MPa

Published Geology

Solid

The Geological Survey of Ireland, 1:100,000 mapping (Sheet 25) was reviewed to determine the geology of the sites. The geology of Cork City is defined by five major units along a syncline. Front north to south, furthest north lies the Gyleen Formation (GY) described as Upper Devonian red Sandstone with Mudstone and Siltstones towards the top of the unit. The Old Head Sandstone Formation (OH) lies immediately south and is characterised by Upper Devonian flaser bedded Sandstone and Minor Mudstone. This is followed by the Cuskinny Member KNcu), defined by Dinantian flaser bedded Sandstone and Mudstone. Next is the Ballysteen Formation (BA), defined by dark muddy Limestone and Shale. This is followed by Waulsortian Limestones (WA) described as massive unbedded Lime-mudstone. The relatively minor Cork Red Marble Formation (CK) occurs next and is described as red brecciated calcilutite Limestone. The central section of the Cork City Syncline is defined by the Little Island Formation (LI) comprised of Massive and crinoidal fine Limestone. Waulsortion Limestones (WA) occur again directly south followed by the geological sequence of the Cuskinny Member, Gyleen Formation and Old Head Sandstone which are repeated on the southern section of the syncline.

Superficial Deposits

Teagasc subsoil mapping indicates the area is underlain by Made Ground deposits. Quaternary deposits mainly consisting of peats and silts are anticipated followed by river deposits of Sands and Gravels and Glacial deposits of Gravels. The national aquifer vulnerability mapping indicated a low to extreme vulnerability rating across the study area.

Ground and Groundwater Conditions

The full details of the ground conditions encountered are provided for on the exploratory records accompanying this report. The records provide descriptions, in accordance with BS 5930 (2015) and Eurocode 7, Geotechnical Investigation and Testing, Identification and classification of soils, Part 1, Identification and description (EN ISO 14688-1: 2002),– Identification and Classification of Soil, Part 2: Classification Principles (EN ISO 14688-2:2004) and Identification and Classification of Rock, Part 1: Identification & Description (EN ISO 14689-1:2004) of the materials encountered, in situ testing and details of the samples taken, together with any observations made during the ground investigation.

Groundwater was encountered at depths 0.2m bgl to 16.5m bgl during the period of works. Groundwater observations may be subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions, tidal variations etc. Under the scope of works no sandpipe wells were installed. The groundwater regime should be assessed from standpipe well installations, where available.

SUMMARY OF GROUNDWATER

Location	Depth Strike (m bgl)	Remarks
BH901	-	None encountered.
BH902	-	None encountered.
BH905	-	None encountered.
BH906	-	None encountered.
BH908	-	None encountered.
BH911	-	None encountered.
BH915	-	None encountered.
BH916	-	None encountered.
BH917	-	None encountered.
BH918	2.60	See shift data.
BH919	3.30	See shift data.
BH920	-	None encountered.
BH921	-	None encountered.
BH923	-	None encountered.
BH925	-	None encountered.
BH927	3.80	See shift data.
BHDA34	-	None encountered.
FIP901	0.80	Standing water. Assumed tidal.
FIP902	-	None encountered.
FIP903	-	None encountered.
FIP904	-	None encountered.
RC901	6.00	See shift data.
RC902	5.00	-
RC905	-	None encountered.
RC906	-	None encountered.
RC908	-	None encountered.
RC911	13.50	-

Location	Depth Strike (m bgl)	Remarks
RC915	-	None encountered.
RC916	10.50	See shift data.
RC917	-	None encountered.
RC918	6.00	See shift data.
RC919	4.50	Ground water volume increased below 15.0m.
RC919	15.00	-
RC920	12.00	-
RC921	16.50	Groundwater volume increased below 21.0m.
RC923	6.00	Groundwater volume increased below 13.0m.
RC925	7.50	-
RC926	6.00	-
RC927	12.00	Groundwater flow increased below 21.0m.
RCDA34(01)	-	None encountered.
RCDA34(02)	-	None encountered.
ST901	-	None encountered.
ST902	-	None encountered.
ST905	-	None encountered.
ST906	0.20	Groundwater encountered running on rock surface.
ST907	-	None encountered.
ST908A	-	None encountered.
ST908-E	-	None encountered.
ST908-V	-	None encountered.
ST909	-	None encountered.
ST910	-	None encountered.
ST913	-	None encountered.
ST914	-	None encountered.
ST914A	-	None encountered.
ST915	-	None encountered.
ST916	-	None encountered.
ST917	-	None encountered.
ST918	-	None encountered.
ST918A	-	None encountered.
ST919	-	None encountered.
ST920	-	None encountered.
ST921	-	None encountered.
ST921A	-	None encountered.
ST922	-	None encountered.
ST923	-	None encountered.

Location	Depth Strike (m bgl)	Remarks
ST924	-	None encountered.
ST925	-	None encountered.
ST926	-	None encountered.
ST927	-	None encountered.
ST928	-	None encountered.
ST929	-	None encountered.
ST930	-	None encountered.
ST931	-	None encountered.
ST932	-	None encountered.
ST933	-	None encountered.
ST938	-	None encountered.
ST940	-	None encountered.
ST941	-	None encountered.
ST942	-	None encountered.
ST951	-	None encountered.
ST952	-	None encountered.
ST953	-	None encountered.
STDA34(01)	-	None encountered.
STDA34(02)	-	None encountered.

Exploratory holes were backfilled upon instruction from the engineer. Backfill details are shown graphically on the exploratory logs accompanying this factual report.

▩ ARISINGS Backfill

▨ BENTONITE Backfill

Should you have any queries in relation to the data collected, please do not hesitate to contact our office.

Yours sincerely,
For **Priority Geotechnical,**

S McSweeney

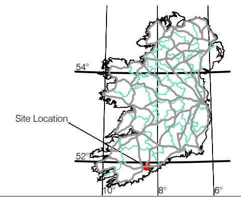
James McSweeney BSc
Engineering Geologist

No responsibility can be held by PGL for ground conditions between exploratory locations. The exploratory logs provide for ground profiles and configuration of strata relevant to the investigation depths achieved during the fieldworks. Caution shall be taken when extrapolating between such exploratory locations. No liability is accepted for ground conditions extraneous to the exploratory locations.

No account has been taken of potential subsidence or ground movement due to mineral extraction, mining works or karstification below or in proximity to the site, unless specifically addressed.

This report has been prepared for Employer and their Representative as outline, herein. The information should not be used without their prior written permission. PGL accepts no responsibility or liability for this document being used other than for the purposes for which it was intended.

Priority Geotechnical Site



JOB NAME:

N40 / Dunkettle Interchange Upgrade Scheme

Sheet Title:

EXPLORATORY LOCATION LAYOUT

JOB NUMBER:

P19248

DRAWING NUMBER:

P19248-SI-A

DRAWN BY:

Gary Curtin

DATE:

06/01/2020

SCALE:	APPROVED:
1:20,000 ON A3	GH

REVISION:

D01

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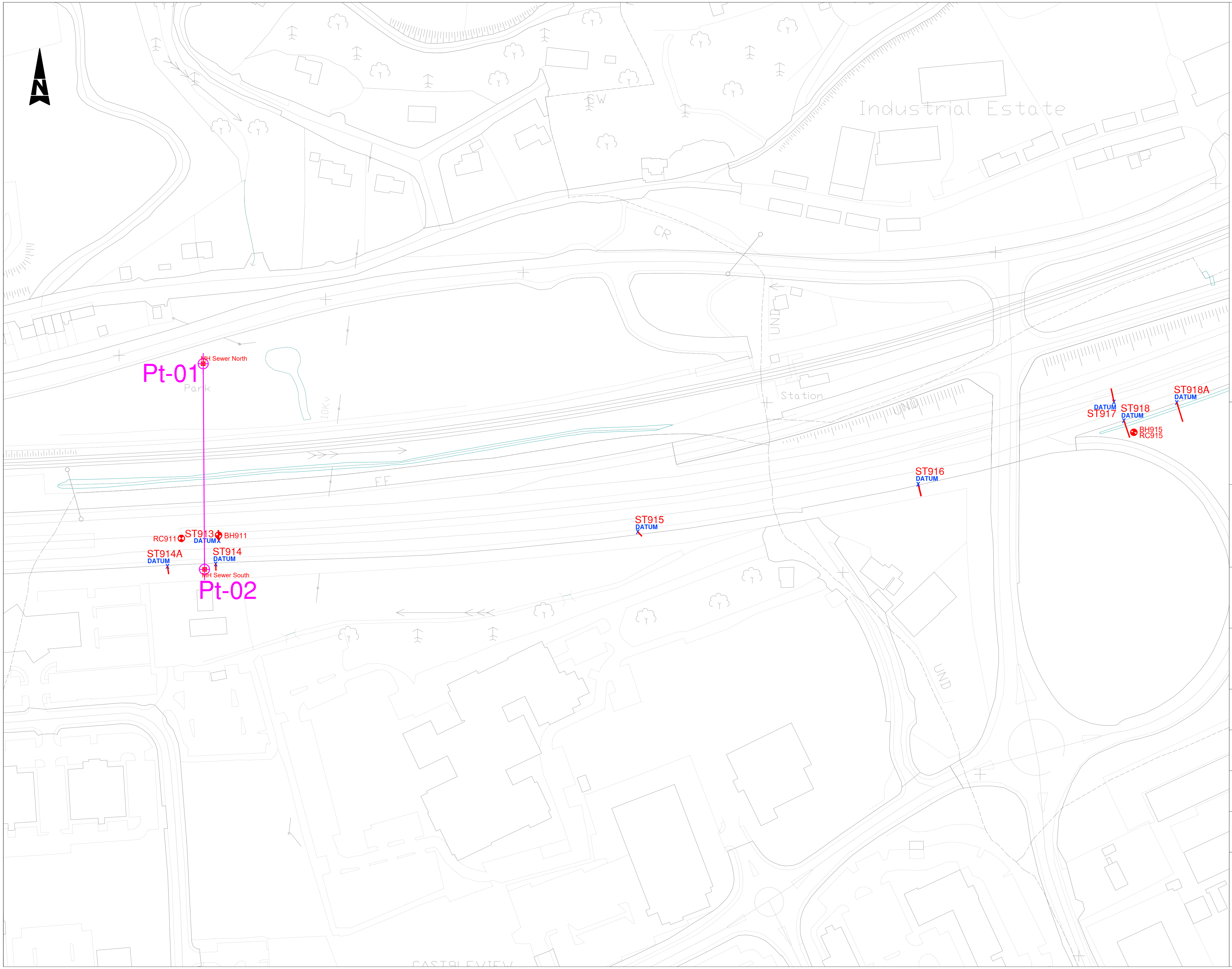

KEY:

▨ TP00	Denotes Trial Pit location
⊕ CPT00	Denotes Dynamic Probe location
● BH00	Denotes Borehole location
● RC00	Denotes Rotary Core location
✱ FP00	Denotes Foundation Pit location

JOB NAME:

N40 / Dunkettle Interchange Upgrade Scheme

Sheet Title:

EXPLORATION LOCATION PLAN

JOB NUMBER:

P19248

DRAWING NUMBER:

P19248-SI-07

DRAWN BY:

Gary Curtin

DATE:

06/01/2020

SCALE:	APPROVED:
1:2000 ON A3	GH

REVISION:

D01

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KEY TO SYMBOLS ON EXPLORATORY HOLE RECORDS

All linear dimensions are in metres or millimetres

DESCRIPTIONS

**	Drillers Description
Friable	Easily crumbled

SAMPLES

U( )	Undisturbed 102mm diameter sample, ( ) denotes number of blows to drive sampler
U( )F, U( )P	F- not recovered, P-partially recovered
U38	Undisturbed 38mm diameter sample
P(F), (P)	Piston sample - disturbed
B	Bulk sample - disturbed
D	Jar Sample - disturbed
W	Water Sample
CBR	California Bearing Ratio mould sample
ES	Chemical Sample for Contamination Analysis
SPTLS	Standard Penetration Test S lump sample from split sampler

CORE RECOVERY AND ROCK QUALITY

TCR	Total Core Recovery (% of Core Run)
SCR	Solid Core Recovery (length of core having at least one full diameter as % of core run)
RQD	Rock Quality Designation (length of solid core greater than 100mm as % of core run)

Where there is insufficient space for the TCR, SCR and RQD, the results may be found in the remarks column

If	Fracture Spacing in mm (Minimum/Average/Maximum) NI - non intact, NR - no recovery
AZCL	Assumed Zone of Core Loss
NI	Non intact

GROUNDWATER

▽	Groundwater strike
▼	Groundwater level after standing period
Date/Water	Date of shift (day/month)/Depth to water at end of previous shift shown above the date and depth to water at beginning of shift given below the date

INSITU TESTING

S	Standard Penetration Test - split barrel sampler
C	Standard Penetration Test - solid 60° cone
SW	Self Weight Penetration
Ivp, HVp (R)	In Situ Vane Test, Hand Vane Test (R) demonstrates remoulded strength
K(F), (C), (R), (P)	Permeability Test
HP	Hand Penetrometer Test

MEASURED PROPERTIES

N	Standard Penetration Test - blows required to drive 300mm after seating drive
x/y	Denotes x blows for y mm within the Standard Penetration Test
x*/y	Denotes x blows for y mm within the seating drive
c_u	Undrained Shear Strength (kN/m^2)
CBR	California Bearing Ratio

ROTARY DRILLING SIZES

Index Letter	Nominal Diameter (mm)	
	Borehole	Core
N	75	54
H	99	76
P	120	92
S	146	113

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Key Sheet

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Drilled By:	JC
Logged By:	OD

Borehole No.
BH911
Sheet 1 of 1

Project Name:	Dunkettle Advance ITS Works	**Project No.**	P19248
Co-ords:	575228E - 572800N	**Hole Type**	CP
Location:	Cork	**Level:**	3.85m OD
Scale	1:50		
Client:	Transport Infrastructure Ireland (TII)	**Date:**	07/01/2020 - 07/01/2020

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
								(TOPSOIL)
					0.30	3.55		Brown, slightly sandy gravelly SILT with rootlets. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded.
		0.50 - 1.00	B					
		1.20	SPT (C)	N=62 (8,10/13,15,18,16)				
					1.30	2.55		Stiff, brown, slightly sandy gravelly SILT with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-angular. Cobbles are angular to sub-angular.
		1.50 - 2.00	B					
		2.00	SPT (C)	N=82 (13,15/16,16,25,25)				
		2.30	SPT (C)	50 (25 for 75mm/50 for 100mm)	2.30	1.55		End of Borehole at 2.300m

Groundwater:

Struck (m bgl)	Rose to	After (mins)	Sealed	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
2.30	200	200

Equipment: Dando 2000

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
1.50	1.65	00:30	Chisel
2.00	2.17	00:30	Chisel
2.30	2.30	01:00	Chisel

Remarks:

Borehole terminated at 2.30m bgl due to obstruction.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	07/01/2020 08:00	0.00	Start of shift
Dry	07/01/2020 18:00	2.30	End of borehole.

Priority Geotechnical Ltd. **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**	**Drilled By:** GW	**Logged By:** N/A	Borehole No. **RC911** Sheet 1 of 3
Project Name: Dunkettle Advance ITS Works	**Project No.** P19248	**Co-ords:** 575207E - 572798N	**Hole Type** Rotary open hole
Location: Cork		**Level:** 3.85m OD	**Scale** 1:50
Client: Transport Infrastructure Ireland (TII)		**Dates:** 04/02/2020	04/02/2020

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / FI (/m)	Level (mOD)	Legend	Stratum Description	
▧										Cable tool borehole depth. Refer to BH911 for detailed overburden description.	1 2
▧							2.30	1.55	▩	Open hole boring. Driller described: (MADE GROUND) Clause 804 or similar with cobble content.	
▧							2.70	1.15	× × × ×	Open hole boring. Driller described: Soft, Silt.	
▧		3.00 - 3.50	WS						× × × ×		3
▧		N=5 (1,1/1,1,2,1) (C)							× × × ×		4
▧		4.50 - 5.50	WS						× × × ×		5
▧		N=4 (1,0/1,1,1,1) (C)							× × × ×		
▧		6.00 - 7.00	WS						× × × ×		6
▧		N=3 (1,0/0,1,1,1) (C)							× × × ×		7
▧		7.50 - 8.50	WS						× × × ×		8
▧							8.40	-4.55	∘ ∘ ∘	Open hole boring. Driller described: Medium dense to dense, clayey sandy Gravel with low cobble content.	
▧		N=26 (4,4/6,6,7,7) (C)							∘ ∘ ∘		9

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
13.50				

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
24.00	131	131

Equipment:	Soilmec PSM.
Method:	Compressed air mist.

Remarks:

Borehole terminated at 24.00m bgl due to water flow.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
Dry	04/02/2020 08:00	0.00	Start of shift.
	04/02/2020 18:00	24.00	End of borehole.

Priority Geotechnical Ltd. **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**	**Drilled By:** GW **Logged By:** N/A	Borehole No. **RC911** Sheet 2 of 3

Project Name:	Dunkettle Advance ITS Works	**Project No.** P19248	**Co-ords:**	575207E - 572798N	**Hole Type** Rotary open hole
Location:	Cork		**Level:**	3.85m OD	**Scale** 1:50
Client:	Transport Infrastructure Ireland (TII)		**Dates:**	04/02/2020	04/02/2020

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / FI (/m)	Level (mOD)	Legend	Stratum Description	
		N=29 (4,4/6,7,8,8) (C)								Open hole boring. Driller described: Medium dense to dense, clayey sandy Gravel with low cobble content.	
											10
		10.50 - 12.00 N=35 (5,6/6,8,10,11) (C)	B								
											11
											12
		N=41 (4,6/8,10,10,13) (C)									
											13
	▼	13.50 - 15.00 N=30 (5,7/7,7,7,9) (C)	B								
											14
							14.50	-10.65		Open hole boring. Driller described: Dense, sandy Gravel.	
											15
		N=50 (6,8/10,10,11,19) (C)									
											16
		N=35 (5,7/7,7,8,13) (C)									
											17
							18.00	-14.15			18

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
13.50				

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
24.00	131	131

Equipment:	Soilmec PSM.
Method:	Compressed air mist.

Remarks:

Borehole terminated at 24.00m bgl due to water flow.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	04/02/2020 08:00	0.00	Start of shift.
Dry	04/02/2020 18:00	24.00	End of borehole.

pgl priority geotechnical	**Priority Geotechnical Ltd.** **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**	**Drilled By:** GW **Logged By:** N/A	Borehole No. **RC911** Sheet 3 of 3

Project Name:	Dunkettle Advance ITS Works	**Project No.** P19248	**Co-ords:**	575207E - 572798N	**Hole Type** Rotary open hole
Location:	Cork		**Level:**	3.85m OD	**Scale** 1:50
Client:	Transport Infrastructure Ireland (TII)		**Dates:**	04/02/2020	04/02/2020

Well	**Water Strike (m)**	**Depth (m)**	**Type /Fs (min, max, avg)**	**Coring (%)** TCR	SCR	RQD	**Depth (m) / FI (/m)**	**Level (mOD)**	**Legend**	**Stratum Description**	
▨		N=29 (5,4/5,8,8,8) (C)							▨	Open hole boring. Driller described: Stiff, slightly sandy gravelly Clay with boulder content.	
											19
		50 (25 for 85mm/50 for 0mm) (C)									
											20
		N=60 (13,10/10,14,16,20) (C)									21
											22
		50 (5,6/50 for 30mm) (C)									
											23
		50 (25 for 75mm/50 for 0mm) (C)					24.00	-20.15		End of Borehole at 24.000m	24
											25
											26
											27

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
13.50				

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
24.00	131	131

Equipment:	Soilmec PSM.
Method:	Compressed air mist.

Remarks:

Borehole terminated at 24.00m bgl due to water flow.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	04/02/2020 08:00	0.00	Start of shift.
Dry	04/02/2020 18:00	24.00	End of borehole.

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Drilled By:	JC
Logged By:	OD
Borehole No.	**BH915**
	Sheet 1 of 1

Project Name:	Dunkettle Advance ITS Works	**Project No.**	P19248
Co-ords:	575736E - 572857N	**Hole Type**	CP
Location:	Cork	**Level:**	3.46m OD
Scale	1:50		
Client:	Transport Infrastructure Ireland (TII)	**Date:**	20/01/2020 - 20/01/2020

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
▨							▨	(TOPSOIL)
▨		0.20 - 0.50	B		0.20	3.26	▨	Brown, slightly sandy slightly gravelly SILT with low cobble content. Sand is fine to coarse. Gravel is fine to coarse and angular to rounded. Cobbles are 63mm to 100mm dia and angular to sub-angular.
		0.50	SPT (C)	50 (25 for 0mm/50 for 0mm)	0.50	2.96		End of Borehole at 0.500m

1
2
3
4
5
6
7
8
9

Groundwater:

Struck (m bgl)	Rose to	After (mins)	Sealed	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
0.50	200	200

Equipment: Dando 2000.

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
0.50	0.50	01:00	Chisel.

Remarks:

Borehole terminated at 0.50m bgl due to refusal.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	20/01/2020 08:00	0.00	Start of shift.
Dry	20/01/2020 18:00	0.50	End of borehole.

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Drilled By:	GW
Logged By:	HG

Borehole No.

RC915

Sheet 1 of 3

Project Name:	Dunkettle Advance ITS Works	**Project No.** P19248	**Co-ords:**	575736E - 572857N	**Hole Type** Rotary open hole
Location:	Cork		**Level:**	3.46m OD	**Scale** 1:50
Client:	Transport Infrastructure Ireland (TII)		**Dates:**	24/01/2020	24/01/2020

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / FI (/m)	Level (mOD)	Legend	Stratum Description
										Cable tool depth. Refer to BH915 for detailed overburden description.
							0.60	2.86		Open hole boring. Driller described: Stiff, Clay with boulder content.
		50 (25 for 60mm/50 for 70mm) (C)								
							1.90	1.56		Open hole boring. Driller described: Slightly sandy slightly gravelly CLAY.
		3.00 - 4.00	WS							
		N=7 (2,2/2,1,2,2) (C)					4.00	-0.54		Open hole boring. Driller described: Firm, Silt.
		4.50 - 5.50	WS							
							4.90	-1.44		Open hole boring. Driller described: Soft, slightly sandy slightly gravelly SILT.
		N=16 (2,3/3,4,5,4) (C)								
		6.00 - 7.00	WS							
		N=5 (1,1/1,2,1,1) (C)								
		7.50 - 8.50	WS							
		N=3 (1,0/0,1,1,1) (C)								
		N=4 (1,0/1,1,1,1) (C)								

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
				None encountered.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
22.50	131	131

Equipment:	Soilmech PSM
Method:	Compressed air

Remarks:

Borehole terminated at 22.50m bgl, required depth.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
Dry	24/01/2020 08:00 24/01/2020 18:00	0.00 22.50	Start of shift. End of borehole.

Priority Geotechnical Ltd. **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**	**Drilled By:** GW	**Logged By:** HG	Borehole No. **RC915** Sheet 2 of 3
Project Name: Dunkettle Advance ITS Works	**Project No.** P19248	**Co-ords:** 575736E - 572857N	**Hole Type** Rotary open hole
Location: Cork		**Level:** 3.46m OD	**Scale** 1:50
Client: Transport Infrastructure Ireland (TII)		**Dates:** 24/01/2020	24/01/2020

Well	**Water Strike (m)**	**Depth (m)**	**Type /Fs (min, max, avg)**	**Coring (%)** TCR	SCR	RQD	**Depth (m) / FI (/m)**	**Level (mOD)**	**Legend**	**Stratum Description**	
										Open hole boring. Driller described: Soft, slightly sandy slightly gravelly SILT.	
											10
		N=2 (1,2/1,0,0,1) (C)									
											11
		N=3 (1,0/0,1,1,1) (C)									12
											13
		N=9 (1,0/0,1,3,5) (C)									
							14.00	-10.54		Open hole boring. Driller described: Medium dense to dense, clayey sandy GRAVEL.	14
											15
		N=25 (4,4/5,7,6,7) (C)									
											16
		0 (39 for 75mm/0 for 0mm) (C)									
											17
											18

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
				None encountered.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
22.50	131	131

Equipment:	Soilmech PSM
Method:	Compressed air

Remarks:

Borehole terminated at 22.50m bgl, required depth.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	24/01/2020 08:00	0.00	Start of shift.
Dry	24/01/2020 18:00	22.50	End of borehole.

Priority Geotechnical Ltd. **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**	**Drilled By:** GW	**Logged By:** HG	Borehole No. **RC915** Sheet 3 of 3

Project Name:	Dunkettle Advance ITS Works	**Project No.** P19248	**Co-ords:**	575736E - 572857N	**Hole Type** Rotary open hole
Location:	Cork		**Level:**	3.46m OD	**Scale** 1:50
Client:	Transport Infrastructure Ireland (TII)		**Dates:**	24/01/2020	24/01/2020

Well	**Water Strike (m)**	**Depth (m)**	**Type /Fs (min, max, avg)**	**Coring (%)**			**Depth (m) / FI (/m)**	**Level (mOD)**	**Legend**	**Stratum Description**	
				TCR	SCR	RQD					
▨		53 (10,10/53 for 150mm) (C)							▒	Open hole boring. Driller described: Medium dense to dense, clayey sandy GRAVEL.	
											19
		N=49 (6,7/8,14,14,13) (C)									
											20
											21
		50 (25 for 85mm/50 for 0mm) (C)									
											22
		50 (16,19/50 for 75mm) (C)					22.50	-19.04		End of Borehole at 22.500m	
											23
											24
											25
											26
											27

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
				None encountered.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
22.50	131	131

Equipment:	Soilmech PSM
Method:	Compressed air

Remarks:

Borehole terminated at 22.50m bgl, required depth.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	24/01/2020 08:00	0.00	Start of shift.
Dry	24/01/2020 18:00	22.50	End of borehole.

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Trial Pit No
ST913
Sheet 1 of 1

Project Name: Dunkettle Advance ITS Works
Project No. P19248
Co-ords: 575228E - 572797N
Level: 3.62m OD
Date 07/01/2020

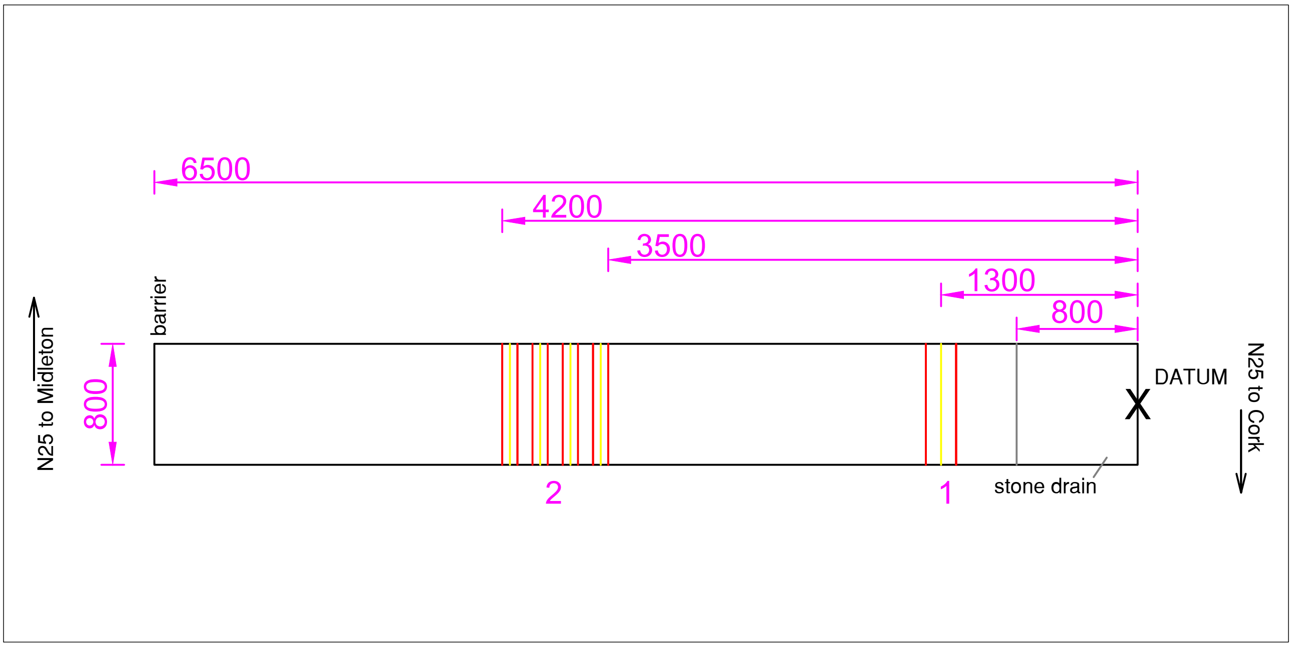
Location: Cork
Dimensions (m): 6.50 × 0.80
Scale 1:25

Client: Transport Infrastructure Ireland (TII)
Depth: 1.50m BGL
Logged DMC

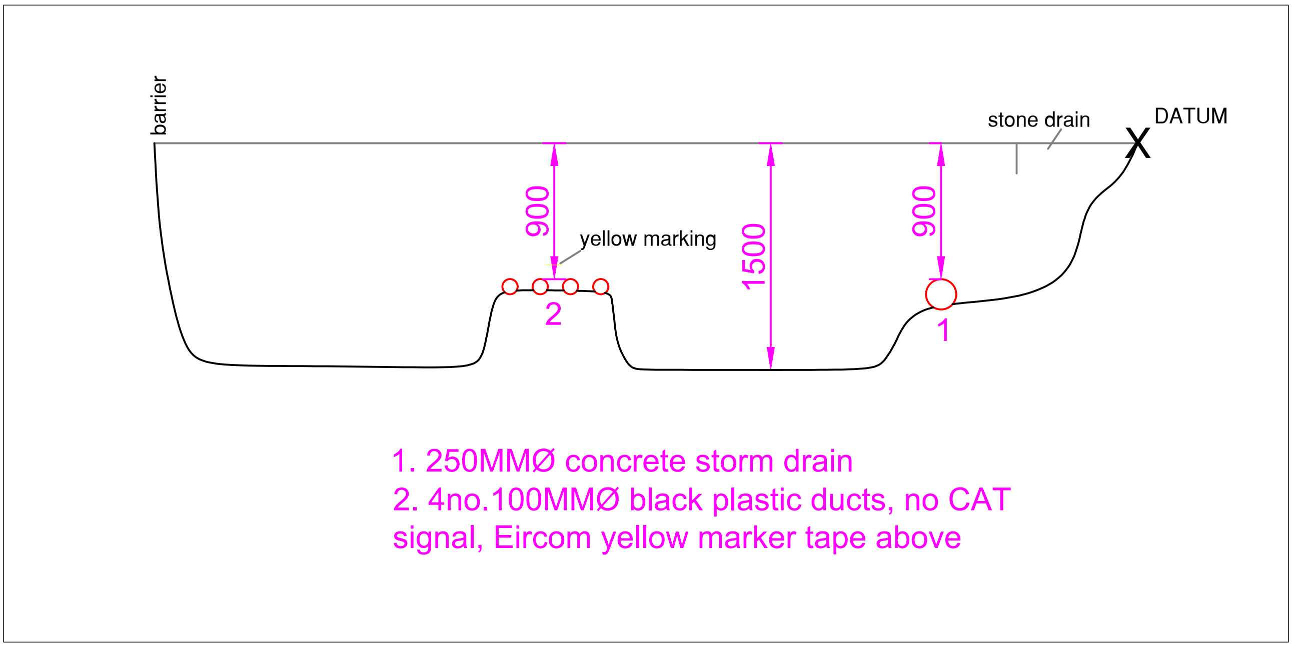
Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
				0.30	3.32		(TOPSOIL)
	0.50 0.50 - 1.50	ENV B		1.50	2.12		Soft, brown, slightly sandy gravelly SILT with medium cobble content and low boulder content. Cobbles are 63mm to 200mm dia, sub-angular. Boulders are 200mm to 800mm dia, sub-angular.
							End of Pit at 1.500m

Stability: Moderate.
Plant: 3t tracked excavator
Backfill: Arisings.
Groundwater: None encountered.

Remarks: Slit trench terminated at 1.50m bgl. Refer to DWG P19248 ST913 for cross sectional detail. Drainage stone surrounding the storm drain.

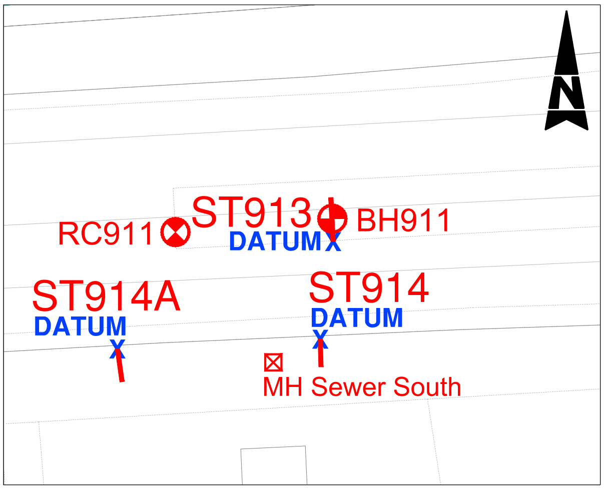


SLIT TRENCH PLAN, 1:50 ON A4



1. 250MMØ concrete storm drain
2. 4no.100MMØ black plastic ducts, no CAT signal, Eircom yellow marker tape above

SLIT TRENCH SECTION, 1:50 ON A4



SLIT TRENCH LOCATION PLAN, 1:1000 ON A4

DATUM COORDINATES:
EASTING: 575227.8
NORTHING: 575797.0
LEVEL: 3.618mAOD

KEY:
DATUM: X

SLIT TRENCH DIMENSIONS:
LENGTH: 6.50m
WIDTH: 0.80m
DEPTH: 1.50m

STRATA SHOWN ON DETAILED LOG

DRAWN BY: G.C.	DATE: 10/01/2020
LOGGED BY: D.McC.	DATE: 07/01/2020

SCALE: AS ST9ATED	APPROVED: GH	REVISION: D01

SLIT TRENCH NUMBER:

ST913

JOB NAME:
N40 / Dunkettle Interchange Upgrade Scheme

JOB NUMBER:
P19248

DRAWING NUMBER:
P19248-ST913

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Number:	**ST913**	**Project** **Project No** **Engineer**	Dunkettle Advance ITS Works P19248 Atkins

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Trial Pit No
ST914
Sheet 1 of 1

Project Name: Dunkettle Advance ITS Works

Project No. P19248

Co-ords: 575226E - 572784N

Level: 3.99m OD

Date 06/01/2020

Location: Cork

Dimensions (m): 4.60 × 0.70

Scale 1:25

Client: Transport Infrastructure Ireland (TII)

Depth: 1.50m BGL

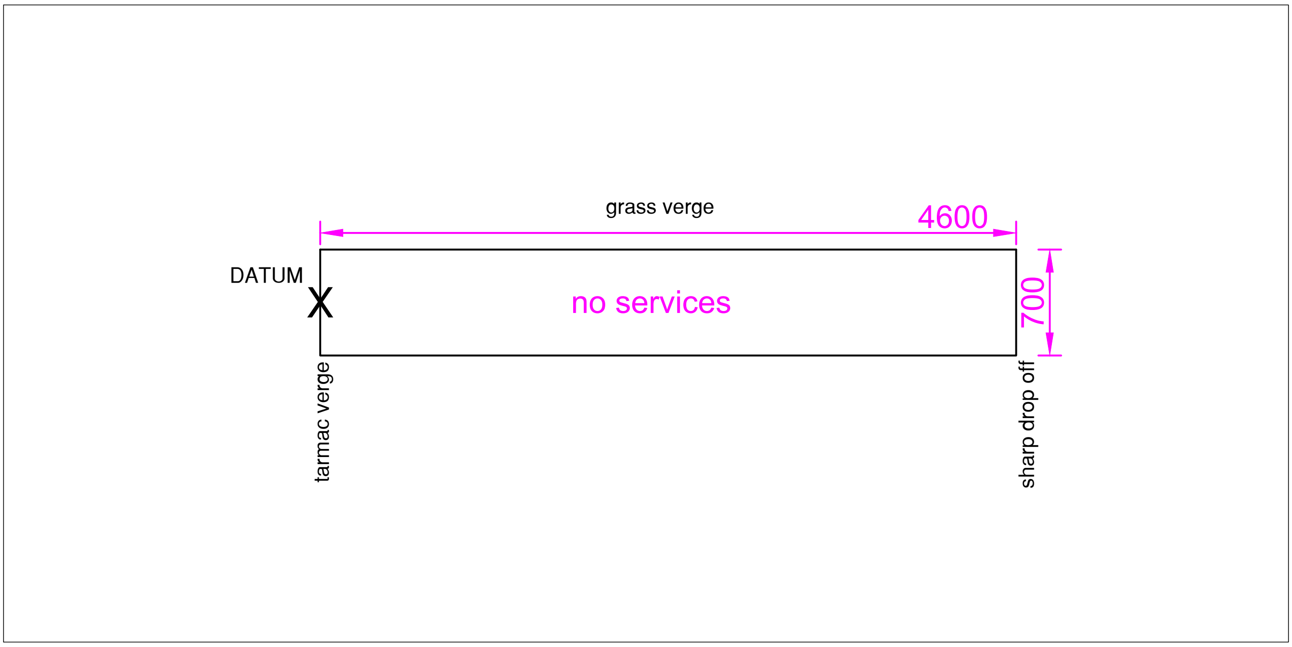
Logged DMC

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
▨				0.30	3.69	▨	(TOPSOIL)
▨	0.60 0.60 - 1.40	ENV B		1.50	2.49	⁘	Soft to firm, brown, slightly sandy gravelly SILT with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular. Cobbles are 63mm to 200mm dia, sub-angular to sub-rounded.
							End of Pit at 1.500m

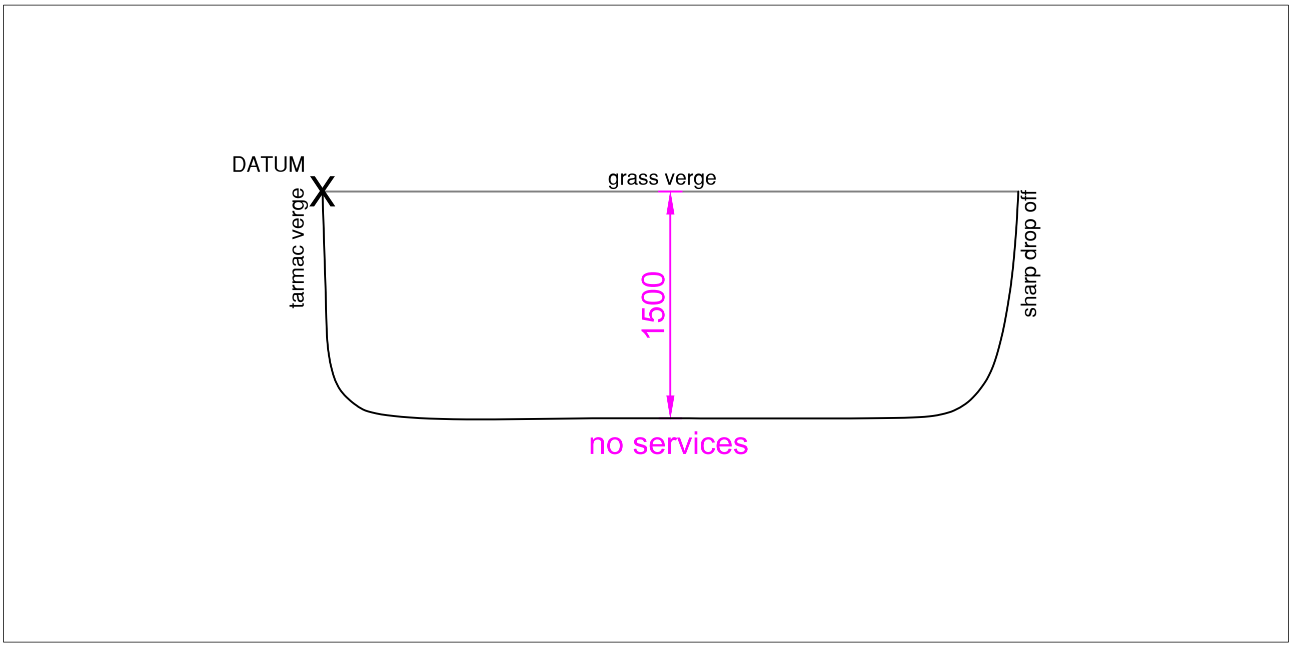
Stability: Good
Plant: 3t tracked excavator
Backfill: Arisings.

Groundwater: None encountered.

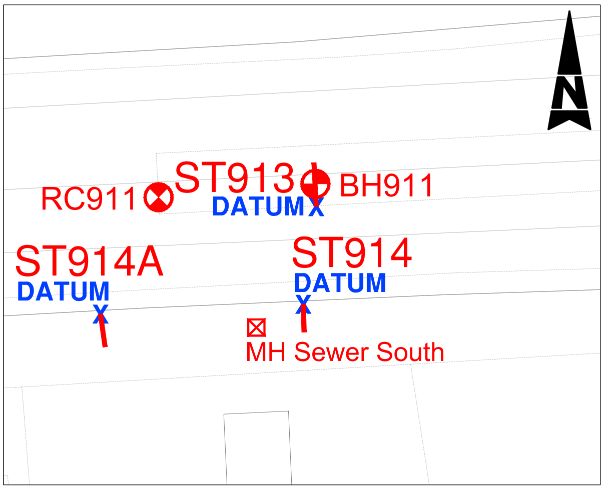
Remarks: Slit trench terminated at 1.50m bgl. Refer to DWG P19248 ST914 for cross sectional detail.



SLIT TRENCH PLAN, 1:50 ON A4



SLIT TRENCH SECTION, 1:50 ON A4



SLIT TRENCH LOCATION PLAN, 1:1000 ON A4

DATUM COORDINATES:

EASTING:	575226.1
NORTHING:	572784.1
LEVEL:	3.986mAOD

KEY:

DATUM: X

SLIT TRENCH DIMENSIONS:

LENGTH:	4.60m
WIDTH:	0.70m
DEPTH:	1.50m

STRATA SHOWN ON DETAILED LOG

DRAWN BY: G.C.		DATE: 09/01/2020
LOGGED BY: D.McC.		DATE: 06/01/2020
SCALE: AS ST9ATED	APPROVED: GH	REVISION: D01

SLIT TRENCH NUMBER:

ST914

JOB NAME:

N40 / Dunkettle Interchange Upgrade Scheme

JOB NUMBER:

P19248

DRAWING NUMBER:

P19248-ST914

pgl priority geotechnical

Number:	**ST914**	**Project** **Project No** **Engineer**	Dunkettle Advance ITS Works P19248 Atkins

Photographic Record

Number:	**ST914**	**Project** **Project No** **Engineer**	Dunkettle Advance ITS Works P19248 Atkins

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Trial Pit No
ST914A
Sheet 1 of 1

Project Name: Dunkettle Advance ITS Works

Project No. P19248

Co-ords: 575199E - 572783N

Level: 4.01m OD

Date 23/01/2020

Location: Cork

Dimensions (m): 4.40 × 0.70

Scale 1:25

Client: Transport Infrastructure Ireland (TII)

Depth: 1.40m BGL

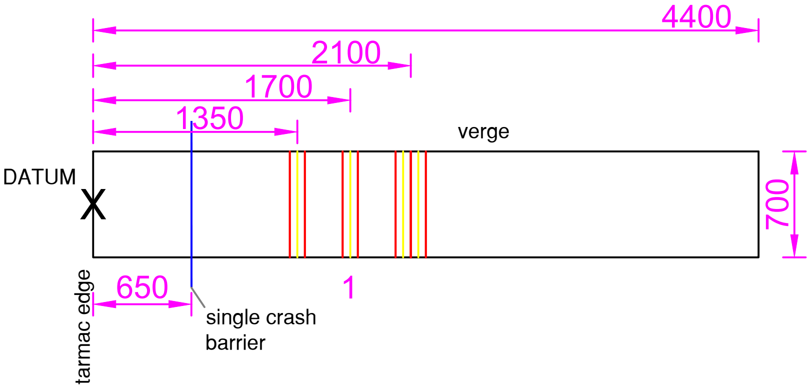
Logged DMC

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
▨						▨	(TOPSOIL)
▨	0.50 0.50 - 1.20 0.50 - 1.20	ENV B D		0.20	3.81	▒	Firm, brown, slightly sandy gravelly CLAY with high cobble content.
				1.40	2.61		End of Pit at 1.400m

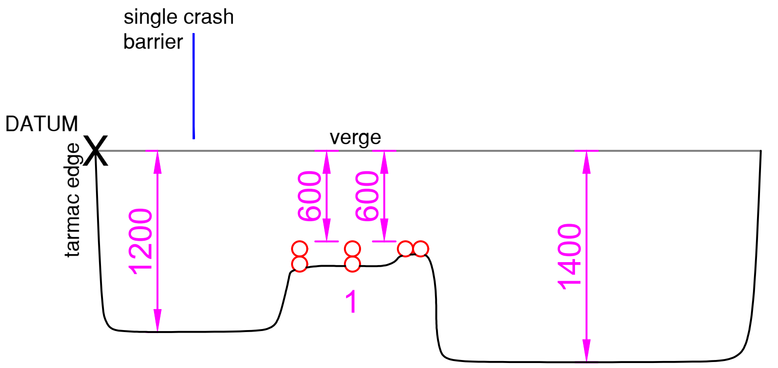
Stability: Good.
Plant: 3t tracked excavator
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Slit trench terminated at 1.40m bgl. Refer to drawing P19248 ST914A for cross section detail.

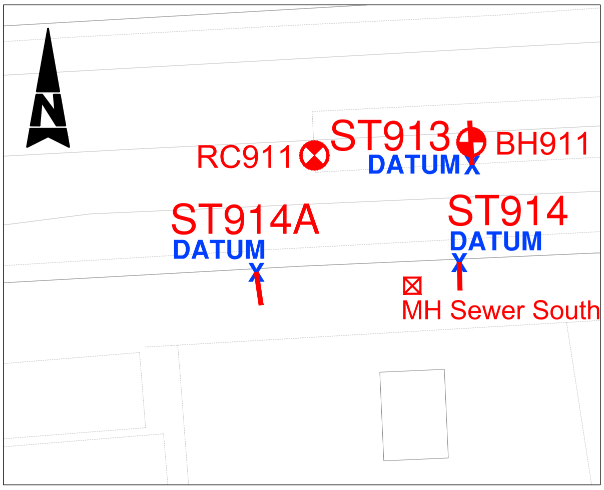


SLIT TRENCH PLAN, 1:50 ON A4



1. 6no.100MMØ black plastic ducts, possibly Eircom

SLIT TRENCH SECTION, 1:50 ON A4



SLIT TRENCH LOCATION PLAN, 1:1000 ON A4

DATUM COORDINATES:

EASTING:	575199.3
NORTHING:	572782.8
LEVEL:	4.006mAOD

KEY:

DATUM: X

SLIT TRENCH DIMENSIONS:

LENGTH:	4.40m
WIDTH:	0.70m
DEPTH:	1.40m

STRATA SHOWN ON DETAILED LOG

DRAWN BY: G.C.		DATE: 24/01/2020
LOGGED BY: D.McC.		DATE: 23/01/2020
SCALE: AS ST9ATED	APPROVED: GH	REVISION: D01

SLIT TRENCH NUMBER:

ST914A

JOB NAME:

N40 / Dunkettle Interchange Upgrade Scheme

JOB NUMBER:

P19248

DRAWING NUMBER:

P19248-ST914A

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Photographic Record

No photos

No photos

Number:	**ST914A**	**Project** **Project No** **Engineer**	Dunkettle Advance ITS Works P19248 Atkins

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Trial Pit No
ST915
Sheet 1 of 1

Project Name: Dunkettle Advance ITS Works

Project No. P19248

Co-ords: 575461E - 572802N

Level: 4.12m OD

Date 06/01/2020

Location: Cork

Dimensions (m): 3.30 0.60

Scale 1:25

Client: Transport Infrastructure Ireland (TII)

Depth: 1.30m BGL

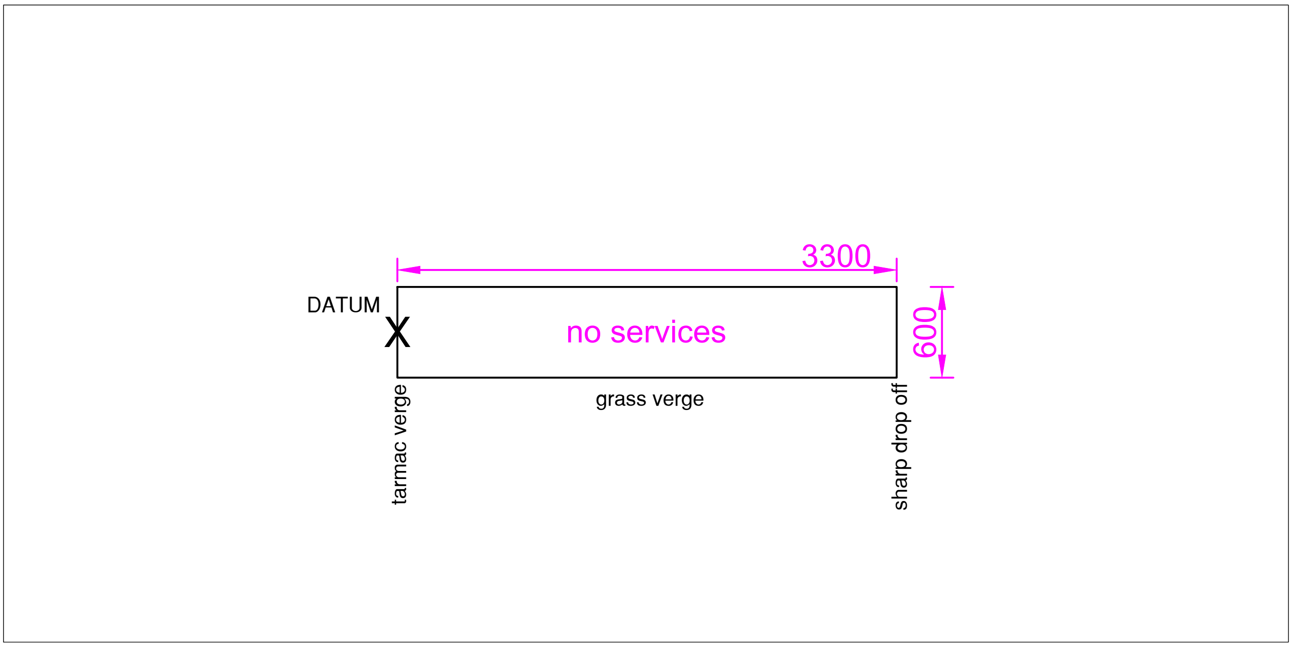
Logged DMC

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
				0.30	3.82		(TOPSOIL)
	0.60 0.60 - 1.20	ENV B		1.30	2.82		Soft to firm, brown, slightly sandy gravelly CLAY with high cobble content. Sand is fine to coarse, angular. Gravel is fine to coarse, angular. Cobbles are 63mm to 150mm dia, sub-angular to angular.
							End of Pit at 1.300m

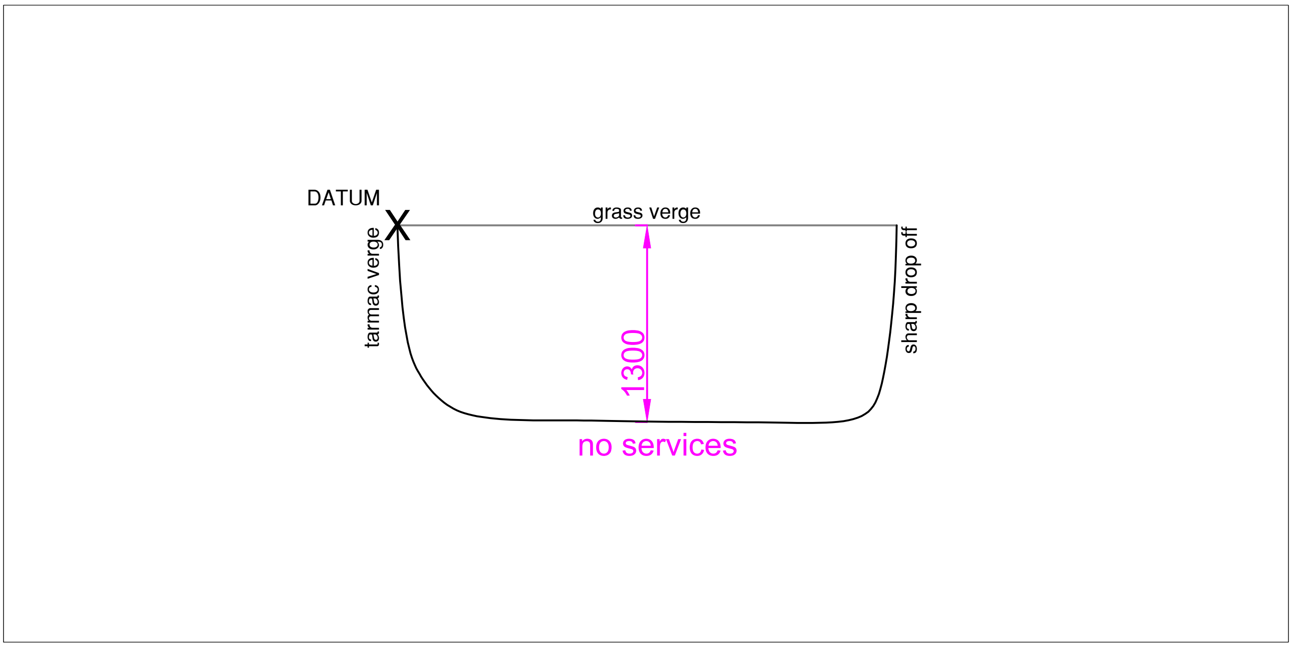
Stability: Good
Plant: 3t tracked excavator
Backfill: Arisings.

Groundwater: None encountered.

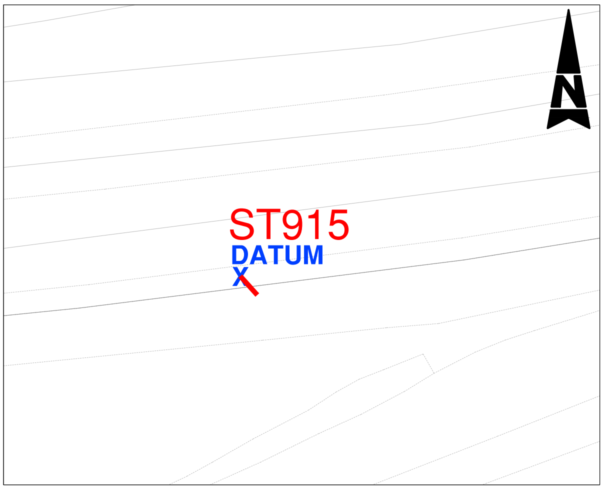
Remarks: Slit trench terminated at 1.30m bgl. Refer to DWG P19248 ST915 for cross sectional detail.



SLIT TRENCH PLAN, 1:50 ON A4



SLIT TRENCH SECTION, 1:50 ON A4



SLIT TRENCH LOCATION PLAN, 1:1000 ON A4

DATUM COORDINATES:

EASTING:	575460.7
NORTHING:	572801.9
LEVEL:	4.122mAOD

KEY:

DATUM: X

SLIT TRENCH DIMENSIONS:

LENGTH:	3.30m
WIDTH:	0.60m
DEPTH:	1.30m

STRATA SHOWN ON DETAILED LOG

DRAWN BY: G.C.

DATE: 09/01/2020

LOGGED BY: D.McC.

DATE: 06/01/2020

SCALE: AS ST9ATED

APPROVED: GH

REVISION: D01

SLIT TRENCH NUMBER:

ST915

JOB NAME:

N40 / Dunkettle Interchange Upgrade Scheme

JOB NUMBER:

P19248

DRAWING NUMBER:

P19248-ST915

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Photographic Record

Number:	**ST915**	**Project** **Project No** **Engineer**	Dunkettle Advance ITS Works P19248 Atkins

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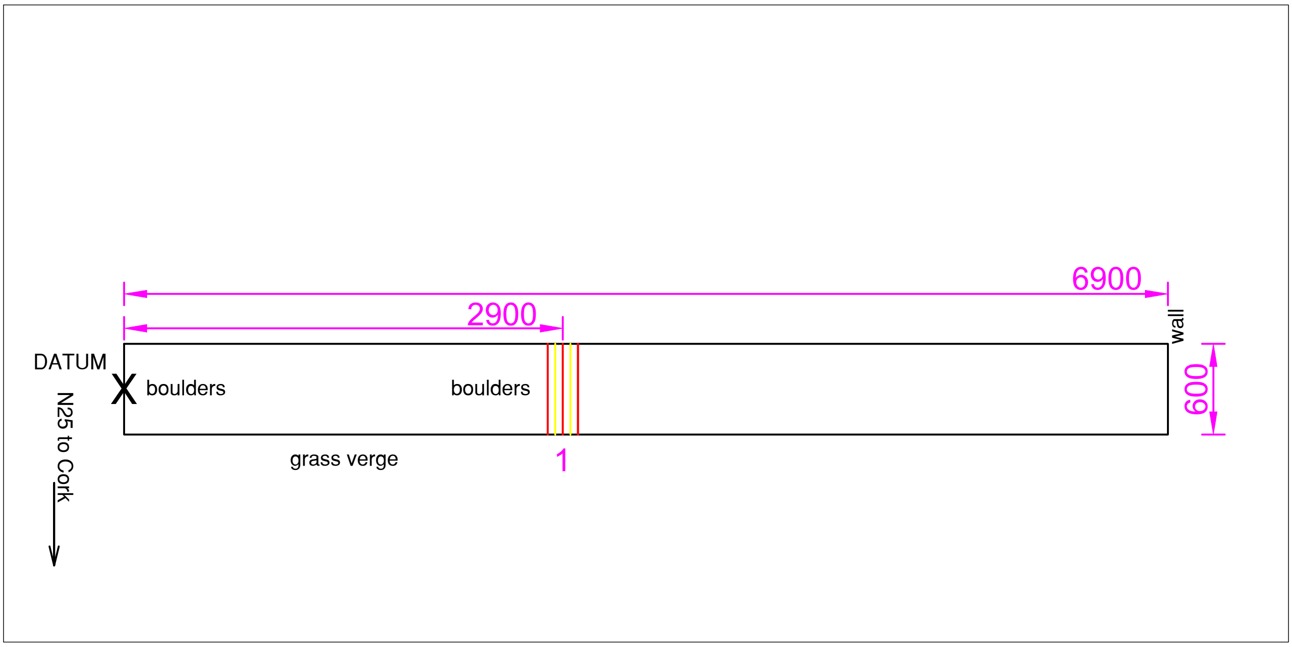
Trial Pit No
ST916
Sheet 1 of 1

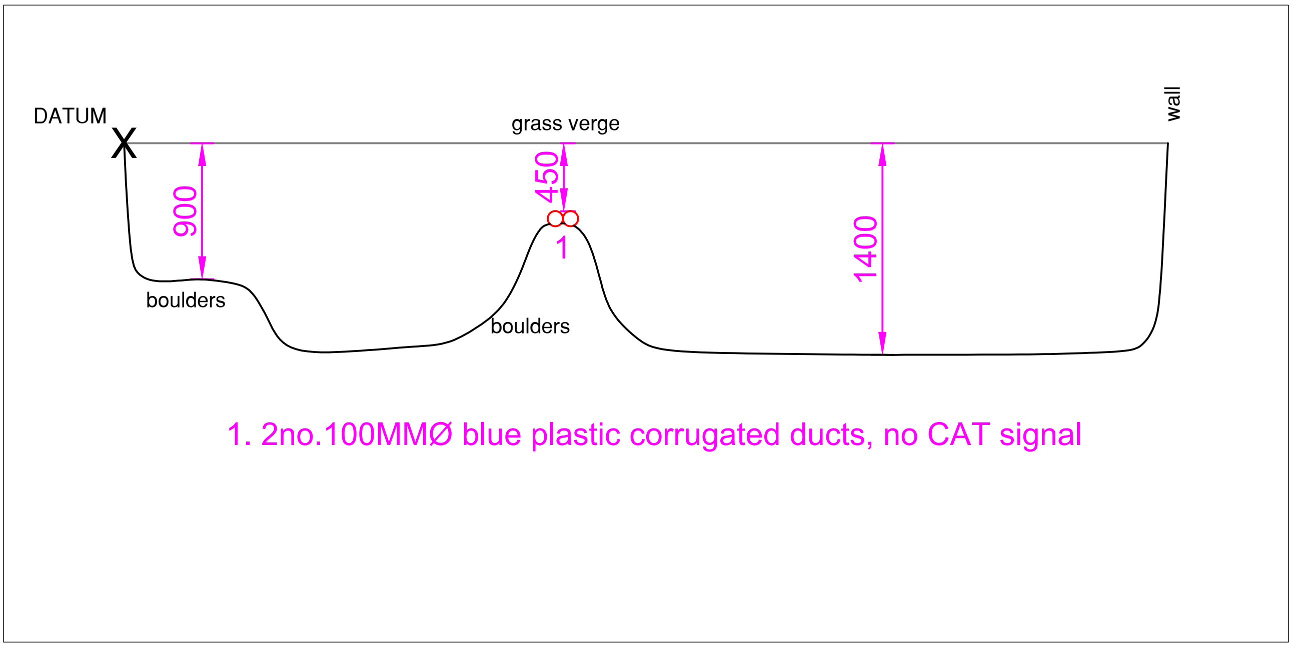
Project Name: Dunkettle Advance ITS Works	**Project No.** P19248	**Co-ords:** 575616E - 572828N **Level:** 4.08m OD	**Date** 06/01/2020
Location: Cork		**Dimensions (m):** 6.90 × 0.60	**Scale** 1:25
Client: Transport Infrastructure Ireland (TII)		**Depth:** 1.40m BGL	**Logged** DMC

Water Strike & Backfill	**Samples & In Situ Testing**			**Depth (m)**	**Level (m OD)**	**Legend**	**Stratum Description**
	Depth (m)	**Type**	**Results**				
▨				0.40	3.68	▨	(TOPSOIL) with roots.
▨	0.50 - 1.40 0.60	B ENV		1.40	2.68	▨	Soft to firm, grey, gravelly SILT with medium cobble content. Gravel is fine to coarse, angular. Cobbles are 63mm to 200mm dia, sub-angular.
							End of Pit at 1.400m

Stability: Good.
Plant: 3t tracked excavator
Backfill: Arisings.
Groundwater: None encountered.
Remarks: Slit trench terminated at 1.40m bgl. Refer to DWG P19248 ST916 for cross sectional detail.

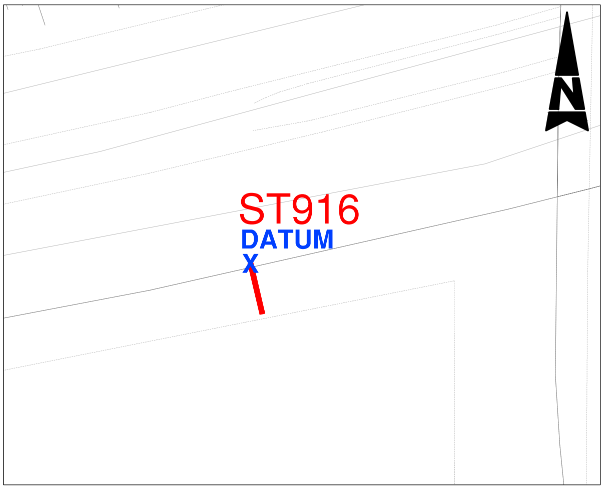


SLIT TRENCH PLAN, 1:50 ON A4



1. 2no.100MMØ blue plastic corrugated ducts, no CAT signal

SLIT TRENCH SECTION, 1:50 ON A4



SLIT TRENCH LOCATION PLAN, 1:1000 ON A4

DATUM COORDINATES:

EASTING:	575616.5
NORTHING:	572828.4
LEVEL:	4.076mAOD

KEY:

DATUM: X

SLIT TRENCH DIMENSIONS:

LENGTH:	6.90m
WIDTH:	0.60m
DEPTH:	1.40m

STRATA SHOWN ON DETAILED LOG

DRAWN BY: G.C.

DATE: 10/01/2020

LOGGED BY: D.McC.

DATE: 06/01/2020

SCALE: AS ST9ATED

APPROVED: GH

REVISION: D01

SLIT TRENCH NUMBER:

ST916

JOB NAME:

N40 / Dunkettle Interchange Upgrade Scheme

JOB NUMBER:

P19248

DRAWING NUMBER:

P19248-ST916

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Number:	**ST916**	**Project** **Project No** **Engineer**	Dunkettle Advance ITS Works P19248 Atkins

Photographic Record

Number:	**ST916**	**Project** **Project No** **Engineer**	Dunkettle Advance ITS Works P19248 Atkins	

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Trial Pit No
ST917
Sheet 1 of 1

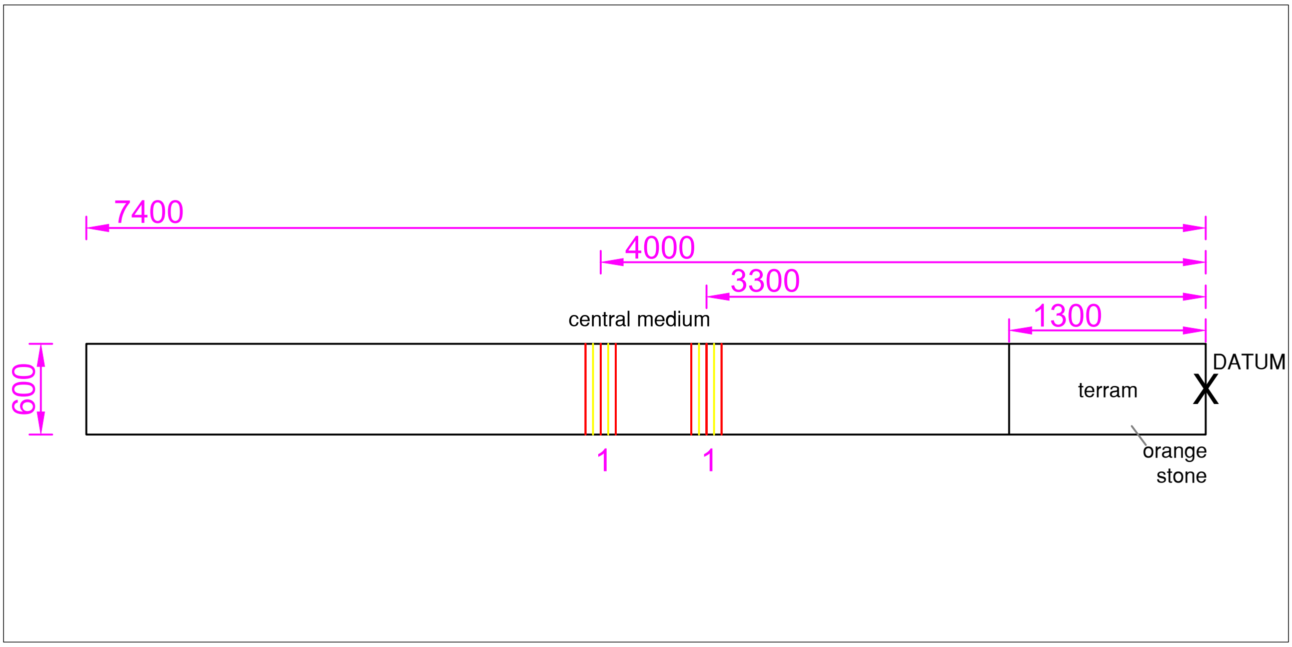
Project Name: Dunkettle Advance ITS Works	**Project No.** P19248	**Co-ords:** 575725E - 572874N **Level:** 3.45m OD	**Date** 07/01/2020
Location: Cork		**Dimensions (m):** 7.40 × 0.60	**Scale** 1:25
Client: Transport Infrastructure Ireland (TII)		**Depth:** 1.40m BGL	**Logged** DMC

Water Strike & Backfill	**Samples & In Situ Testing** Depth (m)	Type	Results	**Depth (m)**	**Level (m OD)**	**Legend**	**Stratum Description**
▨				0.20	3.25	▨	(TOPSOIL) with roots.
▨				1.40	2.05	▩	Soft to firm, brown, gravelly SILT with boulder content. Gravel is fine to coarse, angular. Boulders are 200mm to 1000mm.
							End of Pit at 1.400m

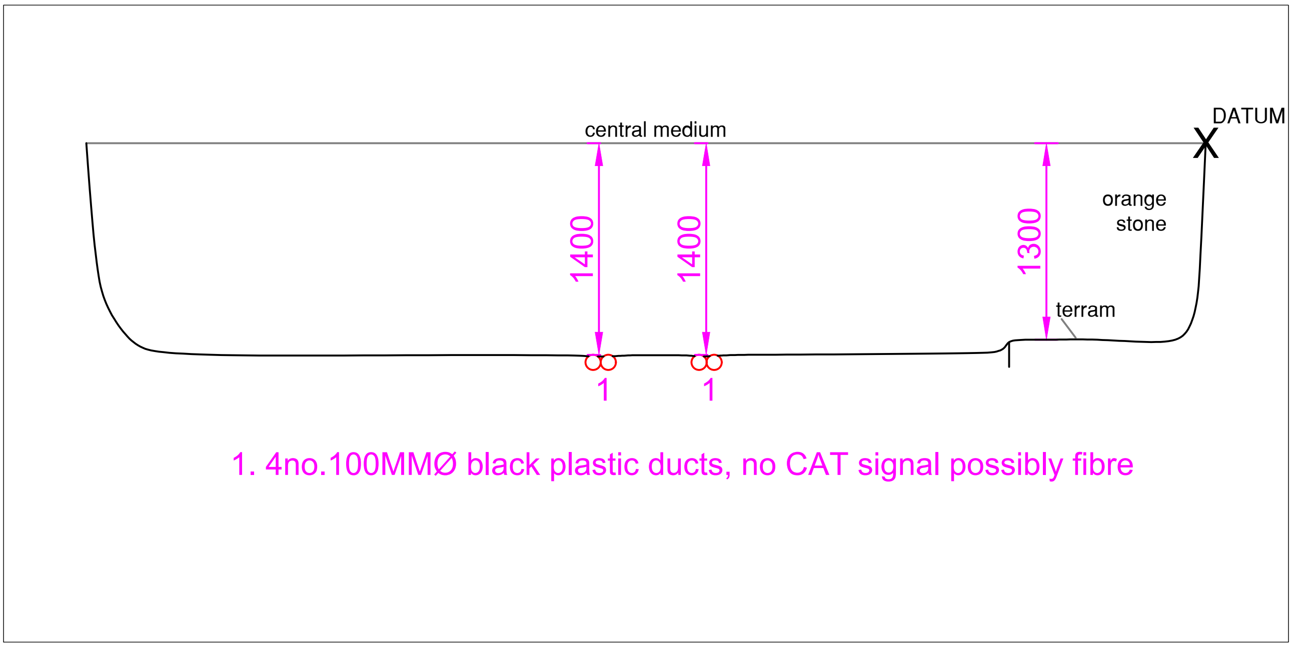
Stability: Moderate
Plant: 3t tracked excavator
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Slit trench terminated at 1.40m bgl. Refer to DWG P19248 for cross sectional detail.

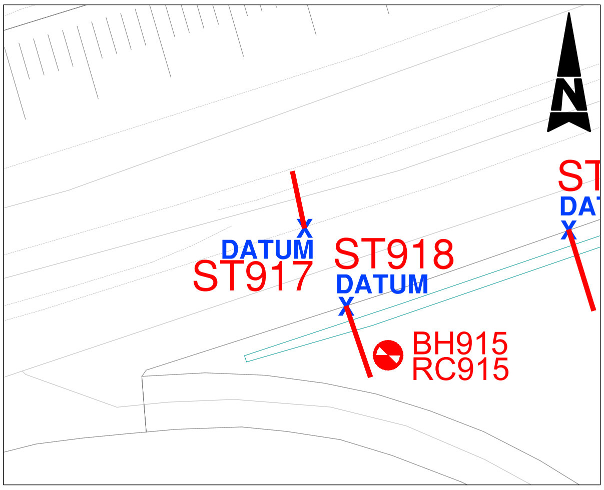


SLIT TRENCH PLAN, 1:50 ON A4



1. 4no.100MMØ black plastic ducts, no CAT signal possibly fibre

SLIT TRENCH SECTION, 1:50 ON A4



SLIT TRENCH LOCATION PLAN, 1:1000 ON A4

DATUM COORDINATES:

EASTING:	575725.3
NORTHING:	572874.0
LEVEL:	3.448mAOD

KEY:

DATUM: X

SLIT TRENCH DIMENSIONS:

LENGTH:	7.40m
WIDTH:	0.60m
DEPTH:	1.40m

STRATA SHOWN ON DETAILED LOG

DRAWN BY: G.C.

DATE: 10/01/2020

LOGGED BY: D.McC.

DATE: 07/01/2020

SCALE: AS ST9ATED

APPROVED: GH

REVISION: D01

SLIT TRENCH NUMBER:

ST917

JOB NAME:

N40 / Dunkettle Interchange Upgrade Scheme

JOB NUMBER:

P19248

DRAWING NUMBER:

P19248-ST917

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Photographic Record

Number:	**ST917**	**Project** **Project No** **Engineer**	Dunkettle Advance ITS Works P19248 Atkins

Photographic Record

Number:	**ST917**	**Project** **Project No** **Engineer**	Dunkettle Advance ITS Works P19248 Atkins

Trial Pit No
ST918
Sheet 1 of 1

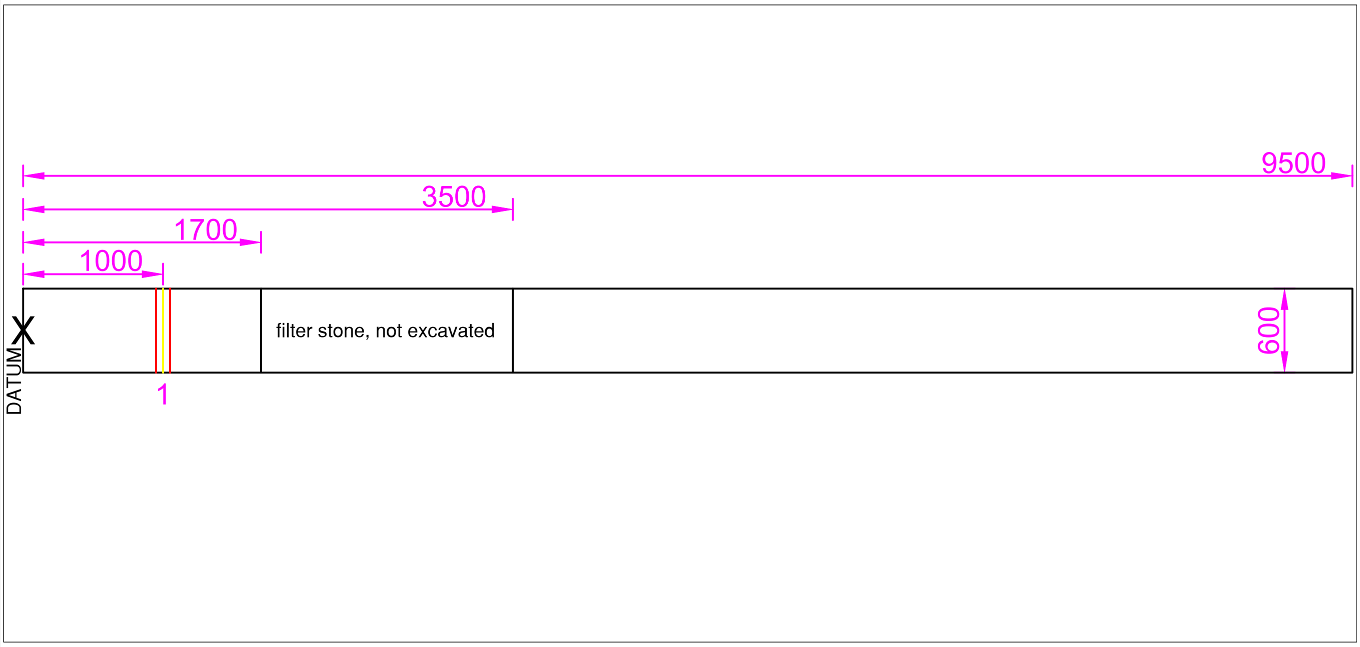
Project Name: Dunkettle Advance ITS Works	**Project No.** P19248	**Co-ords:** 575731E - 572864N **Level:** 3.60m OD	**Date** 19/12/2019
Location: Cork		**Dimensions (m):** 9.50 × 0.60	**Scale** 1:25
Client: Transport Infrastructure Ireland (TII)		**Depth:** 0.60m BGL	**Logged** DMC

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
▨				0.45	3.14	▨	(TOPSOIL)
▨				0.60	3.00	▦	(MADE GROUND) Clause 804 or similar.
							End of Pit at 0.600m

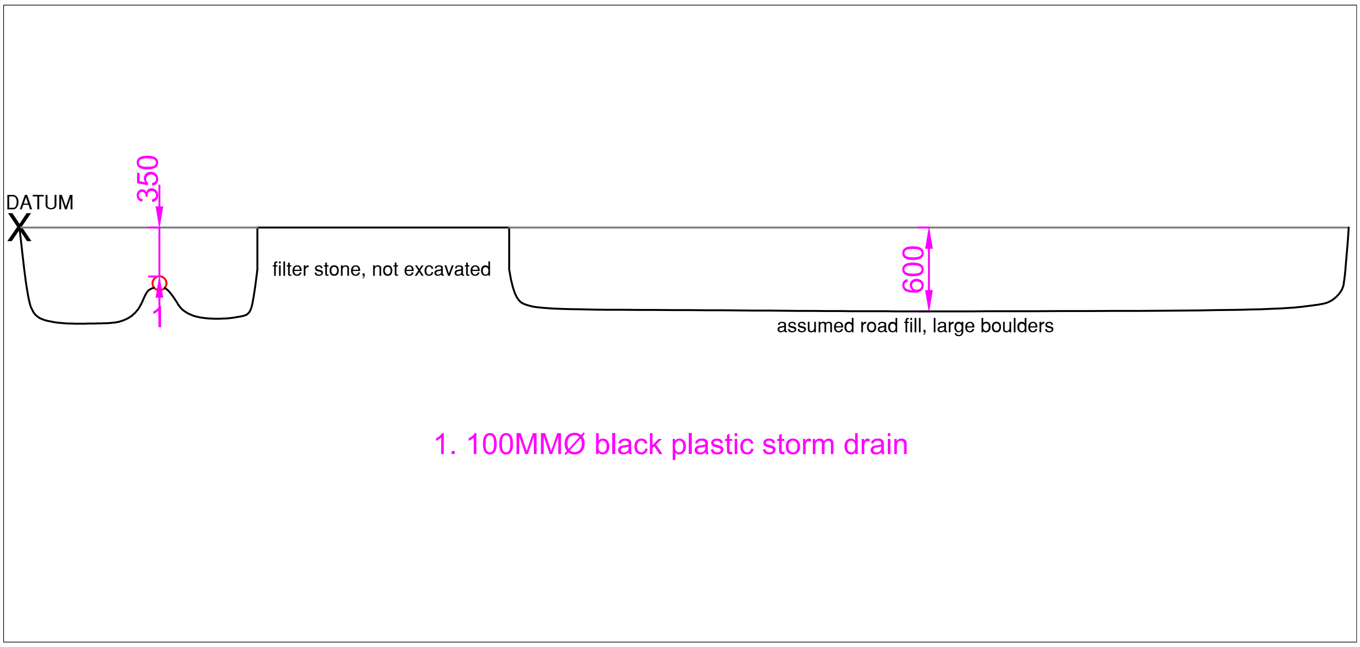
Stability: Good.
Plant: 3t tracked excavator
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Slit trench terminated at 0.60m bgl. Refer to drawing P19248 ST918 for cross section detail. Drainage stone between the road edge and the drainage pipe.

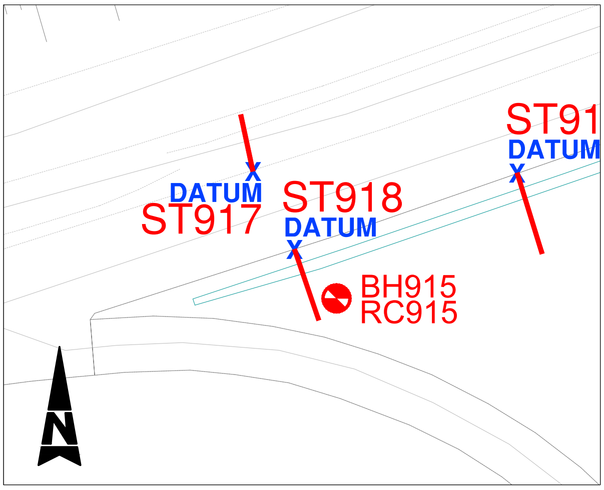


SLIT TRENCH PLAN, 1:50 ON A4



1. 100MMØ black plastic storm drain

SLIT TRENCH SECTION, 1:50 ON A4



SLIT TRENCH LOCATION PLAN, 1:1000 ON A4

DATUM COORDINATES:

EASTING:	575730.8
NORTHING:	572863.7
LEVEL:	3.595mAOD

KEY:

DATUM: X

SLIT TRENCH DIMENSIONS:

LENGTH:	9.50m
WIDTH:	0.60m
DEPTH:	0.60m

STRATA SHOWN ON DETAILED LOG

DRAWN BY: G.C.		DATE: 07/01/2020
LOGGED BY: D.McC.		DATE: 19/12/2019
SCALE: AS ST9ATED	APPROVED: GH	REVISION: D01

SLIT TRENCH NUMBER:

ST918

JOB NAME:

N40 / Dunkettle Interchange Upgrade Scheme

JOB NUMBER:

P19248

DRAWING NUMBER:

P19248-ST918

pgl priority geotechnical

Photographic Record

Number:	**ST918**	**Project** **Project No** **Engineer**	Dunkettle Advance ITS Works P19248 Atkins

Photographic Record

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www.prioritygeotechnical.ie

Trial Pit No
ST918A
Sheet 1 of 1

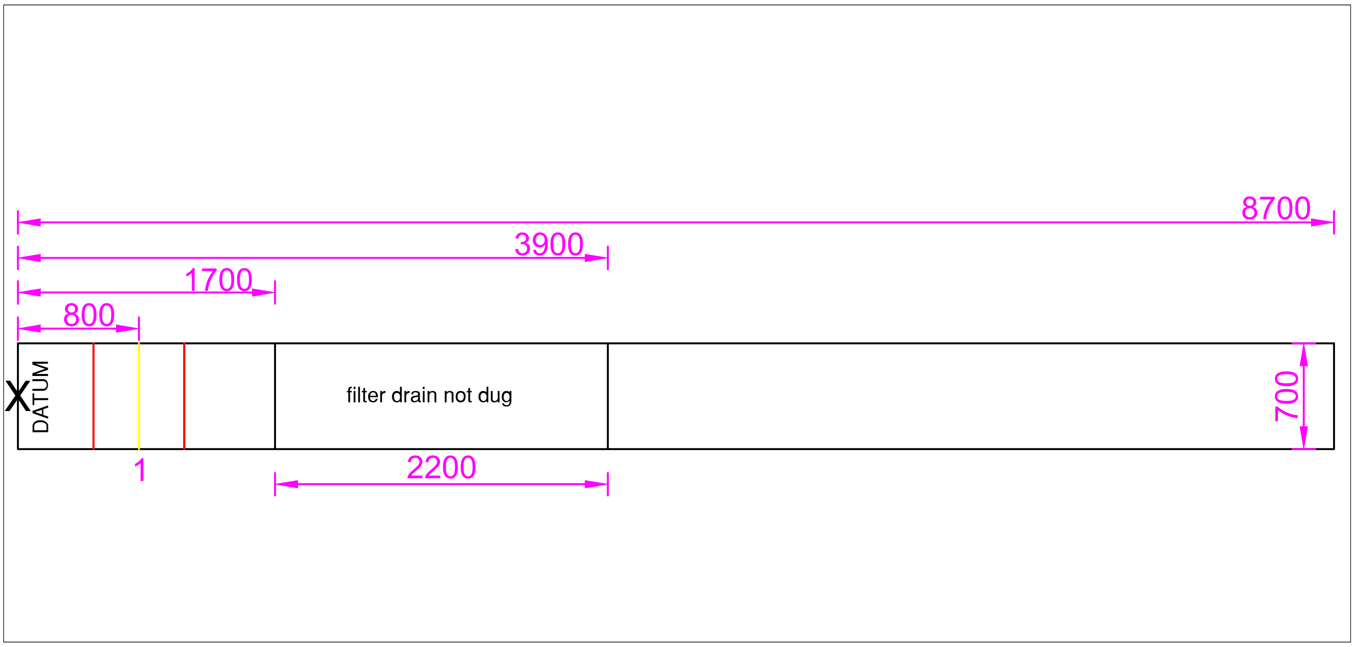
Project Name: Dunkettle Advance ITS Works	**Project No.** P19248	**Co-ords:** 575760E - 572874N **Level:** 3.50m OD	**Date** 23/01/2020
Location: Cork		**Dimensions (m):** 8.70 × 0.70 **Depth:** 1.40m BGL	**Scale** 1:25
Client: Transport Infrastructure Ireland (TII)			**Logged** DMC

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
▨				0.10	3.40	▨	(TOPSOIL)
▨	0.20 - 0.60 0.20 - 0.60 0.50	B D ENV		0.60	2.90	▨	(MADE GROUND) Firm, brown, slightly sandy gravelly SILT.
▨	0.60 - 1.20	B		1.40	2.10	▨	(MADE GROUND) Compacted crushed stone. (1-2inch with fines). Very difficult to excavate.
							End of Pit at 1.400m

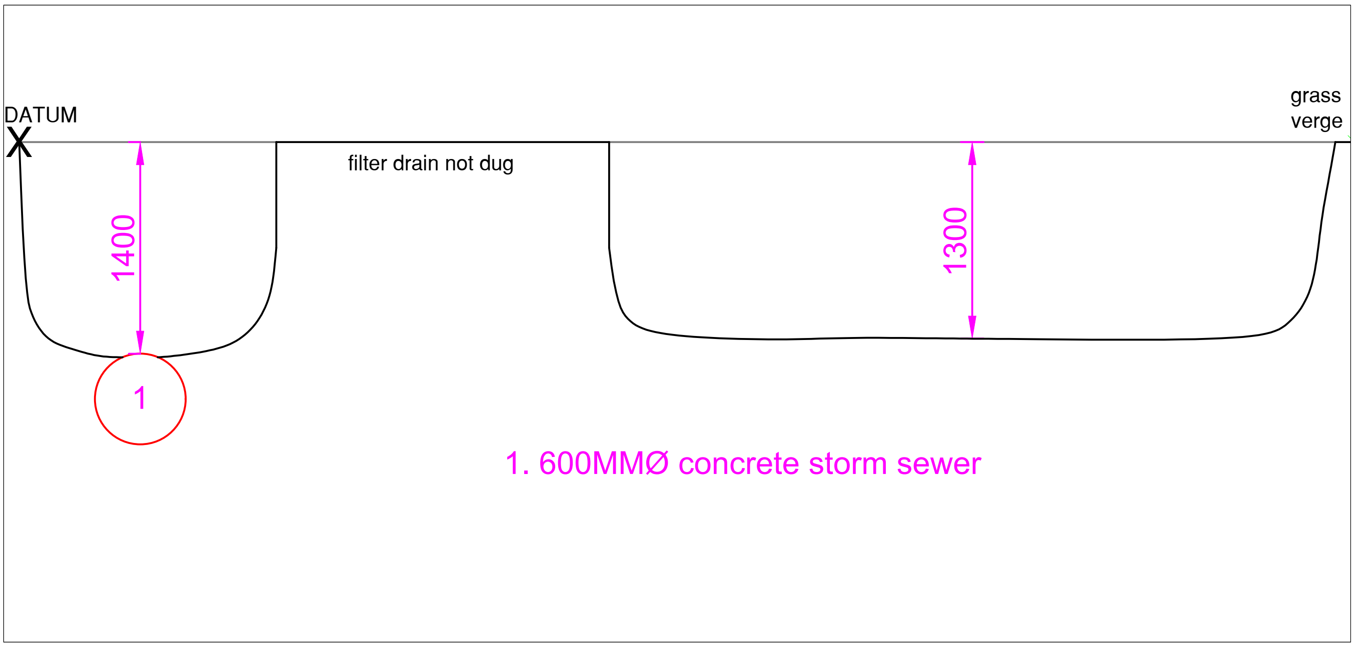
Stability: Moderate.
Plant: 3t tracked excavator
Backfill: Arisings.

Groundwater: None encountered.

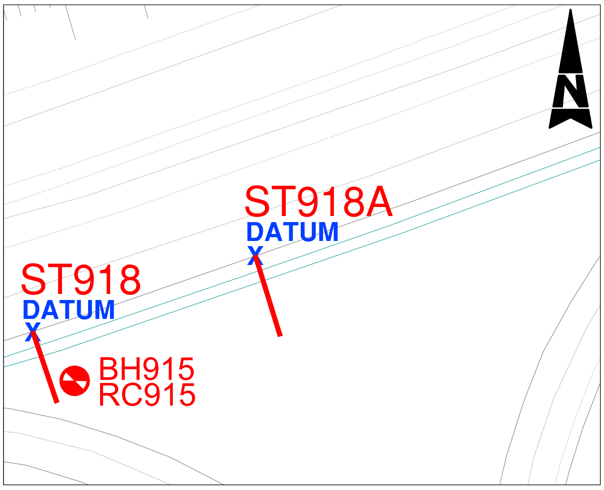
Remarks: Slit trench terminated at 1.40m bgl. Refer to drawing P19248 ST918A for cross section detail. Road edge to filter drain is drainage stone. The remainder of the trench is in grass verge.



SLIT TRENCH PLAN, 1:50 ON A4



SLIT TRENCH SECTION, 1:50 ON A4



SLIT TRENCH LOCATION PLAN, 1:1000 ON A4

DATUM COORDINATES:

EASTING:	575760.2
NORTHING:	572873.8
LEVEL:	3.503mAOD

KEY:

DATUM: X

SLIT TRENCH DIMENSIONS:

LENGTH:	9.50m
WIDTH:	0.60m
DEPTH:	0.60m

STRATA SHOWN ON DETAILED LOG

DRAWN BY: G.C.	DATE: 27/01/2020
LOGGED BY: D.McC.	DATE: 19/12/2019

SCALE: AS ST9ATED	APPROVED: GH	REVISION: D01

SLIT TRENCH NUMBER:

ST918A

JOB NAME:

N40 / Dunkettle Interchange Upgrade Scheme

JOB NUMBER:

P19248

DRAWING NUMBER:

P19248-ST918A

pgl priority geotechnical

KEY TO SYMBOLS - LABORATORY TEST RESULT

U	Undisturbed Sample	
P	Piston Sample	
TWS	Thin Wall Sample	
B	Bulk Sample - Disturbed	
D	Jar Sample - Disturbed	
W	Water Sample	
pH	Acidity/Alkalinity Index	
SO_3	% - Total Sulphate Content (acid soluble)	
SO_3	g/ltr - Water Soluble Sulphate (Water or 2:1 Aqueous Soil Extract)	
+	Calcareous Reaction	
Cl	Chloride Content	
PI	Plasticity Index	
<425	% of material in sample passing 425 micron sieve	
LL	Liquid Limit	
PL	Plastic Limit	
MC	Water Content	
NP	Non Plastic	
Yb	Bulk Density	
Yd	Dry Density	
Ps	Particle Density	
U/D	Undrained/Drained Triaxial	
U/C	Unconsolidated/Consolidated Triaxial	
T/M	Single Stage/Multistage Triaxial	
100/38	Sample Diameter (mm)	
REM	Remoulded Triaxial Test Specimen	
TST	Triaxial Suction Test	
V	Vane Test	
DSB	Drained Shear Box	
RSB	Residual Shear Box	
RS	Ring Shear	
σ_3	Cell Pressure	
σ_1-σ_3	Deviator Stress	
c	Cohesion	
c_	Effective Cohesion Intercept	
ϕ	Angle of Shearing Resistance - Degrees	
ϕ_	Effective Angle of Shearing Resistance	
εf	Strain at Failure	
*	Failed under 1^{st} Load	
**	Failed under 2^{nd} Load	
#	Untestable	
##	Excessive Strain	
p_o	Effective Overburden Pressure	
m_v	Coefficient of Volume Decrease	
c_v	Coefficient of Consolidation	
Opt	Optimum	
Nat	Natural	
Std	Standard Compaction - 2.5kg Rammer	(¶ CBR)
Hvy	Heavy Compaction - 4.5kg Rammer	(§ CBR)
Vib	Vibratory Compaction	
CBR	California Bearing Ratio	
Sat m.c.	Saturation Moisture Content	
MCV	Moisture Condition Value	

Key sheet

pgl priority geotechnical

pgl priority geotechnical	**Natural Moisture Content/Atterberg Limits Summary** **BS 1377 : Part 2 : 1990 : Clause 3**	**Job Ref**
Location	**Dunkettle Advance ITS Works**	**P19248**

Hole ID	Sample Ref	Depth (m)	Sample Type	Sample Description	MC	LL	PL	PI	% Pass 425
BH902	1	0.8	B	Gravelly CLAY	11				
BH902	2	1.5	B	Clayey sandy GRAVEL with low cobble content	9				
BH902	3	2.5	B	Clayey sandy GRAVEL	13	24	17	7	48.7
BH902	4	3.5	B	Clayey sandy GRAVEL with medium cobble content	16	28	18	10	52.3
BH905	1	0.5	B	Slightly sandy gravelly SILT	15	44	27	17	50.3
BH906	1	0.5	B	Slightly sandy gravelly SILT	13	31	20	11	52.6
BH908	1	0.5	B	Slightly sandy gravelly SILT	25	46	28	18	57.5
BH911	1	0.5	B	Slightly sandy gravelly SILT	19	46	30	16	64.3
BH911	2	1.5	B	Slightly sandy gravelly SILT	16	39	26	13	52.9
BH915	1	0.2	B	Slightly sandy slightly gravelly SILT	16	38	26	12	41.8
BH916	3	2.5	B	Slightly sandy gravelly CLAY	17	29	19	10	63.8
BH916	4	3.5	B	Slightly sandy gravelly CLAY	17	30	19	11	56.6
BH916	5	4.5	B	Slightly sandy gravelly CLAY	17	33	21	12	-5.9
BH917	1	0.5	B	Slightly sandy gravelly CLAY	15	33	22	11	47.5
BH917	2	1.5	B	Slightly sandy gravelly CLAY	13	32	17	15	45.6
BH918	1	0.5	B	Slightly sandy gravelly CLAY	14	33	23	10	37.4
BH918	2	1.5	B	Slightly sandy gravelly CLAY	11	27	18	9	37.6
BH918	3	2.6	B	Slightly sandy GRAVEL	8				
BH918	4	3.5	B	Slightly sandy GRAVEL	10				
BH918	5	4.5	B	Sandy GRAVEL	8				

pgl priority geotechnical	**Natural Moisture Content/Atterberg Limits Summary** **BS 1377 : Part 2 : 1990 : Clause 3**	**Job Ref**
Location	**Dunkettle Advance ITS Works**	**P19248**

Hole ID	Sample Ref	Depth (m)	Sample Type	Sample Description	MC	LL	PL	PI	% Pass 425
BH925	3	2.5	B	Clayey very sandy GRAVEL	13	23	15	8	56.9
BH926	1	0.5	B	Slightly sandy gravelly SILT	11	28	17	11	40.8
BH926	2	1.5	B	Very silty very sandy GRAVEL with medium cobble content	13				
BH927	1	0.5	B	Slightly sandy slightly gravelly CLAY	19	36	22	14	51.6
BH927	2	1.6	B	Slightly sandy slightly gravelly CLAY	22				
BH927	3	2.5	B	Slightly sandy slightly gravelly CLAY	22				
BH927	4	3	U	Slightly sandy slightly gravelly CLAY	22				
BH927	5	3.45	D	Slightly sandy slightly gravelly CLAY	4				
BH927	6	4	B	COBBLES	7				
FIP902	1	0.5	B	Slightly sandy gravelly CLAY	15	31	18	13	44
RC901	2	3	B	Silty sandy GRAVEL	13				
RC902	3	0.5	B	Gravelly CLAY	10				
RC902	1	4.8	B	Slightly sandy silty GRAVEL	14				
RC902	2	6	B	Silty very sandy GRAVEL	17				
RC902	4	9	B	Silty sandy GRAVEL	20				
RC902	5	10.5	B	Silty sandy GRAVEL	18				
RC911	1	3	WS	SILT	32	47	31	16	99.7
RC911	2	4.5	WS	SILT	29	44	27	17	100
RC911	3	6	WS	SILT	33	49	33	16	100
RC911	4	7.5	WS	SILT	33	46	30	16	100

	Natural Moisture Content/Atterberg Limits Summary BS 1377 : Part 2 : 1990 : Clause 3	Job Ref
Location	**Dunkettle Advance ITS Works**	**P19248**

Hole ID	Sample Ref	Depth (m)	Sample Type	Sample Description	MC	LL	PL	PI	% Pass 425
RC911	5	10.5	B	Clayey sandy GRAVEL	17				
RC911	6	13.5	B	Clayey sandy GRAVEL	15				
RC915	1	3	WS	Slightly sandy slightly gravelly CLAY	20	35	23	12	71.1
RC915	2	4.5	WS	SILT	80	102	61	41	80.3
RC915	3	6	WS	Slightly sandy slightly gravelly SILT	110	177	116	61	92.4
RC915	4	7.5	WS	Slightly sandy slightly gravelly SILT	68				
RC917	1	7.5	WS	Slightly sandy slightly gravelly SILT	42	52	31	21	97.8
RC917	2	9	WS	Slightly sandy gravelly SILT	34	42	29	13	91.2
RC917	3	12	WS	Slightly sandy slightly gravelly SILT		30	21	9	77.5
RC917	4	12	D	Slightly sandy slightly gravelly SILT	18				
RC917	5	13.5	D	Slightly sandy slightly gravelly CLAY	13	22	16	6	71.1
RC918	1	7.5	WS	Clayey very sandy GRAVEL	16	28	19	9	38.8
RC919	1	4.2	B	Slightly sandy slightly gravelly CLAY	13	27	15	12	51.8
RC919	2	4.5	B	Slightly sandy slightly gravelly CLAY	15				
RC919	3	6	B	Clayey very sandy GRAVEL	13				
RC919	4	7.5	B	Clayey very sandy GRAVEL	14				
RC919	5	13.5	B	SAND	25				
RC919	6	18	B	SAND	24				
RC920	1	6	B	Gravelly CLAY	15	24	13	11	32.4
RC920	2	7.5	B	Gravelly SILT	9	23	NP	NP	28.4

	Natural Moisture Content/Atterberg Limits Summary **BS 1377 : Part 2 : 1990 : Clause 3**	**Job Ref**
Location	**Dunkettle Advance ITS Works**	**P19248**

Hole ID	Sample Ref	Depth (m)	Sample Type	Sample Description	MC	LL	PL	PI	% Pass 425
ST908-E	1	0.5	B	Very clayey very sandy GRAVEL with low cobble content	17	25	18	7	47.9
ST913	1	0.5	B	Slightly sandy gravelly SILT	24	42	27	15	61.8
ST914A	1	0.5	B	Slightly sandy gravelly CLAY	17	35	23	12	53.8
ST914A	2	0.5	D	Slightly sandy gravelly CLAY	14				
ST915	1	0.6	B	Clayey very sandy GRAVEL	14	34	22	12	43.4
ST918A	1	0.2	B	Sandy gravelly SILT	9				
ST918A	2	0.2	D	Sandy gravelly SILT	8				
ST918A	3	0.6	B	GRAVEL	5	21	15	6	21.3
ST920		0.5	B	GRAVEL	17				
ST921	1	0.5	B	Gravelly CLAY	16	37	23	14	54.7
ST922	2	0.5	D	Gravelly CLAY	13	32	21	11	47.1
ST923	1	0.5	B	Gravelly CLAY	39	31	21	10	61
ST923	2	0.5	D	Gravelly CLAY	39	25	18	7	65.8
ST925	1	0.5	B	Gravelly CLAY	13	27	16	11	72.6
ST925	2	0.5	D	Gravelly CLAY	13	27	16	11	72.6
ST926	1	0.5	B	Slightly sandy gravelly CLAY	11	30	19	11	63.8
ST926	2	0.5	D	Slightly sandy gravelly CLAY	11	30	19	11	63.8
ST930	2	0.5	D	Very clayey very sandy GRAVEL	17	30	20	10	53
ST931	2	0.5	D	Slightly sandy gravelly CLAY	14	29	18	11	63.9
ST932	1	0.8	B	Slightly gravelly sandy CLAY	15	25	18	7	65.8

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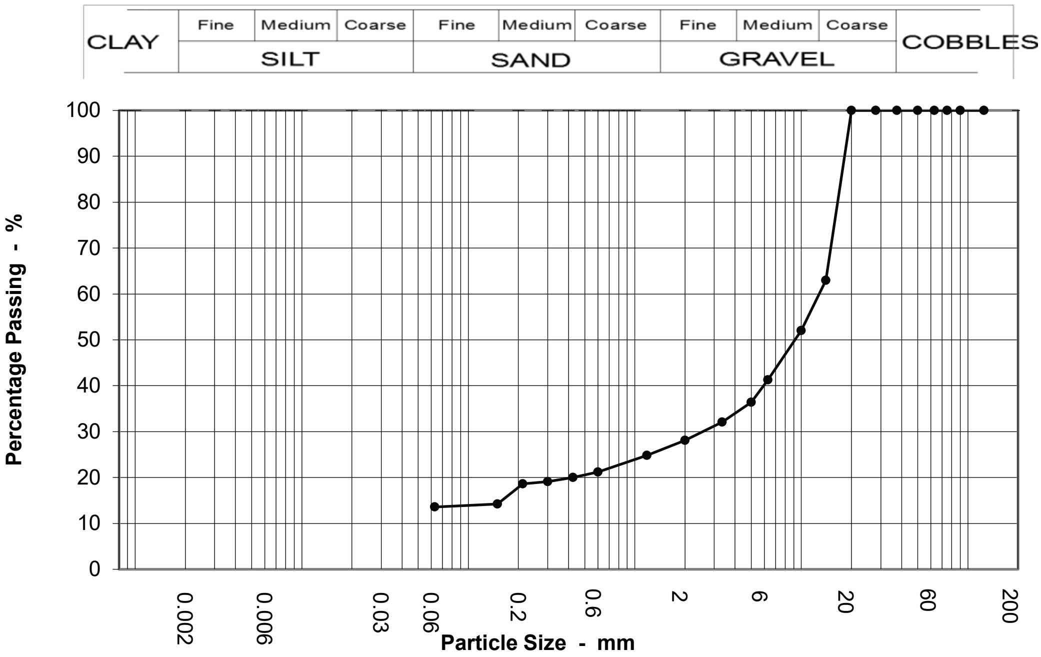
PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19248**
		Borehole / Pit No	RC911
Location	**Dunkettle Advance ITS Works**	Sample No	5
		Depth	10.50 m
Soil Description	Clayey sandy GRAVEL	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	63		
10	52		
6.3	41		
5	36		
3.35	32		
2	28		
1.18	25		
0.6	21		
0.425	20		
0.3	19		
0.212	19		
0.15	14		
0.063	14		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	72.0
Sand	15.0
Silt & Clay	14.0

Grading Analysis	
D100	20.00
D60	12.80
D10	
Uniformity Coefficient	

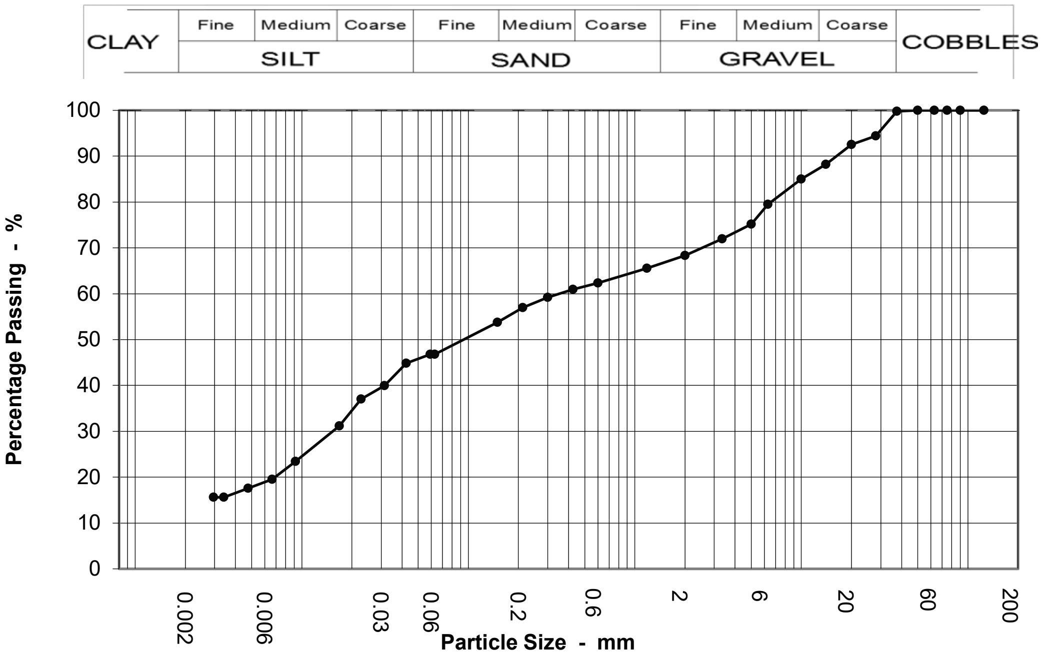
pgl priority geotechnical

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

Job Ref	**P19248**
Borehole / Pit No	RC915
Sample No	1
Depth	3.00 m
Sample type	WS

Location	**Dunkettle Advance ITS Works**
Soil Description	Slightly sandy slightly gravelly CLAY



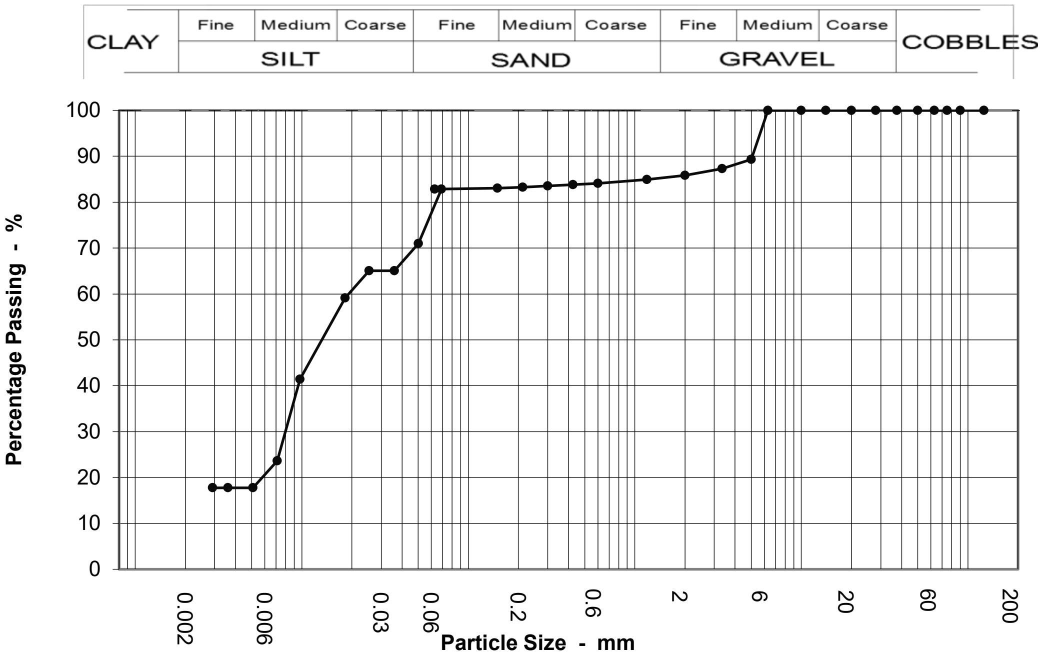
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.059	47
90	100	0.042	45
75	100	0.031	40
63	100	0.023	37
50	100	0.017	31
37.5	100	0.009	23
28	94	0.007	20
20	93	0.005	18
14	88	0.003	16
10	85	0.003	16
6.3	80	0.001	10
5	75		
3.35	72		
2	68		
1.18	66		
0.6	62		
0.425	61		
0.3	59		
0.212	57		
0.15	54		
0.063	47		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

Sample Proportions	
Cobbles	0.0
Gravel	32.0
Sand	22.0
Silt	33.0
Clay	14.0

Grading Analysis	
D100	50.00
D60	0.35
D10	0.00
Uniformity Coefficient	390.00

pgl priority geotechnical	**PARTICLE SIZE DISTRIBUTION** **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P19248**
		Borehole / Pit No	RC915
Location	**Dunkettle Advance ITS Works**	Sample No	3
		Depth	6.00 m
Soil Description	Slightly sandy slightly gravelly SILT	Sample type	WS



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.069	83
90	100	0.050	71
75	100	0.036	65
63	100	0.025	65
50	100	0.018	59
37.5	100	0.010	41
28	100	0.007	24
20	100	0.005	18
14	100	0.004	18
10	100	0.003	18
6.3	100	0.002	18
5	89		
3.35	87		
2	86		
1.18	85		
0.6	84		
0.425	84		
0.3	84		
0.212	83		
0.15	83		
0.063	83		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

Sample Proportions	
Cobbles	0.0
Gravel	14.0
Sand	3.0
Silt	65.0
Clay	18.0

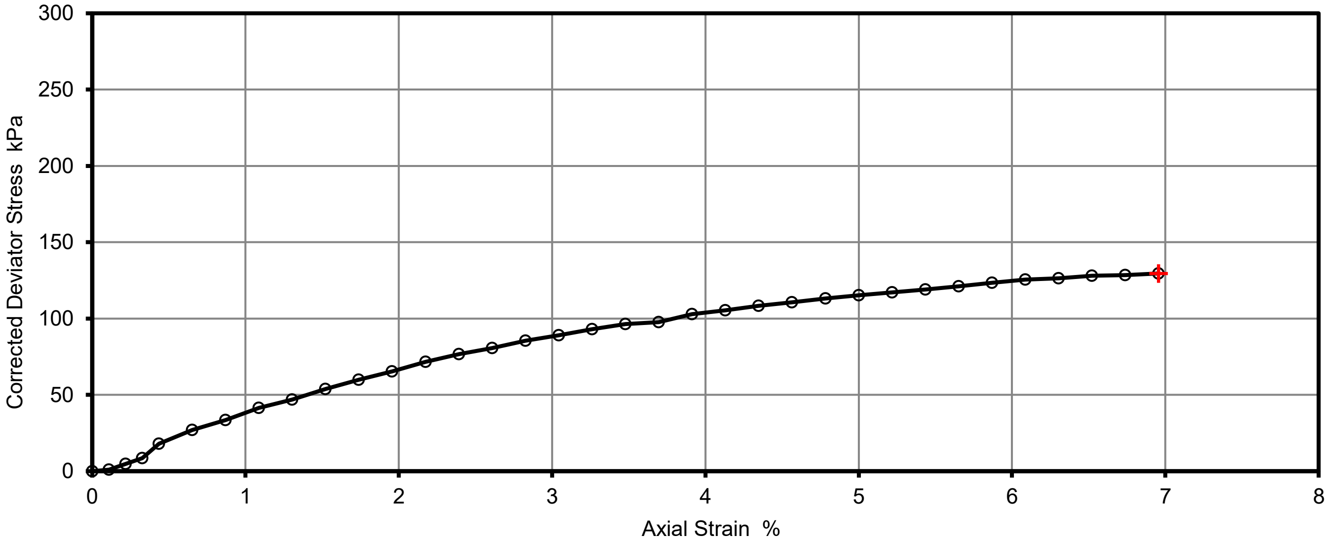
Grading Analysis	
D100	6.30
D60	0.02
D10	
Uniformity Coefficient	

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen

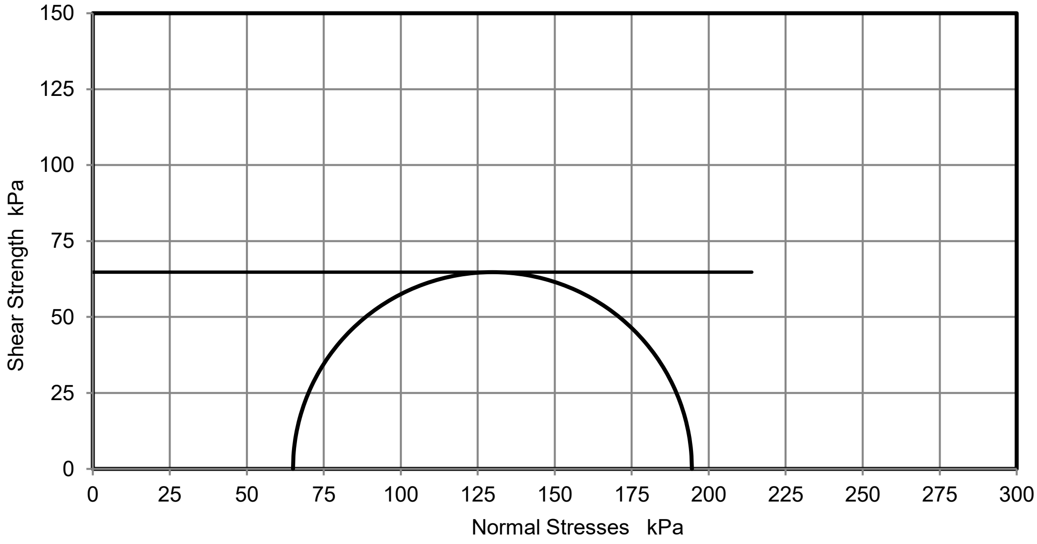
		Job Ref	P19248
		Borehole/Pit No.	RC911
Site Name	Dunkettle Advance ITS Works	Sample No.	1
Soil Description	SILT	Depth	3.00
		Sample Type	WS
		KeyLAB ID	PGL12020052510
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen		

Test Number		1	
Length		230.0	mm
Diameter		100.0	mm
Bulk Density		1.71	Mg/m3
Moisture Content		31.6	%
Dry Density		1.30	Mg/m3
Rate of Strain			%/min
Cell Pressure		65	kPa
At failure	Axial Strain	7.0	%
	Deviator Stress, (σ1 - σ3)f	130	kPa
	Undrained Shear Strength, cu	65	kPa ½(σ1 - σ3)f
	Mode of Failure	Plastic	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks	Approved	Printed	Fig. No.
	Cilla	18/06/2020 17:03	1
			Sheet
			3

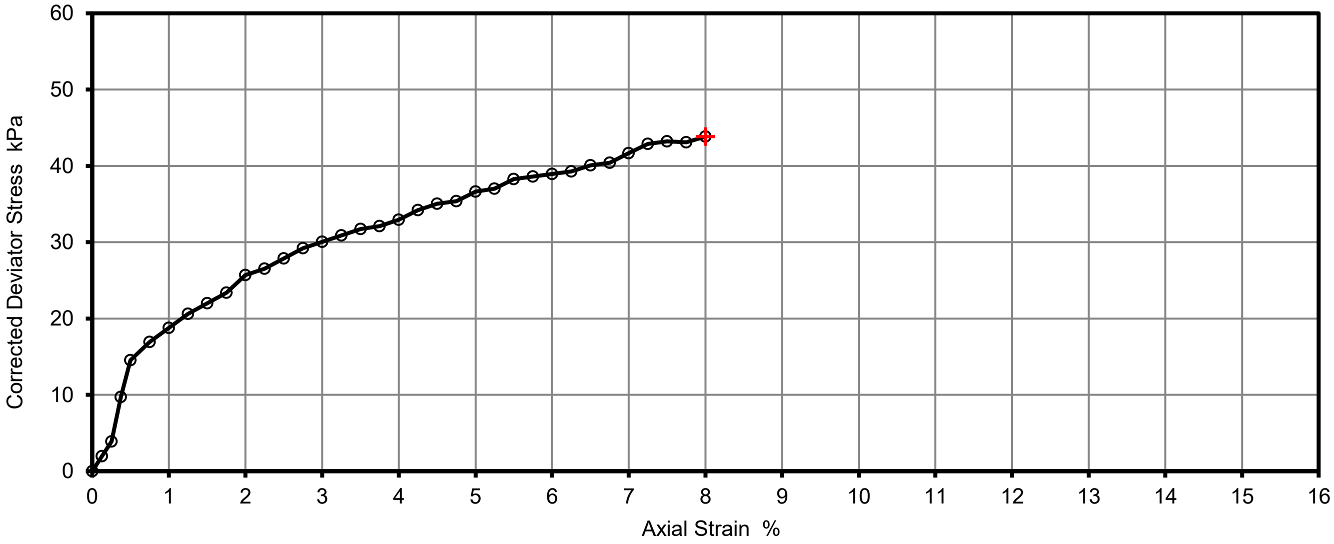
Lab Sheet Reference :

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen

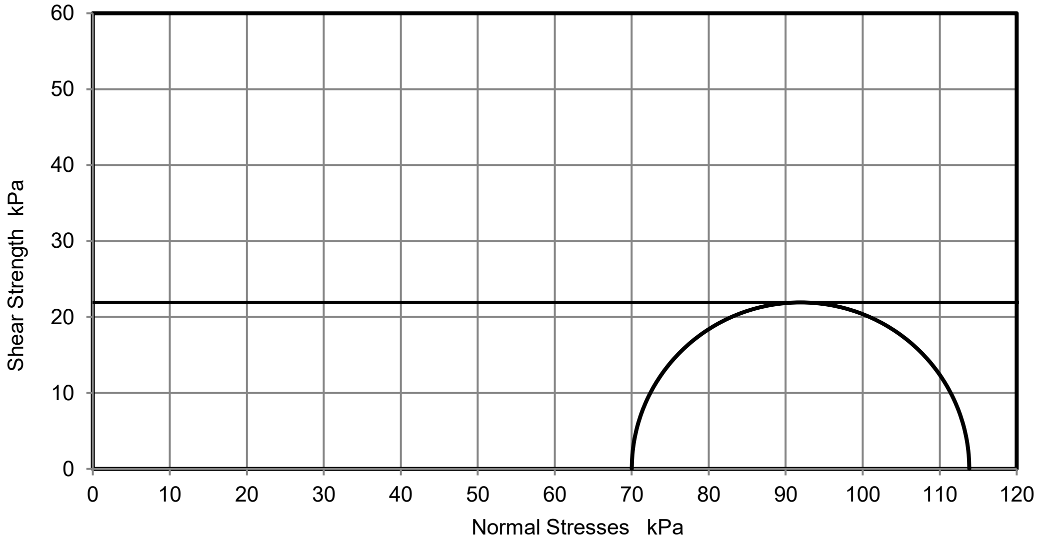
		Job Ref	P19248
		Borehole/Pit No.	RC915
Site Name	Dunkettle Advance ITS Works	Sample No.	1
Soil Description	Slightly sandy slightly gravelly CLAY	Depth	3.00
		Sample Type	WS
		KeyLAB ID	PGL12020012862
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen		

Test Number		1	
Length		200.0	mm
Diameter		100.0	mm
Bulk Density		2.22	Mg/m3
Moisture Content		21.4	%
Dry Density		1.83	Mg/m3
Rate of Strain			%/min
Cell Pressure		70	kPa
At failure	Axial Strain	8.0	%
	Deviator Stress, (σ1 - σ3)f	44	kPa
	Undrained Shear Strength, cu	22	kPa ½(σ1 - σ3)f
	Mode of Failure	Plastic	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
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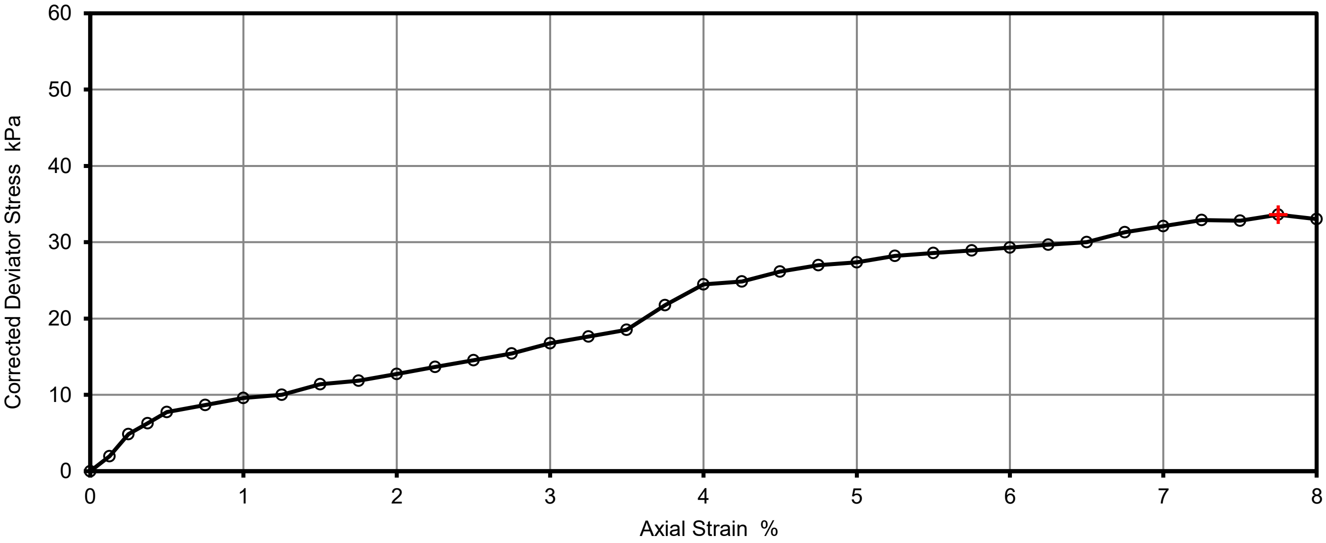
Remarks	Approved	Printed	
	Cilla	18/06/2020 17:03	Fig. No. 1
Lab Sheet Reference :			Sheet 4

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen

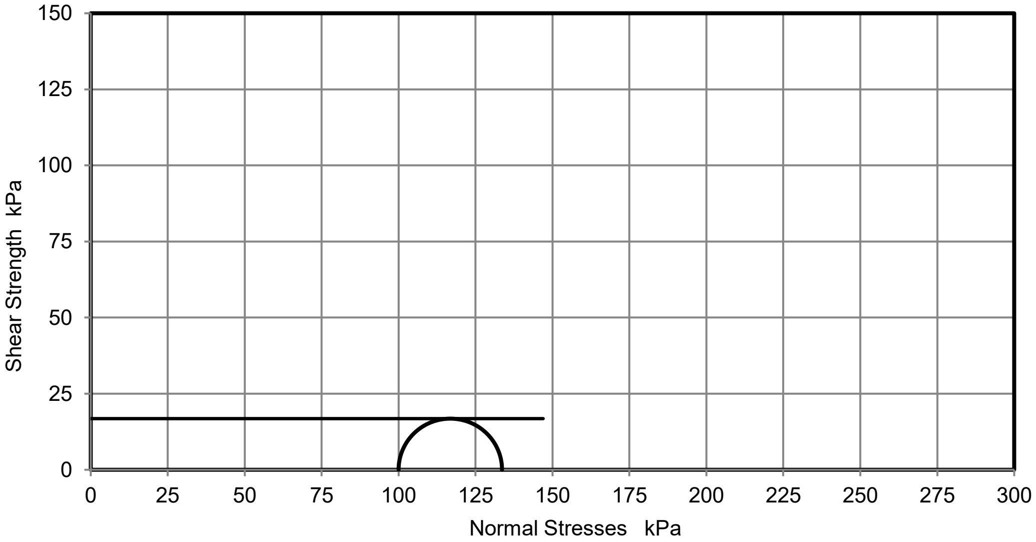
		Job Ref	P19248
		Borehole/Pit No.	RC915
Site Name	Dunkettle Advance ITS Works	Sample No.	2
Soil Description	SILT	Depth	4.50
		Sample Type	WS
		KeyLAB ID	PGL12020012863
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen		

Test Number		1	
Length		200.0	mm
Diameter		100.0	mm
Bulk Density		1.34	Mg/m3
Moisture Content		156.5	%
Dry Density		0.52	Mg/m3
Rate of Strain			%/min
Cell Pressure		100	kPa
At failure	Axial Strain	7.8	%
	Deviator Stress, (σ1 - σ3)f	34	kPa
	Undrained Shear Strength, cu	17	kPa ½(σ1 - σ3)f
	Mode of Failure	Plastic	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks

Approved: Cilla

Printed: 18/06/2020 17:03

Lab Sheet Reference :

Fig. No. 1

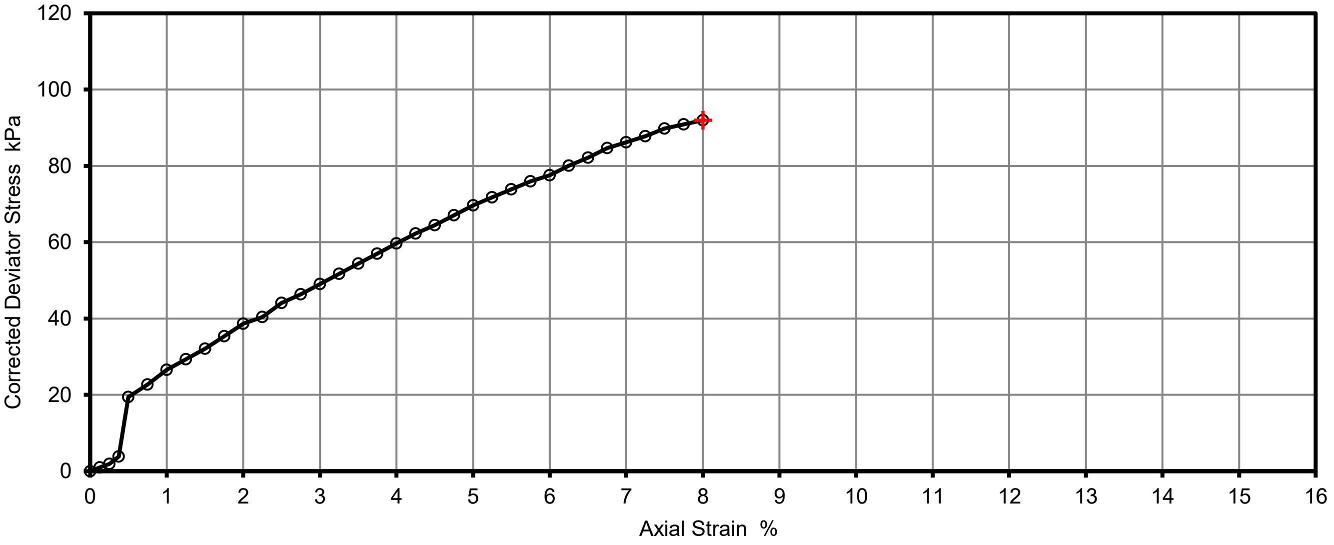
Sheet 5

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen

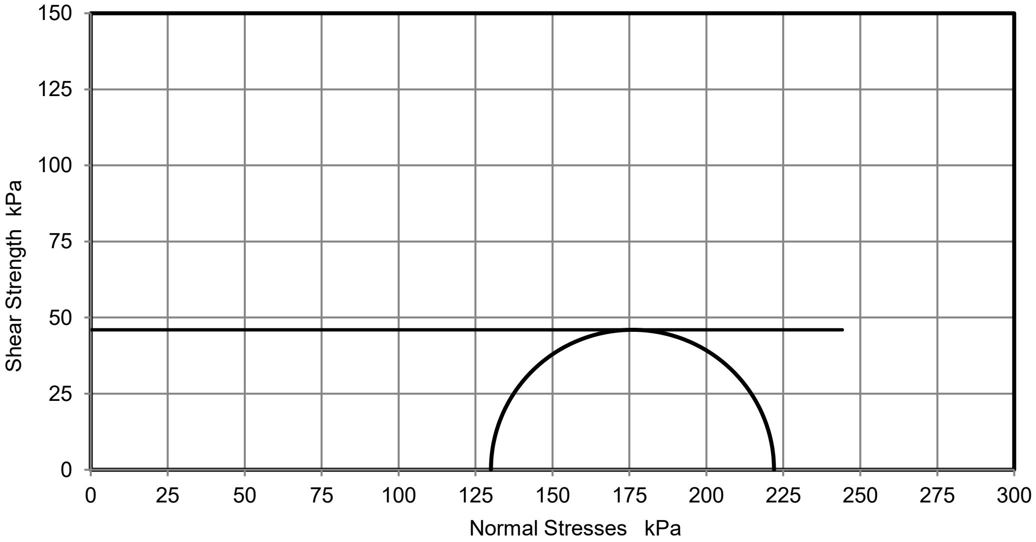
		Job Ref	P19248
		Borehole/Pit No.	RC915
Site Name	Dunkettle Advance ITS Works	Sample No.	3
Soil Description	Slightly sandy slightly gravelly SILT	Depth	6.00
		Sample Type	WS
		KeyLAB ID	PGL12020012864
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen		

Test Number		1	
Length		200.0	mm
Diameter		100.0	mm
Bulk Density		1.34	Mg/m3
Moisture Content		105.8	%
Dry Density		0.65	Mg/m3
Rate of Strain			%/min
Cell Pressure		130	kPa
At failure	Axial Strain	8.0	%
	Deviator Stress, (σ1 - σ3)f	92	kPa
	Undrained Shear Strength, cu	46	kPa ½(σ1 - σ3)f
	Mode of Failure	Plastic	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks

Approved	Printed
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Lab Sheet Reference :

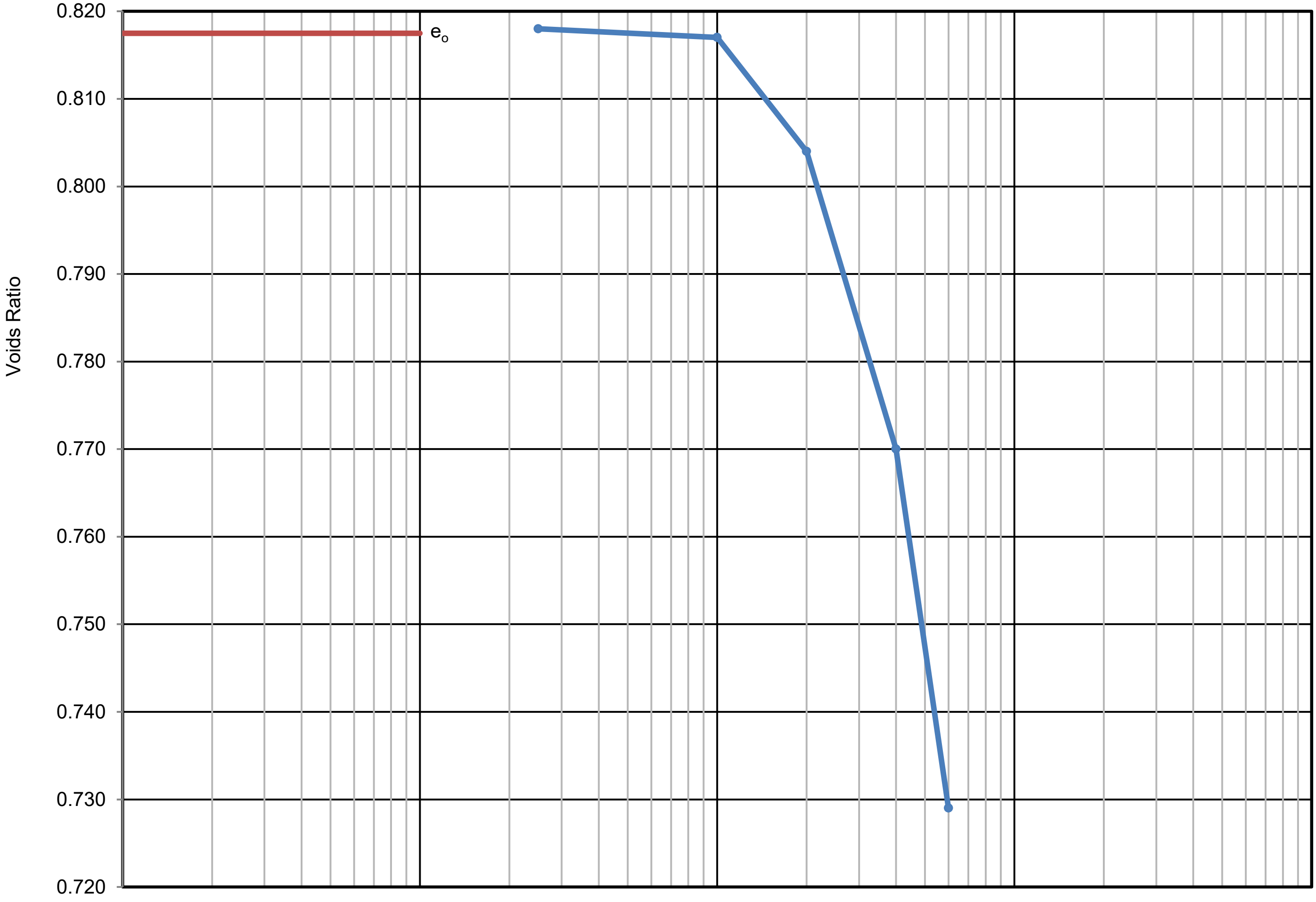
Fig. No. 1

Sheet 6

pgl priority geotechnical

ONE DIMENSIONAL CONSOLIDATION TEST
BS1377:Part 5:1990, clause 3

		Job Ref	P19248
		Borehole/Pit No.	RC911
Site Name	Dunkettle Advance ITS Works	Sample No.	2
		Depth	4.5
		Sample Type	WS
Sample Description	SILT	KeyLAB ID	PGL12020052511
Test Method	BS1377:Part 5:1990, clause 3		



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t90, root) m2/yr
0.0	0.817	-	-
25	0.818	-0.01	
100	0.817	0.004	760
200	0.804	0.074	4.6
400	0.770	0.094	180
600	0.729	0.12	1400

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	20.00	19.03	mm
Moisture Content	32.5	27.4	%
Bulk density	1.93	1.95	Mg/m3
Dry density	1.46	1.53	Mg/m3
Voids Ratio	0.817	0.729	
Saturation	105	99	%
Average temperature for test	18.0		oC
Swelling Pressure			kPa
Settlement on saturation			%

Remarks

Final values should be used with caution
Cv plotted at mid point of load increments
Cv corrected to 20oC

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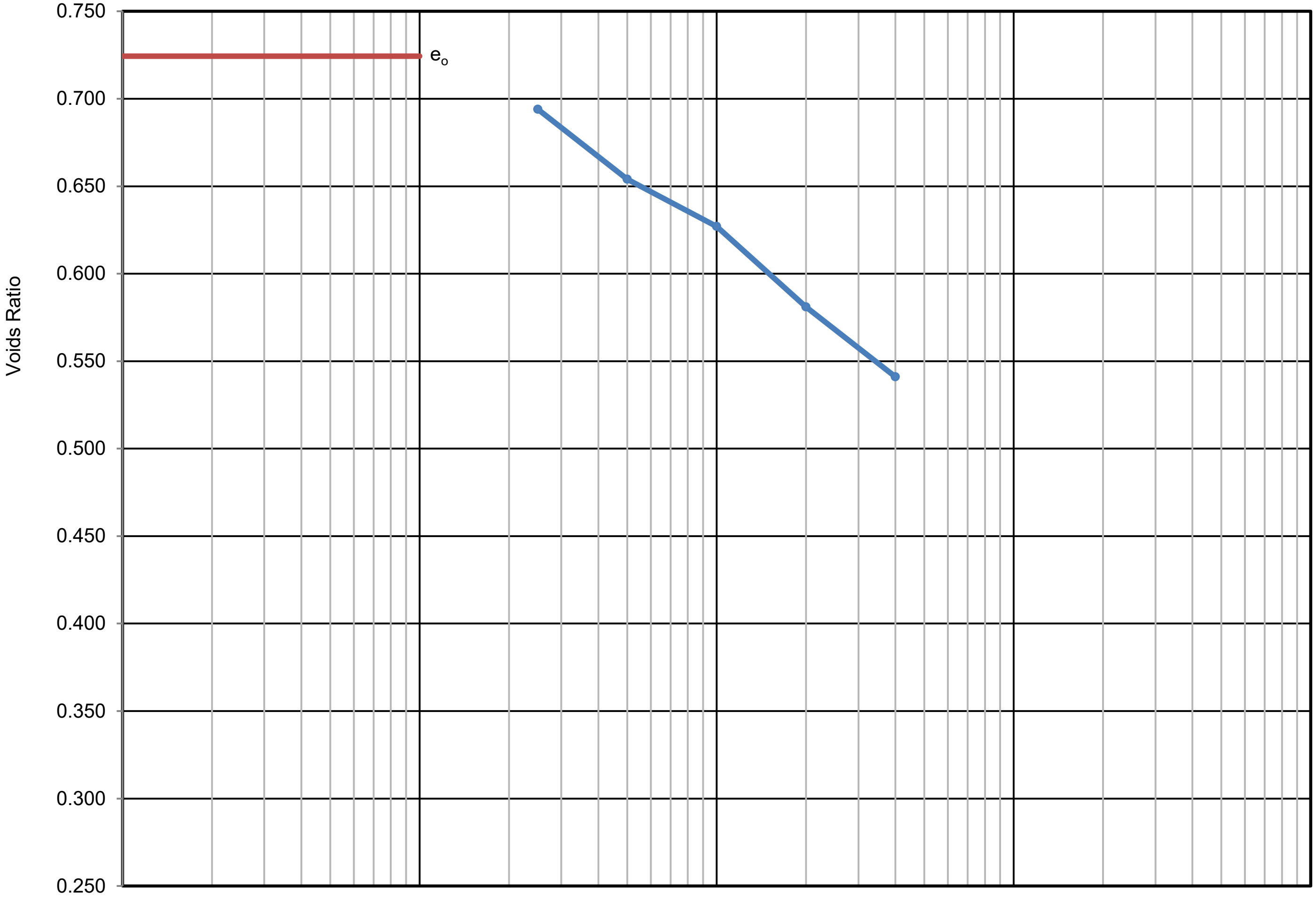
Fig. No 1

ONE DIMENSIONAL CONSOLIDATION TEST
BS1377:Part 5:1990, clause 3

		Job Ref	P19248
		Borehole/Pit No.	RC911
Site Name	Dunkettle Advance ITS Works	Sample No.	4
		Depth	7.5
		Sample Type	WS
Sample Description	SILT	KeyLAB ID	PGL12020052513
Test Method	BS1377:Part 5:1990, clause 3		



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t90, root) m2/yr
0.0	0.724	-	-
25	0.694	0.7	26
50	0.654	0.94	1800
100	0.627	0.33	4.5
200	0.581	0.29	9200
400	0.541	0.13	840

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	20.00	17.88	mm
Moisture Content	29.0	26.3	%
Bulk density	1.98	2.17	Mg/m3
Dry density	1.54	1.72	Mg/m3
Voids Ratio	0.724	0.541	
Saturation	106	129	%
Average temperature for test	18.0		oC
Swelling Pressure			kPa
Settlement on saturation			%

Remarks

Final values should be used with caution

Cv plotted at mid point of load increments

Cv corrected to 20oC

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19/06/2020 12:13

Fig. No

1

2183

The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.: 20-13420-1

Initial Date of Issue: 03-Jun-2020

Client Priority Geotechnical Ltd

Client Address:
Unit 12
Owenacurra Business Park
Midleton
County Cork
Ireland

Contact(s): Colette Kelly

Project P19248 N40

Quotation No.:		**Date Received:**	28-May-2020
Order No.:	12463	**Date Instructed:**	28-May-2020
No. of Samples:	4		
Turnaround (Wkdays):	7	**Results Due:**	05-Jun-2020
Date Approved:	03-Jun-2020		

Approved By:

Details: Glynn Harvey, Technical Manager

Results - Soil

Project: P19248 N40

Client: Priority Geotechnical Ltd				**Chemtest Job No.:**	20-13420	20-13420	20-13420	20-13420
Quotation No.:				**Chemtest Sample ID.:**	1009719	1009720	1009721	1009722
				Sample Location:	RC911	RC911	RC925	RC926
				Sample Type:	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	3.0	7.5	6.0	3.0
				Date Sampled:	26-May-2020	26-May-2020	26-May-2020	26-May-2020
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
Moisture	N	2030	%	0.020	16	18	29	11
pH	U	2010		4.0	8.2	8.0	9.2	9.2
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.056	1.0	0.78	0.093

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

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The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	20-04608-1		
Initial Date of Issue:	19-Feb-2020		
Client	Priority Geotechnical Ltd		
Client Address:	Unit 12 Owenacurra Business Park Midleton County Cork Ireland		
Contact(s):	Colette Kelly		
Project	P19248 N40		
Quotation No.:		**Date Received:**	12-Feb-2020
Order No.:	12463	**Date Instructed:**	13-Feb-2020
No. of Samples:	3		
Turnaround (Wkdays):	7	**Results Due:**	21-Feb-2020
Date Approved:	18-Feb-2020		
Approved By:			
Details:	Darrell Hall, Director		

Results - Soil

Project: P19248 N40

Client: Priority Geotechnical Ltd				**Chemtest Job No.:**	20-04608	20-04608	20-04608
Quotation No.:				**Chemtest Sample ID.:**	968952	968953	968954
				Sample Location:	RC915	RC915	RC919
				Sample Type:	SOIL	SOIL	SOIL
				Top Depth (m):	3.00	6.00	4.20
				Date Sampled:	10-Feb-2020	10-Feb-2020	10-Feb-2020
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Moisture	N	2030	%	0.020	16	57	10
pH	U	2010		4.0	8.3	7.2	8.5
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.096	0.69	0.031

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

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Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	20-02703-1		
Initial Date of Issue:	06-Feb-2020		
Client	Priority Geotechnical Ltd		
Client Address:	Unit 12 Owenacurra Business Park Midleton County Cork Ireland		
Contact(s):	Colette Kelly		
Project	P19248 N40		
Quotation No.:	Q20-19314	**Date Received:**	29-Jan-2020
Order No.:	12463	**Date Instructed:**	29-Jan-2020
No. of Samples:	4		
Turnaround (Wkdays):	7	**Results Due:**	06-Feb-2020
Date Approved:	06-Feb-2020		
Approved By:			
Details:	Darrell Hall, Director		

Results - Leachate

Project: P19248 N40

Client: Priority Geotechnical Ltd	**Chemtest Job No.:**					20-02703	20-02703	20-02703	20-02703
Quotation No.: Q20-19314	**Chemtest Sample ID.:**					960305	960306	960307	960308
	Sample Location:					ST914A	ST918A	ST940	ST942
	Sample Type:					SOIL	SOIL	SOIL	SOIL
	Top Depth (m):					0.50	0.50	0.60	0.60
	Date Sampled:					23-Jan-2020	23-Jan-2020	22-Jan-2020	22-Jan-2020
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**				
Total Dissolved Solids	N	1020	10:1	mg/l	1.0	40	35	91	59
Chloride	U	1220	10:1	mg/l	1.0	1.9	< 1.0	1.6	3.4
Fluoride	U	1220	10:1	mg/l	0.050	0.16	0.19	0.13	0.20
Sulphate	U	1220	10:1	mg/l	1.0	< 1.0	< 1.0	48	< 1.0
Arsenic (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0	< 1.0	1.2
Barium (Dissolved)	U	1450	10:1	µg/l	5.0	< 5.0	< 5.0	< 5.0	< 5.0
Cadmium (Dissolved)	U	1450	10:1	µg/l	0.080	< 0.080	< 0.080	< 0.080	< 0.080
Chromium (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper (Dissolved)	U	1450	10:1	µg/l	1.0	1.4	1.6	< 1.0	1.7
Mercury (Dissolved)	U	1450	10:1	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Molybdenum (Dissolved)	U	1450	10:1	µg/l	1.0	2.9	1.1	1.6	2.4
Nickel (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lead (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Antimony (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Selenium (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	1.1	1.1	< 1.0
Zinc (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dissolved Organic Carbon	U	1610	10:1	mg/l	2.0	6.4	6.1	5.6	6.5
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030	< 0.030	< 0.030	< 0.030

Results - Soil

Project: P19248 N40

Client: Priority Geotechnical Ltd				**Chemtest Job No.:**	20-02703	20-02703	20-02703	20-02703
Quotation No.: Q20-19314				**Chemtest Sample ID.:**	960305	960306	960307	960308
				Sample Location:	ST914A	ST918A	ST940	ST942
				Sample Type:	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.50	0.50	0.60	0.60
				Date Sampled:	23-Jan-2020	23-Jan-2020	22-Jan-2020	22-Jan-2020
				Asbestos Lab:	LIVERPOOL	LIVERPOOL	LIVERPOOL	LIVERPOOL
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
ACM Type	U	2192		N/A	-	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-	-	-
Moisture	N	2030	%	0.020	12	5.9	13	8.5
pH	U	2010		4.0	7.9	8.6	7.9	8.5
pH (2.5:1)	N	2010		4.0	8.0	8.6	8.0	
Magnesium (Water Soluble)	N	2120	g/l	0.010	< 0.010	< 0.010	< 0.010	
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.037	< 0.010	0.37	
Total Sulphur	U	2175	%	0.010	0.043	0.032	0.17	
Chloride (Water Soluble)	U	2220	g/l	0.010	0.010	< 0.010	< 0.010	
Nitrate (Water Soluble)	N	2220	g/l	0.010	< 0.010	< 0.010	< 0.010	
Sulphate (Acid Soluble)	U	2430	%	0.010	0.016	< 0.010	0.12	
Arsenic	U	2450	mg/kg	1.0	5.8	9.1	7.0	14
Barium	U	2450	mg/kg	10	23	21	20	17
Cadmium	U	2450	mg/kg	0.10	0.15	0.29	0.23	0.44
Mercury Low Level	U	2450	mg/kg	0.05	0.11	< 0.05	0.06	< 0.05
Molybdenum	U	2450	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Antimony	N	2450	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Copper	U	2450	mg/kg	0.50	14	9.2	11	10
Nickel	U	2450	mg/kg	0.50	21	19	22	26
Lead	U	2450	mg/kg	0.50	17	12	18	13
Selenium	U	2450	mg/kg	0.20	0.28	< 0.20	< 0.20	< 0.20
Zinc	U	2450	mg/kg	0.50	42	37	47	54
Chromium (Trivalent)	N	2490	mg/kg	1.0	15	10	14	13
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50
LOI	U	2610	%	0.10	3.1	1.3	2.5	1.6
Total Organic Carbon	U	2625	%	0.20	0.93	< 0.20	0.80	0.24
Mineral Oil	N	2670	mg/kg	10	< 10	< 10	< 10	< 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0

Results - Soil

Project: P19248 N40

Client: Priority Geotechnical Ltd	**Chemtest Job No.:**				20-02703	20-02703	20-02703	20-02703
Quotation No.: Q20-19314	**Chemtest Sample ID.:**				960305	960306	960307	960308
	Sample Location:				ST914A	ST918A	ST940	ST942
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.50	0.50	0.60	0.60
	Date Sampled:				23-Jan-2020	23-Jan-2020	22-Jan-2020	22-Jan-2020
	Asbestos Lab:				LIVERPOOL	LIVERPOOL	LIVERPOOL	LIVERPOOL
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10	< 10	< 10
Benzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Toluene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Ethylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
m & p-Xylene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
o-Xylene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Methyl Tert-Butyl Ether	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Naphthalene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Acenaphthylene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Acenaphthene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Fluorene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Phenanthrene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Anthracene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Fluoranthene	N	2800	mg/kg	0.010	0.10	< 0.010	< 0.010	< 0.010
Pyrene	N	2800	mg/kg	0.010	0.11	< 0.010	< 0.010	< 0.010
Benzo[a]anthracene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Chrysene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[b]fluoranthene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[k]fluoranthene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[a]pyrene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Indeno(1,2,3-c,d)Pyrene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[g,h,i]perylene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Coronene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Of 17 PAH's	N	2800	mg/kg	0.20	0.21	< 0.20	< 0.20	< 0.20
PCB 28	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 52	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 90+101	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 118	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 153	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 138	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010

Results - Soil

Project: P19248 N40

Client: Priority Geotechnical Ltd				**Chemtest Job No.:**	20-02703	20-02703	20-02703	20-02703
Quotation No.: Q20-19314				**Chemtest Sample ID.:**	960305	960306	960307	960308
				Sample Location:	ST914A	ST918A	ST940	ST942
				Sample Type:	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.50	0.50	0.60	0.60
				Date Sampled:	23-Jan-2020	23-Jan-2020	22-Jan-2020	22-Jan-2020
				Asbestos Lab:	LIVERPOOL	LIVERPOOL	LIVERPOOL	LIVERPOOL
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
PCB 180	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total PCBs (7 congeners)	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010

Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2220	Water soluble Chloride in Soils	Chloride	Aqueous extraction and measuremernt by 'Aquakem 600' Discrete Analyser using ferric nitrate / mercuric thiocyanate.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.

Test Methods

SOP	Title	Parameters included	Method summary
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

UKAS TESTING
2183

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.: 20-01207-1

Initial Date of Issue: 27-Jan-2020

Client Priority Geotechnical Ltd

Client Address:
Unit 12
Owenacurra Business Park
Midleton
County Cork
Ireland

Contact(s): Colette Kelly

Project P19248 N40

Quotation No.:

Date Received: 14-Jan-2020

Order No.: 12463

Date Instructed: 16-Jan-2020

No. of Samples: 3

Turnaround (Wkdays): 7

Results Due: 24-Jan-2020

Date Approved: 27-Jan-2020

Approved By:

Details: Darrell Hall, Director

Results - Leachate

Project: P19248_N40

Client: Priority Geotechnical Ltd	**Chemtest Job No.:**					20-01207	20-01207	20-01207
Quotation No.:	**Chemtest Sample ID.:**					953804	953805	953806
	Client Sample ID.:					ST914	ST916	ST938
	Sample Type:					SOIL	SOIL	SOIL
	Top Depth (m):					0.60	0.60	0.50
	Date Sampled:					06-Jan-2020	06-Jan-2020	06-Jan-2020
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**			
Total Dissolved Solids	N	1020	10:1	mg/l	1.0	10	72	140
Chloride	U	1220	10:1	mg/l	1.0	1.2	2.0	39
Fluoride	U	1220	10:1	mg/l	0.050	0.083	0.11	0.31
Sulphate	U	1220	10:1	mg/l	1.0	< 1.0	< 1.0	11
Arsenic (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	1.2	< 1.0
Barium (Dissolved)	U	1450	10:1	µg/l	5.0	< 5.0	< 5.0	< 5.0
Cadmium (Dissolved)	U	1450	10:1	µg/l	0.080	< 0.080	< 0.080	< 0.080
Chromium (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0	< 1.0
Copper (Dissolved)	U	1450	10:1	µg/l	1.0	1.5	1.9	< 1.0
Mercury (Dissolved)	U	1450	10:1	µg/l	0.50	< 0.50	< 0.50	< 0.50
Molybdenum (Dissolved)	U	1450	10:1	µg/l	1.0	1.6	< 1.0	1.4
Nickel (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0	< 1.0
Lead (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0	< 1.0
Antimony (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0	< 1.0
Selenium (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0	< 1.0
Zinc (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0	< 1.0
Dissolved Organic Carbon	U	1610	10:1	mg/l	2.0	5.0	5.5	< 2.0
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030	< 0.030	< 0.030

Results - Soil

Project: P19248 N40

Client: Priority Geotechnical Ltd	**Chemtest Job No.:**				20-01207	20-01207	20-01207
Quotation No.:	**Chemtest Sample ID.:**				953804	953805	953806
	Client Sample ID.:				ST914	ST916	ST938
	Sample Type:				SOIL	SOIL	SOIL
	Top Depth (m):				0.60	0.60	0.50
	Date Sampled:				06-Jan-2020	06-Jan-2020	06-Jan-2020
	Asbestos Lab:				DURHAM	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
ACM Type	U	2192		N/A	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-	-
Moisture	N	2030	%	0.020	9.6	10	6.0
pH	U	2010		4.0	8.4	8.4	8.8
Arsenic	U	2450	mg/kg	1.0	12	18	9.1
Barium	U	2450	mg/kg	10	36	39	21
Cadmium	U	2450	mg/kg	0.10	0.34	0.64	0.24
Mercury Low Level	U	2450	mg/kg	0.05	0.07	0.10	< 0.05
Molybdenum	U	2450	mg/kg	2.0	2.1	2.2	< 2.0
Antimony	N	2450	mg/kg	2.0	< 2.0	< 2.0	< 2.0
Copper	U	2450	mg/kg	0.50	19	19	12
Nickel	U	2450	mg/kg	0.50	28	29	29
Lead	U	2450	mg/kg	0.50	27	40	14
Selenium	U	2450	mg/kg	0.20	< 0.20	< 0.20	< 0.20
Zinc	U	2450	mg/kg	0.50	64	89	60
Chromium (Trivalent)	N	2490	mg/kg	1.0	18	19	18
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50
LOI	U	2610	%	0.10	3.2	4.2	1.8
Total Organic Carbon	U	2625	%	0.20	0.74	1.5	0.30
Mineral Oil	N	2670	mg/kg	10	< 10	< 10	< 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0

Results - Soil

Project: P19248_N40

Client: Priority Geotechnical Ltd	**Chemtest Job No.:**				20-01207	20-01207	20-01207
Quotation No.:	**Chemtest Sample ID.:**				953804	953805	953806
	Client Sample ID.:				ST914	ST916	ST938
	Sample Type:				SOIL	SOIL	SOIL
	Top Depth (m):				0.60	0.60	0.50
	Date Sampled:				06-Jan-2020	06-Jan-2020	06-Jan-2020
	Asbestos Lab:				DURHAM	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10	< 10
Benzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Toluene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
o-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Methyl Tert-Butyl Ether	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Naphthalene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010
Acenaphthylene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010
Acenaphthene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010
Fluorene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010
Phenanthrene	N	2800	mg/kg	0.010	0.22	< 0.010	< 0.010
Anthracene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010
Fluoranthene	N	2800	mg/kg	0.010	0.29	< 0.010	< 0.010
Pyrene	N	2800	mg/kg	0.010	0.25	< 0.010	< 0.010
Benzo[a]anthracene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010
Chrysene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010
Benzo[b]fluoranthene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010
Benzo[k]fluoranthene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010
Benzo[a]pyrene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010
Indeno(1,2,3-c,d)Pyrene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010
Benzo[g,h,i]perylene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010
Coronene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010
Total Of 17 PAH's	N	2800	mg/kg	0.20	0.76	< 0.20	< 0.20
PCB 28	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 52	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 90+101	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 118	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 153	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 138	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 180	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010
Total PCBs (7 congeners)	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010

Test Methods

SOP	Title	Parameters included	Method summary
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1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS

Test Methods

SOP	Title	Parameters included	Method summary
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

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All water samples will be retained for 14 days from the date of receipt
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customerservices@chemtest.com

VOLUME 2

Report on a Site Investigation of the Bord Gais Eireann proposed Gas Pipeline route from Ballinacurra to Cork City with a branch to Marino Point.

Electricity Supply Board,
Projects & Hydrometric Division,
Civil Works Department,
Stephen Court,
18/21 St. Stephen's Green,
Dublin 2.

SEPTEMBER, 1976.

SITE INVESTIGATION ON GAS PIPELINE ROUTE FROM POWERHEAD BAY TO CORK, AGHADA AND MARINO POINT

INDEX OF VOLUMES

VOLUME No.	TITLE
1	Site Investigation on Pipeline Route from Powerhead Bay to Ballinacurra and branch to Aghada.
2	Site Investigation on pipeline route from Ballinacurra to Cork City and branch to Marino Point.
3	Maps and Drawings showing location of boreholes on pipeline route.

CONTENTS

APPENDICES

I. FOREWORD

Notes on Site Investigation Procedure

The following notes should be read in conjunction with the Report. Any modifications to the procedures outlined below are indicated in the main text.

GENERAL:

The recommendations made and opinions expressed in the Report are based on the Boring Records, an examination of samples and the results of the site and laboratory tests. No responsibility can be held for conditions which have not been revealed by the boreholes, for example, between borehole positions. Whilst the Report may express an opinion on a possible configuration of strata both between borehole positions and below the maximum depth of the investigation, this is for guidance only and no liability can be accepted for its accuracy.

BORING TECHNIQUE:

Unless otherwise stated the 'Shell and Auger' technique of soft ground boring has been employed. Whilst this technique allows the maximum data to be obtained on strata conditions, a degree of mixing of some layer soils, (e.g. thin layers of coarse and fine granular material) is inevitable. Specific attention is drawn to the factor where evidence of such a condition is available.

GROUND WATER:

The ground water conditions entered on the Boring Records are those appertaining at the time of the investigation. The normal rate of boring does not usually permit the recording of an equilibrium water level for any one water strike. Moreover, ground water levels are subject to variations caused by seasonal effects or changes in local drainage conditions. The table on each Boring Record shows the ground water level at the quoted borehole and casing depths, usually at the start of the days work.

ROUTING SAMPLING:

Undisturbed samples of predominantly cohesive soils are obtained in a 102 mm diameter open-drive sampler, complying with the requirements of the British Standard Code of Practice C.P.2001. Large disturbed samples of granular soils, or of soils in which undisturbed sampling is not possible or appropriate, are taken from the boring tools and sealed into polythene bags. Small disturbed samples are taken at frequent intervals of depth and sealed into 0.5 kg glass jars with screw lids for subsequent visual classification. Where encountered in sufficient quantity, samples of ground water are taken.

Unless otherwise stated in the main text, disturbed soil samples may not be at their natural water content.

SITE INVESTIGATION ON GAS PIPELINE ROUTE FROM POWERHEAD BAY TO CORK, AGHADA AND MARINO POINT

SEPTEMBER, 1976.

II. INTRODUCTION.

Gas will be conveyed by submarine pipeline from the offshore gas field to a land terminal at Inch near Powerhead Bay 5 km to the east of the entrance to Cork Harbour. The land pipeline commences at Inch and from there it runs in a general northerly direction to Ardra Beg A.G.I. Site where there is a branch to Aghada. It carries on to near the town of Midleton, crossing the Owenacurra River at Ballinacurra. It then swings west, passing to the south of Carrigtohill, where there is another A.G.I. Site and a branch to Marino Point, after which it crosses to the north side of the main Cork-Waterford road and the Cork-Youghal railway line. It then follows a north-westerly and westerly course as far as Caherlag A.G.I. Site before turning south to cross the same road and railway line again. From there it follows a south-westerly course and crosses the River Lee at Lough Mahon, after which it takes a west to north-west direction along a disused railway and the Marina riverside walk to the E.S.B. Generating Station at Marina, and thence along public roads to Cork Gas Works.

Feasibility studies for the three main water crossings at Lough Mahon, Weir Island and Ballinacurra have been carried out separately and the investigation which is the subject of this report relates only to ground conditions along the proposed pipeline route including other crossings and Above Ground Installation (A.G.I.) Sites.

The investigation was carried out to obtain information which will be of assistance in assessing excavation and pipelaying difficulties along the pipeline route and foundation requirements for attendant Above Ground Installations (A.G.I. Sites).

To expedite the site investigation work two contractors were engaged in the first stage of the investigation to drill shell and auger boreholes at road and other crossings.

One contractor drilled on the route from Powerhead Bay to Ballinacurra including the branch line to Aghada (Volume I of the Report) while the other drilled from Ballinacurra to Cork City including the branch line to Marino Point (Volume II of the Report). For the second stage of the investigations a series of rock probe drillings was carried out by one contractor over the entire route to supplement the borehole information.

Unfortunately, Bord Gais Eireann were refused permission to enter on lands along the route to carry out trial pitting, which was an essential requirement in preparing a comprehensive report. In certain areas permission was refused to enter lands to carry out any type of investigation whatsoever, and in these cases an opinion based on visual observations only has been included in the report.

The report in three volumes, contains the information obtained and discusses in general terms the implications of ground conditions in relation to the proposed project.

III. FIELDWORK

A total of 57 shell and auger boreholes and 43 Percussion Probes were drilled in the locations shown on the strip maps in Volume 3 of this report and along the line shown on the site plan in Appendix III.

The description and depth of the various strata encountered and the depths at which samples were recovered are shown on the boring records in Appendix I. Also shown on these records are the results of in-situ penetration tests, the ground water conditions observed during the course of boring operations and details of rotary drilling operations where appropriate.

The route of the proposed pipeline which is the subject of the investigation described in this report, extends from Ballinacurra, near Midleton to Cork City with a branch line to Marino Point.

For reference purposes the route has been divided into sections and the following should, therefore, be read in conjunction with Volume 3 of this report.

Main Pipeline Route - Ballinacurra to Cork City

Ballinacurra to Carrigtohill A.G.I. Site - Strip maps 01/08 to 01/11:

The northern side of the river crossing at Ballinacurra, which was investigated as part of the river crossing feasibility study, showed a silty gravel layer of five to six metres depth overlying limestone rock and in the first borehole (SX 18) on the main pipeline to Cork City conditions were somewhat similar with a stiff gravelly sandy clay of depth 2.90 metres overlying shattered limestone rock with some clay. The borehole was drilled to a total depth of 7.10 metres and the 4.20 metres of rock coring gave a core recovery of approx. 40%. No water was met in this hole.

Borehole SX 19 revealed a very stiff grey silt becoming more sandy from a depth of 2 metres below ground level and eventually hitting a stiff boulder clay (S.P.T. 32) at 6.00 metres below ground level. Standing water level in this hole was at 5.50 metres below ground level.

The next two boreholes SX 20 and SX 21 are very similar penetrating upper layers of stiff stoney clay and then very stiff boulder clay. Depth of drilling here was 5.00 metres with no rock or water in either borehole.

Boreholes 22, 22A, 22B, 22C and 23 are in a generally marshy area south of Carrigtohill traversed by a small probably tidal stream with numerous connecting drains. The top 1.5 metres in these holes consists of a mixture of fill, peat and soft silt but thereafter a stiff gravelly clay with cobbles followed by fine sand or a mixture of sands and gravels persists to five metres. As would be expected water level is generally not more than 2 metres below ground level.

Four boreholes were drilled on the initial A.G.I. site at Carrigtohill and these showed compact clayey gravels or gravelly clay from under top soil (0.30 metres) to six metres below ground level. Standing water level was approx. 1.50 metres below ground level.

For reasons other than ground conditions Bord Gais decided to move the A.G.I. site to a new position between the above site and borehole SX 24. Because of the obvious uniformity of ground conditions at the two adjoining sites, it was decided not to drill any further boreholes.

Carrigtohill A.G.I. Site to Caherlag A.G.I. Site - Strip Maps 01/11 to 01/15:

From the A.G.I. Site at Carrigtohill up to and including road crossing SX 30 no access permission was obtainable from the owner but a visual inspection of this area indicated apparently good ground conditions except for a small marshy area and stream adjoining the Carrigtohill site.

The main road and railway crossing at SX 31 and SX 32 was investigated but due to access being refused by the owner it was not possible to drill holes in the area between the road and the railway. However, boreholes SX 31 and SX 32 were very similar and showed a stiff stoney clay to a depth of approx. 2 metres followed by a compact coarse gravel to 6 metres below ground level. Water level here varied between two and three metres below ground level although a high level stream flows alongside the main road.

From borehole SX 32 the pipeline heads north-westward towards the high level ground north of the main road from Cork to Waterford and ground conditions change, with rock (generally sandstone) appearing in almost all boreholes. The sandstone is weathered in the top layers but rock was found in boreholes SX 33, SX 34 and SX 36, between 0.60 and 2.00 metres below ground level. Access to drill borehole SX 35 was not possible. No water was struck in any of these holes.

Four boreholes were drilled on the original Caherlag A.G.I. site and two further holes on the adjoining finally selected site. All the above boreholes except borehole No. 2 on the initial site showed a stiff or very stiff silty clay with gravel and angular rock particles approx. two to three metres deep overlying a coarse grained red sandstone. Rock coring in three of these holes gave varying core recoveries averaging around 50%. Two boreholes, one on the original site and one on the final site, showed water at 3 metres below ground level. Borehole No. 2 referred to earlier had rock at 0.60 metres below ground level.

Caherlag A.G.I. Site to Inchera A.G.I. Site - Strip maps 01/15 to 01/17:

From Caherlag A.G.I. Site the pipeline heads practically due south and downhill towards the main Cork-Waterford road and Cork-Cobh and Youghal railway line. Boreholes SX 37 and SX 38 are very similar to the boreholes on the route to Caherlag with sandstone rock in various states of decay from 0.60 metres below ground level. No water was found in these holes.

Boreholes SX 39 and SX 39A were placed alongside the main Cork Waterford road and railway line and these showed some gravel filling material in the top metre to two metres followed by soft silt or silty clay to a depth of six metres below ground level. No water was found in these holes. A borehole south of the railway line was not possible as access to the land was refused.

From the railway line crossing, the pipeline turns south-west towards Inchera. No access was permitted by the owner to the first 1100 metres of this route. From visual inspection the initial part of this line is apparently reasonably good agricultural land but a marshy low-lying area up to 300 metres long with a stream flowing through its centre is evident towards the Inchera end.

Boreholes 39B, 39C, 39D, 39E and 39F were all drilled in or around a marshy tidal area controlled by a sluice valve just short of Inchera A.G.I. Site. The surrounding ground rises steeply from the area liable to flooding and boreholes 39E and 39D were drilled on the rising ground and showed good compact clayey gravel from ground level. Borehole 39C has a soft organic silt with shells followed by a soft silty clay to a depth of 4.00 metres below ground level but 39B and 39F have a shallower depth of silt, between 1.2 and 2.0 metres, followed by a fairly compact silty gravel. Water level in all these holes is at ground level to 0.60 metres below ground level.

The Industrial Development Authority, who own the land at Inchera dug a series of trial pits on their property prior to our investigation. Some of these pits were on the A.G.I. Site and were inspected and all showed a compact silty gravel from ground level to a depth of abour four metres.

Inchera A.G.I. Site to Marina A.G.I. -
Strip maps 01/17 to 01/20:
A feasibility study of the river crossing Inchera to Mahon has been carried out and reported on separately.

The A.G.I. Site at Lough Mahon shows a soft silt or silty clay to a depth of 2.00 metres below ground level, followed by a stiff sandy boulder clay. Limestone rock was found in boreholes adjacent to the site.

From the A.G.I. Site at Lough Mahon the pipeline heads in a westerly direction towards the disused railway cutting. Near Lough Mahon A.G.I. Site limestone rock levels are approx. 1.5 metres below ground level but in borehole C_6 and C_5 rock was not met until 5 metres below ground level although rock is visible near the surface in the quarry adjacent to the disused railway. A very stiff stoney silt or gravelly clay was found in the upper parts of C_5 and C_6 and no water was struck.

Between boreholes C_4 and C_3 the pipeline runs along the top of the railway cutting and a stiff gravelly sandy silt was found in both of these holes to a depth of 5 metres. The top two metres of borehole C_4 was found to have a somewhat softer clayey silt layer. No water was struck.

At borehole C_3 the pipeline enters the cutting and continues in the cutting and the subsequent embankment to near borehole C_2. The pipe will be laid on the surface in this area. Boreholes C_8, C_9 and C_{10} were drilled on the route of a possible diversion from this line. These holes all contained a considerable depth of soft silt and water levels were generally within 0.5 metres of ground level.

Boreholes C_2 and C_1 were drilled in the road margin at Marina. Water level in these holes probably varies with the tides. Both boreholes showed good firm material at two metres below ground level, but borehole C_1 has a layer of silt with some gravel from 2.70 to 4.30 metres below ground level which varies between soft and stiff in consistency.

Four boreholes were drilled on Marina A.G.I. Site and these all showed fill to a depth of 2.50 to 3.00 metres followed by a soft grey organic silt and in some holes a loose sandy gravel before hitting a compact coarse sandy gravel at a depth of between 6 and 8 metres below ground level. Water level is generally 3 metres below ground level but probably varies with the tides. Tests on a sample of soil from borehole No. 2 gave a Ph of 7.10 and So_3 0.08%.

Marina A.G.I. Site to Cork Gas A.G.I. Site -
Strip map 01/20:

No boreholes were drilled along the main industrial estate roadway between these sites. In the boreholes drilled on Cork Gas property limestone rock was generally found at depths varying between 1.5 and 3.0 metres with the cover consisting mainly of gravel filling and some top soil. No water was found in any of these holes except borehole No. 6. Here the water was found at 4.00 metres below ground level and may be influenced by the tide.

Branch Pipeline Route -
Carrigtohill to Marino Point

Carrigtohill A.G.I. Site to Weir Island -
Strip maps 03/01 and 03/02:

Boreholes SX 24 and SX 24A show a compact coarse sand or sandy gravel to 5.00 metres below ground level with a relatively high water level in borehole SX 24A of 1.40 metres below ground level. When drilling borehole SX 24A blowing back of material occurred between 4.0 and 5.0 metres below ground level.

From borehole SX 24A the ground slopes gently downwards to a soft marshy tidal area traversed by a stream. Borehole SX 24B on the edge of this area showed similar sub-surface conditions to SX 24A with water level about one metre below ground level.

Borehole SX 25 which is located in a field approx. 2 metres below the adjoining road level shows a mixture of silty clay and peat to 2.0 metres below ground followed by a compact gravelly clay and finally gravel to 6.0 metres. No water was found in this borehole.

After crossing the roadway at SX 25 there follows almost immediately an area approx. 250 metres long which is low-lying, liable to flooding by tides and is controlled by some form of sluice. Borehole SX 25A which is in the centre of this area contained a soft grey silty clay from ground level to a depth of 6.0 metres. No water was found in this hole. Results of laboratory tests on this material can be seen in Appendix II.

The remainder of the route to Weir Island contains a compact sandy silty gravel from ground level except for a small section at borehole SX 25B which is situated at the top of an area liable to flooding. Borehole SX 25B has 1.3 metres of soft/firm silty clay followed by a stiff gravelly silt and coarse gravel at 1.8 metres below ground level.

Weir Island (Rosslague Side) to Marino Point - Strip maps 03/02 to 03/04:

A feasibility study of the river crossing from Weir Island to Rosslague has been carried out and reported on separately. Boreholes SX 26, SX 27 and SX 28, which were drilled to a depth of 5.0 metres all show compact layers of silty gravels or boulder clays. No water was found except in SX 26 where water level was five metres below ground level.

From borehole SX 28 the pipeline descends gradually to the Cork-Cobh railway where borehole SX 29 was drilled on the western side of the crossing. It was not possible to drill a borehole on the eastern side of the railway crossing because access was not permitted by the owner. Borehole SX 29 shows broken rock and clay (probably fill) for 2.90 metres followed by a compact clayey gravel with cobbles.

The exact location of the A.G.I. Site at Marino Point was not available to enable furhter boreholes to be drilled at the time of this investigation.

IV. COMMENTS ON GROUND CONDITIONS IN RELATION TO THE PROPOSED WORKS

From information received from Bord Gais Eireann, it is understood that the invert level of the proposed pipeline will generally be approximately two metres below ground level although the depth may be increased at road, rail and stream crossings to four or five metres.

It is further understood that A.G.I. Sites represent the locations of various pressure reducing valves, structures, bases, light buildings etc., with loadings of 100 to 200Kn/m^2. Foundations would be placed at a depth of approximately one metre below ground level unless conditions dictated otherwise.

Main Pipeline Route - Ballinacurra to Cork City

Ballinacurra to Carrigtohill A.G.I. Site - Strip maps 01/08 to 01/11:
From the river crossing at Ballinacurra to the vicinity of borehole SX 18 the pipe invert will generally be in compact silty gravel and information would suggest that no water or trench support problems should be encountered.

Commencing at borehole SX 18 and continuing to borehole SX 19, SX 20, SX 21 and as far as SX 22 the pipe invert will be in a stiff grey silt or boulder clay. Ground water at the time of the investigation was well below the 2.0 metres excavation line but depending on weather conditions and the time of year it may be necessary to grade back the sides of the excavation or to use close timber sheeting in certain areas.

The area from SX 22 to SX 23 will generally have the pipe invert below ground water level and because of this and the fact that the overlying material consists of mainly peat and soft silts trench support will probably be required. Considerable pumping may also be required on this section. Also depending on tides and rainfall at the time of construction access to this area by machinery may be limited. Since this area is partly tidal it may be necessary to include for some special protective coating to the pipes. There are many land drains and open drains in this area and special precautions as regards marking and replacing these to the owners satisfaction will be necessary.

From SX 23 to the A.G.I. Site at Carrigtohill compact silty gravel is present at pipe invert and no special difficulties are envisaged.

Carrigtohill A.G.I. Site to Caherlag A.G.I. Site - Strip maps 01/11 to 01/15:

Carrigtohill A.G.I. Site:

On this site a compact silty gravel or gravelly clay is present with C.P.T. results between 19 and 28 at 1.65 metres below ground level. Excavation and foundation loadings at the levels envisaged should present no problems.

Because access was not allowed by the owner investigation was limited to a visual inspection of the ground between the A.G.I. Site at Carrigtohill and crossing SX 30. Conditions would appear to be similar to those between borehole SX 23 and the A.G.I. Site. One small section about 100 metres long probably has a small depth of silt and could be quite soft in winter conditions. A stream which may be tidal on spring tides runs through the centre of this area.

From crossing SX 30 to broehole SX 31 probe information suggests a similar compact silty gravel and no particular problems of excavation are envisaged.

The method and depth of excavation to be carried out at the road and railway crossings at SX 31 and SX 32 are not known at this time but a very stiff stoney clay at 1.50 metres depth changes to a compact gravel at 1.90 metres at SX 31 and to a gravelly clay at 2.50 metres in SX 32. Water was struck between 2 and 3 metres below ground level and could be higher in winter conditions. Trench protection and pumping may be needed in this location.

At half way between SX 32 and SX 33 rock appears in the rock probes and the pipe invert level from here to Caherlag A.G.I. could be assumed to lie mainly below the rock horizon. The rock consists generally of sandstone and good recovery was achieved in the rock coring. However, a weathered top surface is present in some of the boreholes and excavation of this material by machine would appear possible. No ground water was encountered in these holes.

Caherlag A.G.I. Site to Inchera A.G.I. Site - Strip maps 01/15 to 01/17:

Caherlag A.G.I. Site:
The two boreholes drilled on this final site and the four on the adjoining initial site show rock at varying depths of 0.60 to 3.50 metres below ground level covered with a silty sandy clay with cobbles which required chiselling from 1.50 metres below ground level. Water level was least 3.00 metres below ground level although the position of the site would indicate that this could rise considerably in winter conditions. Excavation and foundation loadings at the levels envisaged should present no problems.

From Caherlag A.G.I. Site to near borehole SX 39 the pipeline rises and then descends towards the main road and conditions are very similar to those found in SX 33 to SX 36. The rock levels are within one metre of ground level in SX 37 and SX 38 and core recovery is good. Considerably variation in rock quality at a depth of 2.0 metres could occur and again excavation by machine to these depths may prove possible over large stretches. Both on the route to Caherlag A.G.I. Site and from there to SX 39 there are some very steep sections of ground which may impose some limitations as regards the type of machinery used.

Again at the road and railway crossing at SX 39 and SX 39A the depth and method of excavation can only be finally decided in consultation with Cork County Council and C.I.E. but with loose fill on top of a soft silt or silty clay all open excavation will require close timber sheeting. If thrust boring under the railway is contemplated then further borehole drilling on the south of the railway will be necessary to determine suitable layers for boring. No water was found in boreholes SX 39 and SX 39A at the time of drilling but in winter conditions this picture could alter considerably in this location.

From the south side of the railway crossing for 1100 metres as stated earlier access for boreholes or inspection was not granted by the owners but from a visual examination a distance of 300 to 400 metres of pipeline would be laid in marshy area subject to flooding and with a stream in its centre. Conditions are probably very similar to the next section at SX 39C but special precautions would need to be taken in replacing field drains etc., which were being laid during the time of this investigation.

The pipeline is shown crossing the marshy tidal area short of Inchera site at borehole SX 39C. In this location the high ground water levels and depth of silt together with the tidal stream will make excavation difficult. Trench supports will be required and machinery may experience difficulties in working in this area unless specially tracked for the purpose. An alternative crossing line which would probably be less difficult would be to just south of the concrete sluice chamber adjacent to borehole SX 39F. Here the depth of silt is only one metre and is followed by a compact silty gravel and ground conditions on each side are better for machinery etc.

Inchera A.G.I.Site to Marina A.G.I. Site - Strip maps 01/17 to 01/20:

Inchera A.G.I. Site:

Site development by the I.D.A. has produced a level surface over most of this area and there is a depth of at least 4 metres of compact silty gravel with water level well below proposed foundation levels. Again excavation and foundations should present no difficulties.

Lough Mahon A.G.I.Site:

The upper layers on this site consist of a soft silt or silty clay to a depth of approx. 2.00 metres below ground level. It may be necessary to go through this layer to the stiff sandy boulder clay which is found beneath it. Part of this site has ground levels below spring tide level and because of its proximity to the sea is actually flooded by these tides. Excavations may have to be supported and pumping allowed for.

From the A.G.I. at Lough Mahon to the road crossing at borehole C_4 the pipe invert should generally be in a stiff stoney silt or gravelly sand and in quite a few positions may be in limestone rock. No water levels were recorded and no particular difficulties are envisaged apart from the fact that limestone rock where found will probably be of good quality requiring blasting.

At a depth of 2 metres below ground level between C_4 and C_3 a good pipe foundation is available but depending on the time of year precautions with excavation machinery close to the top of the disused railway embankment may have to be taken to avoid any possibility of a slip.

In the railway cutting we understand that the pipe will be laid on the cutting invert and apart from the obvious clearing of rubble, waste and undergrowth and its disposal no other difficulty is envisaged. Also the detour from the cutting on the line of boreholes C_8, C_9 and C_{10} has now been abandoned and the pipe will be laid on the adjoining embankment to the north.

Between borehole C_2 and the Marina A.G.I. Site a compact sand and sandy stoney clay was found at pipe invert level and if two metres is the maximum excavation level no particular difficulties should be encountered. Even though water levels here are probably tidal the trench should be dry at about two metres depth during all stages of the tide.

Marina A.G.I. Site to Cork Gas A.G.I. Site - Strip map 01/20:

Marina A.G.I. Site:
Fill material followed by a soft silt seems to indicate that unless large settlements can be entertained foundations would have to be piled. Bored piles have been used successfully on adjoining sites and if used should be taken to the dense gravel layer at 6-8 metres below ground level. Sulphate tests here gave a low value of SO_3 but in view of the fact that the adjacent site gave much higher values (generally Class 2 values) and that the ground water is probably tidal a sulphate resistant cement should be used.

As previously mentioned in Section III of this Report no boreholes were drilled on this route but visual inspection suggested that there was unlikely to be any difficulties. Excavation through the premises of the Cork Gas Co. will require careful attention to avoid underground pipes etc.

Cork Gas A.G.I. Site:
A tarmacadam surface on fill material on this site has shown large settlement in places and in view of the fact that the boreholes show rock at between 1.5 and 3.0 metres overlain by an assorted mixture of top soil, fill and brown clay, we consider that all foundations should preferably go to rock. No water was found in the boreholes and is unlikely to be present in the excavation but trench support may be necessary.

Branch Pipeline Route - Carrigtohill to Marino Point

Carrigtohill A.G.I. Site to Weir Island - Strip maps 03/01 and 03/02:

From borehole 24A to 24B and for a further distance of approx. 70 metres beyond borehole 24B there lies a marshy area subject to flooding and high spring tides. The ground water level is high and the presence of gravels and sands at pipe invert level probably means trench supports and considerable pumping. Special protection coating may be needed on the pipes and the movement of machinery could be difficult in this area.

From the above area to a distance of 100 metres beyond borehole SX 25 the pipe invert should generally be in a gravelly clay or clayey gravel. The initial section of this length could still require pumping and trench support. At borehole SX 25 a firm to stiff silty clay at 1.60 metres depth is followed by peat from 1.60 to 2.00 metres below ground level. This could cause problems at this road crossing particularly as the roadway level is 2 to 3 metres over field level.

The next length of pipeline will traverse an area liable to flooding where ground conditions consist of a soft grey silt and silty clay from ground level to a depth of 6 metres. Trench support may be required here and access of machinery will depend on weather conditions and the time of year.

On the remainder of the length to Weir Island sandy silty gravel is present at pipe invert level and where the gravel is loose and also in a small section at SX 25B some trench support might need to be employed.

Weir Island to Marino Point - Strip maps 03/02 to 03/04:

After the river crossing from Weir Island to Rosslague and continuing through boreholes SX 26, SX 27, SX 28 to SX 29 at Marino Point compact silty gravels or boulder clays predominate with no water present in the boreholes. No special works or precuations would appear necessary in this section of the route.

Marino Point A.G.I.:

The exact location of this site was not defined at the time of writing this report but the area near borehole SX 29 has a considerable depth of well consolidated hardcore and clay. Settlement would depend on the depth and presence of any silt under the particular site decided on.

APPENDIX II

LABORATORY TEST RESULTS

SUMMARY OF LABORATORY TEST RESULTS

Borehole No.	Sample No.	Depth (mtrs)	Nat M.C. %	C_u (Kn/m^2)	$\emptyset_u$	B.D. (Mg/m^3)	L.L.	P.L.	Description
25A	3361	0.6 to 1.1	38.3%	-	-	-	50%	27%	Soft grey organic silty clay.
25A	3363	2.0 to 2.5	55.8%	19.8	0°	1.65	-	-	Soft grey silty clay.
25A	3365	4.0 to 4.5	52.5%	-	-	-	-	-	Soft blue/grey silty clay
25A	3367	5.5 to 6.0	76.0%	-	-	-	-	-	Soft blue/grey silty clay
25B	3184	1.0 to 1.5	35.3%	-	-	-	-	-	Soft/firm grey silty clay
39	1314	1.5 to 2.0	36.6%	27.6	2.0°	1.84	87%	35%	Soft grey organic silty clay (root fibre).
39	1316	3.0 to 3.5	53.6%	-	-	-	84%	35%	Soft grey organic silty clay.
39	1318	4.5 to 5.0	31.0%	-	-	-	48%	31%	Soft grey organic silty clay.
39A	1322	1.5 to 2.0	25.5%	-	-	-	-	-	Soft grey organic gravell silt.
39A	1324	3.5 to 4.0	39.3%	-	-	-	-	-	Very stiff grey organic silt.
39A	1326	5.5 to 6.0	45.5%	-	-	-	-	-	Soft grey organic sandy silt.
39A	1328	7.0 to 7.5	45.1%	-	-	-	-	-	Soft grey organic sandy silt.
39F	3191	6.8 to 1.3	38.3%	-	-	-	-	-	Soft grey organic clayey silt.
2 (Marina)	0673	2.5 to 3.0	44.7%	16.2	0°	1.78	51%	30%	Soft grey organic sandy clayey silt.
3 (Marina)	0685	3.5 to 4.0	39.7%	-	-	-	52%	34%	Soft grey organic clayey silt.
3	0687	4.5 to 5.0	44.4%	10.9	0°	1.74	52%	40%	Soft grey organic clayey silt.

RESULTS OF CHEMICAL TESTS

Borehole No.	Sample No.	Depth (Mtrs)	PhValue	SO_3 Content
25A	3361	0.6 to 1.1	7.45	1.45%
25B	3184	1.0 to 1.5	7.15	0.10%
39F	3191	0.8 to 1.3	7.10	0.08%
2 (Marina)	0673	2.50 to 3.00	7.10	0.08%

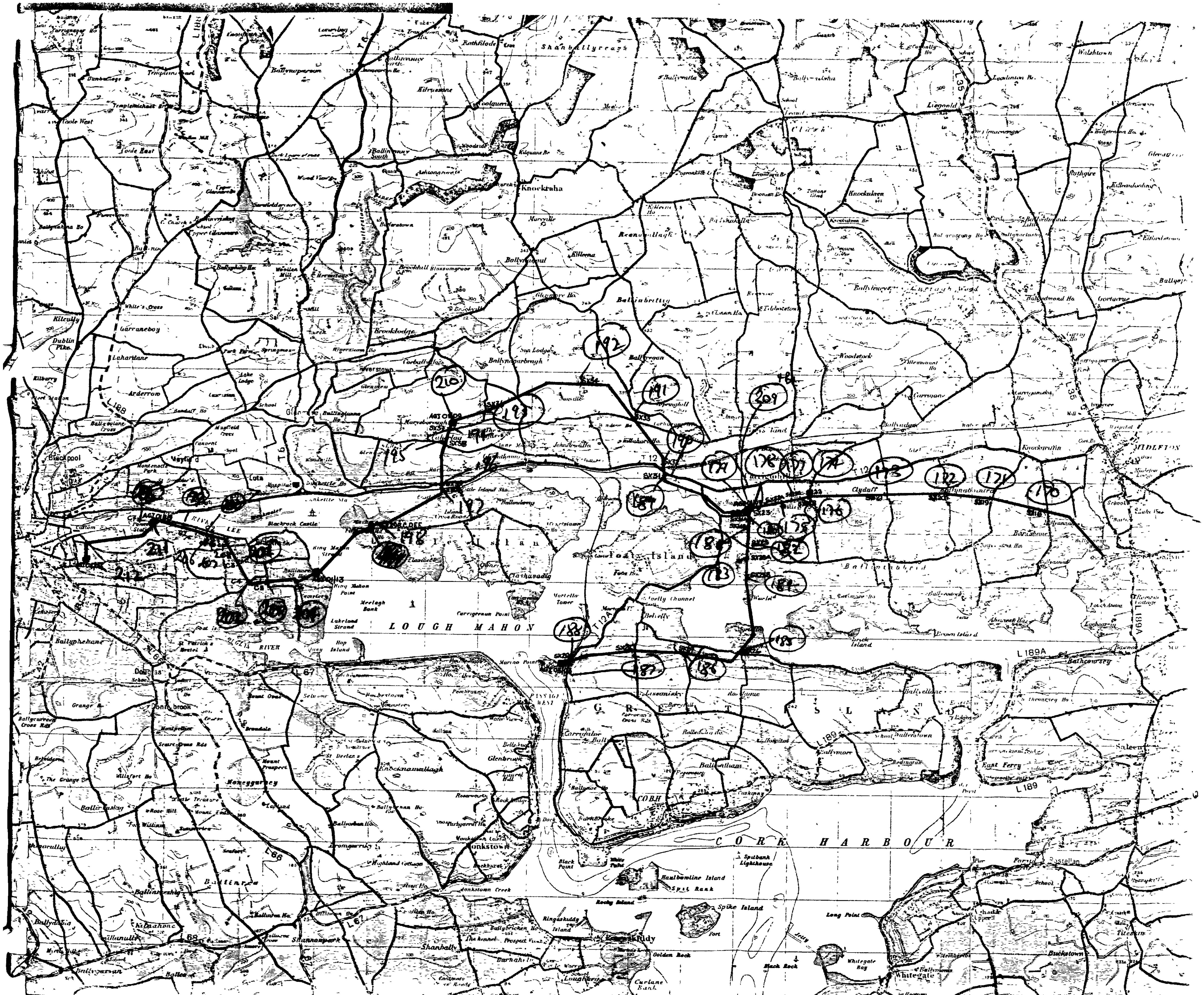
NOTE: All laboratory tests were carried out by Professor R. W. Kirwan at Trinity College, Dublin.

VOLUME III

MAPS AND DRAWINGS

Electricity Supply Board,
Civil Works Department,
Stephen Court,
18/21 St. Stephen's Green,
Dublin 2.

SEPTEMBER, 1976.


Shanballyreagh
Templemichael Br
Toole West
Toole East
Knockraha
Ballynaglaugh
Ballinbrittig
Woodstock
Carrigane
Lisgoold
Kilcully
Dublin Pike
Garraneboy
Lahardane
Kilbarry
Arderrow
L188
Blackpool
Montenotte Park
Mayfield
Lota
Brooklodge
Blackrock Castle
Foaty Island
Lough Mahon
Belvelly Channel
Marino Point
Passage West
Great Island
Cobh
Cork Harbour
Spike Island
Haulbowline Island
Ringaskiddy
Monkstown
Rochestown
Douglas
Ballyphehane
Knocknamallagh
Ballinrea
Shanbally
Whitegate
Rostellan
East Ferry
Saleen
Midleton
Knockgriffin
L35
L189
L189A
L66
L67
L68
T6
T12
T12A
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SITE INVESTIGATIONS LTD.

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SOIL INVESTIGATION

BORING RECORD

~~19~~

CONTRACT Boro Gais Pipeline.

BOREHOLE No. SX 39A

Report No.

Order No.

Bored for E. S. B.

Site Address South East Cork.

Boring Commenced 18.6.1976.

Boring Completed 19.6.1976.

Type of Boring Shell & Auger

Diameter of Borehole 200 mm.

Ground level O.D.

Water Struck (1) Nil. **(2)** **(3)**

Standing Water Level -

70375

Remarks All levels are related to ground level.

Description of Strata	Depth		Thickness	Samples		
	From	To		Ref No.	Type	Depth
Filling of clay, stones, etc.	0	0.50	0.50			
Soft grey/brown organic gravelly silty clay.	0.50	1.60	1.10	1321 1322	0 U	1.50 1.50 - 1.95
Stiff grey silt.	1.60	5.00	3.40	1323 1324 1325	0 U D	3.00 3.50 - 4.00 4.50
Soft grey organic sandy clayey silt.	5.00	7.00	2.00	1326 1327 1328	U 0 U	5.50 - 6.00 6.00 7.00 - 7.50
Final level.	7.00					

SITE INVESTIGATIONS LTD.

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SOIL INVESTIGATION

BORING RECORD

26

CONTRACT Bord Gais Pipeline.

BOREHOLE No. SX 39

Report No.

Order No.

Bored for E. S. B.

Site Address South East Cork.

Boring Commenced 18.6.1976.

Boring Completed 18.6.1976.

Type of Boring Shell& Auger

Diameter of Borehole 200 mm.

Ground level O.D.

Water Struck (1) Nil. (2) (3)

Standing Water Level -

703.74-

Remarks All levels are related to ground level.

Description of Strata	Depth		Thickness	Samples		
	From	To		Ref No.	Type	Depth
Brown clayey gravel.	0	1.90	1.90	1313 1314	D U	1.50 1.50 - 2.00
Soft grey organic clayey silt.	1.90	2.00	0.10			
Soft grey silty clay.	2.00	6.50	4.50	1315 1316 1317	D U D	2.00 3.00 - 3.50 4.00
Final level.	6.50			1318 1319 1320	U D D	4.50 5.00 6.50
Standard Penetration Tests.						
At 6.65 9 blows to 12"						

N25 Little Island Pedestrian and Cyclist Bridge
Environmental Impact Assessment Report