ATKINS

Member of the SNC-Lavalin Group

N52 Grange to Clontail Scheme

Environmental Report

Meath County Council

29/09/2020

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1. Introduction

The N52 has been identified as one of the country's most important National Secondary Routes, linking the northeast to the southwest of the country. The N52 serves the towns of Dundalk, Ardee, Kells, Mullingar, Tullamore, Birr and Nenagh. The existing N52 connects with the M1 and N1 northeast of Dundalk town and continues in a southwest direction where it intersects with a number of primary and secondary national roads (the N2 and N33 in Ardee, the M3 and N3 in Kells, the N51 in Devlin, the N4 in Mullingar, the M6 at Tyrrellspass, the M6 at Kilbeggan, the N80 in Tullamore, the N62 at Birr, the N65 at Borrisokane) and terminates at the M7 in Nenagh. The section of the proposed N52 under consideration connects Kells, Co. Meath to Ardee, Co. Louth, as shown on Scheme Location drawing in Appendix A.

In 2005 a national infrastructure plan entitled Transport 21 targeted the N52 for upgrade works including it as a '*strategic linking corridor'*. The National Secondary Roads Needs Study - East Region 2011 (NSRNS) identifies the N52 as a significant route which connects Dundalk to Nenagh with various connections to other national primary and secondary routes along its overall 203 km length. The route is of national strategic importance as part of the National Spatial Strategy and is identified as a National Transport Corridor between Tullamore and Dundalk.

The Westmeath, Meath and Louth County Development plans also earmark the N52 as a high priority component of their respective road networks to be upgraded. This further reinforces the regional acknowledgement of the importance of this road. The Meath County Development Plan 2013-2019 (MCDP) recognises the importance of the national primary and secondary road network through the county servicing the Dublin – Belfast Economic Corridor and also in providing easy access to Dublin City for people living in the commuting centres of Kells and north Meath. The N52 forms a key part of this network linking Kells to Ardee and also linking the M3 to the M1 (via. the N33).

In 2005, the Republic of Ireland's National Roads Authority and Roads Service Northern Ireland jointly applied the EuroRAP Risk Mapping methodology to motorways and major highways. Collision and traffic data for the five-year period 1998-2002 inclusive was collated and assessed. In the Republic of Ireland sections of road with higher than average risk were distributed throughout the network, with 10% rated as medium-high risk and 2% rated as high risk. Updated results were published in 2008, covering the data period 2002 to 2006. This showed that all high-risk sections had been eliminated. The assessed section of the N52 (i.e. Ardee to Kells) was awarded a Medium – High Risk rating, the highest remaining category after the 2008 update and among the 10% of highest risk sections in the country.

The existing N52 has current traffic flows of approximately 3,000 AADT[1] and this area consists of a single carriageway with varying cross-section, generally 6.0m wide with no hard shoulder or hard-strip provision. Drainage from the road is primarily informal, over-the-edge drainage with no attenuation or treatment.

There is no provision for cyclists or pedestrians, and it is felt that this section of road would be particularly hazardous for these vulnerable road users.

The proposed road type will be a Type 2 Single Carriageway, all-purpose road with a 3.50m wide lane in each direction will be constructed to the geometric standards of DN-GEO-03031 and TII Standard Construction Detail CC-SCD-00002 with a Design Speed of 100km/h. This road cross section provides facilities for pedestrians and cyclists in the form of a two-way facility located on one side of the road. It can cater for approximate capacities of up to 8,600 AADT. Refer to Figure 1-1 below for the proposed Type 2 Single Carriageway Cross Section.

The proposed road cross-sections will, where practicable, also account for the inclusion of Clear Zones (as defined in TII Publication DN-REQ-03034) to provide forgiving roadsides, and maintenance areas (as defined in accordance with DN-GEO-03036). Required Clear Zone widths for 100km/h National Roads are min. 8.0m.

[1] Source: TII Traffic Counter TMU N52 040.0 W (2015 – 2018)

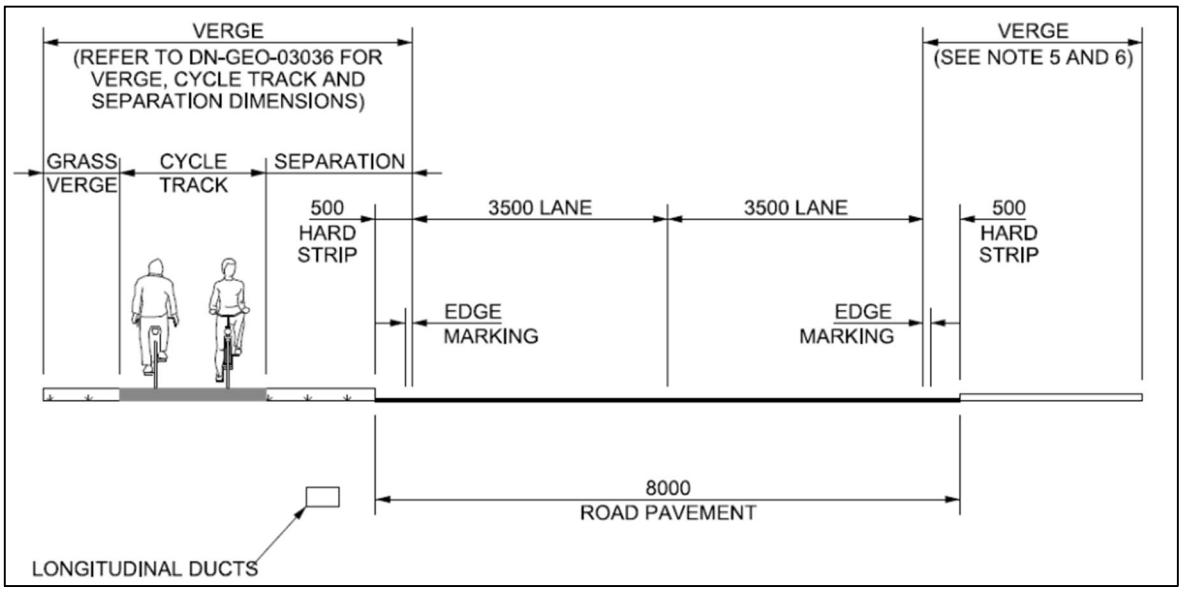

Figure 1-1 - Type 2 Single Carriageway (extract from CC-SCD-00002)

This road type consists of an overall paved road width of 8.0m which comprises 2no. 3.50m trafficked lanes and 2no. 0.5m hard strips along each verge, with provision for an off-line shared cycle/pedestrian facility in one of the verges.

1.1. Purpose of this Report

This report has been prepared to support a Part 8 planning application for the proposed scheme. The Environmental Report describes the existing situation, the proposed scheme and its potential impact on the surrounding environment. A brief summary of the scheme context, route options appraisal and a description of the preferred route are also presented within this report.

1.2. Report Format

Whilst the need for the preparation of an EIAR for the proposed scheme has been screened out as detailed separately within the EIA Screening Assessment (document reference; 5158291DG0149) prepared to accompany this Part 8 Planning Application (Atkins, 2020), the determination of the environmental topics to be considered in this non-statutory Environmental Report, as well as the specific scope of each chapter, was informed through consideration of the following best practice guidance documents (notwithstanding the fact that this document is not an EIAR):

- '*Guidelines on the Information to be contained in Environmental Impact Assessment Reports – Draft*', EPA, 2017;
- '*Revised Guidelines on the Information to be contained in Environmental Impact Statements – Draft*', EPA, 2015;
- '*Advice Notes for Preparing Environmental Impact Statements*', EPA, 2015; and
- '*Environmental Impact Assessment (EIA) Guidance for Consent Authorities regarding Sub-threshold Development'* DoEHLG, 2003.

This Environmental Report outlines the environmental baseline and predicts the associated impacts of the proposed scheme along with proposed mitigation measures in relation to the following selected key environmental factors:

- Chapter 3 – Climate Strategy;
- Chapter 4 - Air Quality;
- Chapter 5 - Noise & Vibration;
- Chapter 6 - Land, Soils and Geology;
- Chapter 7 - Material Assets;
- Chapter 8 - Water;

- Chapter 9 – Archaeology and Architectural Heritage;
- Chapter 10 - Traffic;
- Chapter 11 - Ecology;
- Chapter 12 - Landscape and Visual;
- Chapter 13 - Agronomy; and,
- Chapter 14 - Population and Human Health.

1.3. Report Methodology

This desk-based assessment has been prepared following a detailed review of all available data sources including, but not limited to;

- GSI Datasets Public Viewer and Groundwater web-mapping, (GSI, 2020);
- Environmental Protection Agency (EPA) Envision mapping, (EPA, 2020);
- Ordnance Survey Ireland (OSI) web-mapping (OSI, 2020);
- Transport Infrastructure Ireland (TII) National Strategic Noise Maps (TII, 2020);
- National Monuments Service Historic Environment Viewer (NMS, 2020);
- Office of Public Works Flood Maps (OPW, 2020);
- National Parks and Wildlife Services Map Viewer (NPWS, 2020);
- National Biodiversity Data Centre Map Viewer (NBDC, 2020);
- Wetlands Surveys Ireland – Map of Irish Wetlands (2020);
- All available information for the site (including topographic surveys, and preliminary engineering information);
- Meath County Development Plan 2013-2019;
- County Meath Noise Action Plan 2013 (Meath County Council, 2013);
- Meath Climate Action Strategy 2019 – 2024 (Meath County Council, 2019);
- '*Cultural Heritage Impact Assessment for N52 Realignment, Grange to Clontail, County Meath'* (Moore Archaeological & Environmental Services Limited (Moore Group), 2019)*;*
- N52 Grange to Clontail Scheme Option Selection Report. Volume 1 (Doc. Ref: 5158291DG0044) (Atkins, 2018);
- N52 Grange to Clontail Scheme Option Selection Report. Volume 2 (Doc. Ref: 5158291DG0044) (Atkins, 2018);
- N52 Grange to Clontail Scheme – Phase 3 Design Report (Doc. Ref: 5158291DG0121) (Atkins, 2020); and,
- N52 Grange to Clontail Flood Risk Assessment (Doc. Ref. 5158291DI0088) (Atkins, 2019).

Throughout the route selection and preliminary design process, regular liaison and consultation was undertaken between the engineering design and environmental teams. The findings of the initial desk-based review were further supplemented by additional information gathered during a number of site walkover surveys of the proposed scheme undertaken by relevant members of the design team and specialist sub consultants between May 2017 and October 2019. These include but are not limited to ecological surveys, geotechnical surveys, geophysical surveys and archaeological testing

All of the above information was then evaluated to inform the findings of this environmental report.

This report has been prepared by Atkins based on all available information including specific recommendations by the following members of the design team; AWN Consulting Ltd (Noise), Philip Farrelly & Company (Agronomy) and Moore Archaeological & Environmental Services Ltd. (Archaeology and Architectural Heritage).

2. Scheme Description

2.1. Road Development Policy – National, Regional and Local

The following national and regional policy documents have been reviewed to ascertain and identify the importance of the N52 at a regional and national level:

- Meath County Development Plan (MCDP) 2013 – 2019;
- Louth County Development Plan 2015 – 2021;
- Westmeath County Development Plan 2014 – 2020;
- Road Safety Strategy 2013 – 2020;
- Transport Strategy for the Greater Dublin Area 2016 – 2035;
- Greater Dublin Area Regional Planning Guidelines 2010 – 2022;
- Smarter Travel – A Sustainable Transport Future 2009 – 2020;
- Building on Recovery; infrastructure and Capital Investment 2016 – 2021;
- Strategic Investment Framework for Land Transport – 2015;
- Ireland 2040 - National Planning Framework – 2018; and,
- National Secondary Roads Needs Study – East Region 2011.

2.1.1. Meath County Development Plan 2013 - 2019 (MCDP)

As outlined in the MCDP, the effective use of the transport network is beneficial to all. An efficient transport system allows the economic movement of goods stimulating economic expansion while an easily accessible system enhances the quality of life for communities and promotes social cohesion. The MCDP also recognises the importance of the national primary and secondary road network through the county servicing the Dublin – Belfast Economic Corridor and in providing easy access to Dublin City for people living in the commuting centres of Kells and north Meath. The N52 forms a key part of this network linking Kells to Ardee and also linking the M3 to the M1 (via. the N33).

The key goals of the development plan in terms of transport infrastructure are to:

- *"Promote and facilitate the provision of the necessary transport infrastructure to fully accommodate existing and future population needs as well as the demand for economic development in an environmentally sustainable manner"; and,*
- *"Facilitate the provision of the County's infrastructure in a sustainable and efficient manner that promotes the social and economic development of the County".*

The transport objectives outlined in the MCDP relevant to the scheme include Transport Objective 10 and Transport Objective 17 which are outlined below.

> **Transport Objective 10**: *"To develop and implement, in consultation with the TII, a programme for the upgrading, improvement and maintenance of the national road network within the county".*
>
> **Transport Objective 17**: *"To support, where appropriate, major road improvements, bypasses of local towns and villages and proposed national road schemes by reserving the corridors of any such proposed routes free of developments, which would interfere with the provision of such proposals".*

The works required to attain these objectives for the N52 (Fringestown) are described in the plan as: "*Re-alignment of approximately 3km of the existing N52*".

The works required to attain this objective for the N52/R162 Junction are described in the plan as: "*Re-alignment of N52 and amendment of junction arrangement to give priority to National Road Traffic. Including re-alignment necessary to remove height restriction at the crossing with the Navan – Kingscourt Railway*".

2.2. Stakeholder Consultation

2.2.1. Utility and Service Providers

As part of the constraints and design phases of the scheme, all major service providers were contacted and consulted with in order to establish the utility constraints within the vicinity of the proposed scheme. The services identified within vicinity of the site to date are ESB Networks and Eir services.

2.2.2. Statutory Bodies

Consultations took place between Atkins and Transport Infrastructure Ireland (TII) and various departments of Meath County Council (MCC), in the form of individual meetings have been ongoing since between May 2017.

The OPW were consulted regarding the proposed watercourse crossings i.e. construction of culverts at the 4no. watercourse crossings along the scheme. Section 50 Applications were submitted to the OPW for these crossings; all of which were accepted by the OPW. The agreed design has been incorporated into the Part 8 design drawings and in the construction methodology as outlined in section 2.5 of this report.

Consultation was also carried out as required with relevant statutory bodies including National Monuments Service (NMS) throughout the pre planning stages of this scheme.

2.2.3. Landowners

Consultation has taken place with the various landowners whose lands will be impacted by the proposed scheme in the form of individual meetings with the design team. Philip Farrelly & Co. prepared agronomy reports for the agricultural landowners along the scheme following the completion of an agronomy specific questionnaire and onsite surveys that included consultation with the landowner to get their views of the proposed scheme in order to assess and recommend accommodation works that will mitigate where possible any impact on these lands.

2.2.4. Environmental Bodies

Data files were obtained from National Parks and Wildlife Service (NPWS) and species data obtained from the National Biodiversity Data Centre (NBDS).

2.3. Options Assessment

A Feasibility and Options Assessment was completed by Atkins in accordance with TII Project Management Guidelines (PMG) to consider the context of the scheme in terms of key planning policies, to identify significant engineering / environmental constraints, to determine and evaluate route options, and ultimately to identify a preferred route. Various constraints / considerations were identified along the scheme as part of the assessment process. Four route options were appraised under the following criterion; Economy, Safety, Environment, Accessibility, Integration and Physical Activity. The 'Red' route emerged from the selection process as the preferred route. Key engineering and environmental considerations associated with the Red route are summarised below.

2.3.1. Engineering Considerations

- The proposed route would require one major junction in the form of a roundabout at the R162/N52 crossing, two minor priority junctions (staggered) and the eventual tie-in to the existing N52;
- The proposed route will intersect the existing disused Navan to Kingscourt railway line with an at grade crossing. The proposed Boyne Valley to Lakelands County Greenway follows this disused railway line;
- The proposed scheme will require four watercourse crossings; for the Headstown stream, Stephenstown stream and 2no. unnamed streams in the form of a culvert; and,
- A Type 2 Single carriageway, all purposed road with a 3.5m lane as per Figure 2-2 is proposed for this scheme.

2.3.2. Environmental Considerations

The key environmental impacts from this scheme are considered to be the following:

- **Land Soils and Geology:** It is anticipated that the construction works will generate ca. 137,900m^3 of unsuitable material with ca. 91,900m^3 of imported fill required.
- **Water:** There are 4no. surface water courses which are intercepted by the proposed scheme.
- **Archaeology, Architectural and Cultural Heritage:** There are numerous. archaeological sites / features identified within and close to the proposed scheme, which may be negatively impacted;
- **Traffic:** The proposed scheme is anticipated to have a positive impact on road user safety and improve journey time savings.
- **Ecology:** The key ecological constraint of the proposed scheme is the 4no. surface water courses which are intercepted by the proposed scheme. These watercourses flow in a northern direction before joining the River Dee which discharges to Dundalk Bay ca. 37km west of the proposed scheme. Dundalk Bay has been designated as a Special Area of Conservation (SAC) and Special Protection Area (SPA);
- **Landscape and Visual Amenity:** The proposed scheme will pass through undisturbed agricultural lands. The scheme design, where possible will maintain the existing character of the landscape types through which it passes, by means of new planting along the scheme, replanting of trees and hedgerows etc to restore severed field patterns.
- **Agronomy:** The proposed scheme will directly impact 2no. dairy farms, which will require access to be retained either side of the proposed scheme. The scheme will directly impact a number of other agricultural holdings.

Other environmental impacts considered from the scheme include Climate, Air, Material Assets and Population and Human Health.

2.4. Details of the Proposed Scheme

The location and extent of the proposed scheme is presented on the site location drawing included in Appendix A. The proposed scheme commences in the town land of Grange to the west of the existing R162/N52 staggered junction. The R162/ N52 junction is proposed to be upgraded to a roundabout. After the proposed roundabout junction of the R162/N52 the scheme continues in a north easterly direction, where it crosses the disused Navan to Kingscourt railway line at grade as shown on Figure 2-1 below. The scheme continues north east, crossing the Headstown Stream. It continues in a north easterly direction, crossing the Stephenstown Stream and a minor drainage ditch, beyond which it crosses the existing N52 and the L34013 at grade at Stokes Cross junction. The proposed scheme then takes a more north easterly direction where it comes close to the Carnacop Stream and continues in a north easterly direction, crossing the L74102, after which it eventually ties into the existing N52 in the townland of Clontail. 2no. properties (one residential; and the partial demolition of a commercial premises) will require demolishing as part of this scheme, as indicated on Figure 2-1 below. Details of the proposed road type are included in Chapter 1.

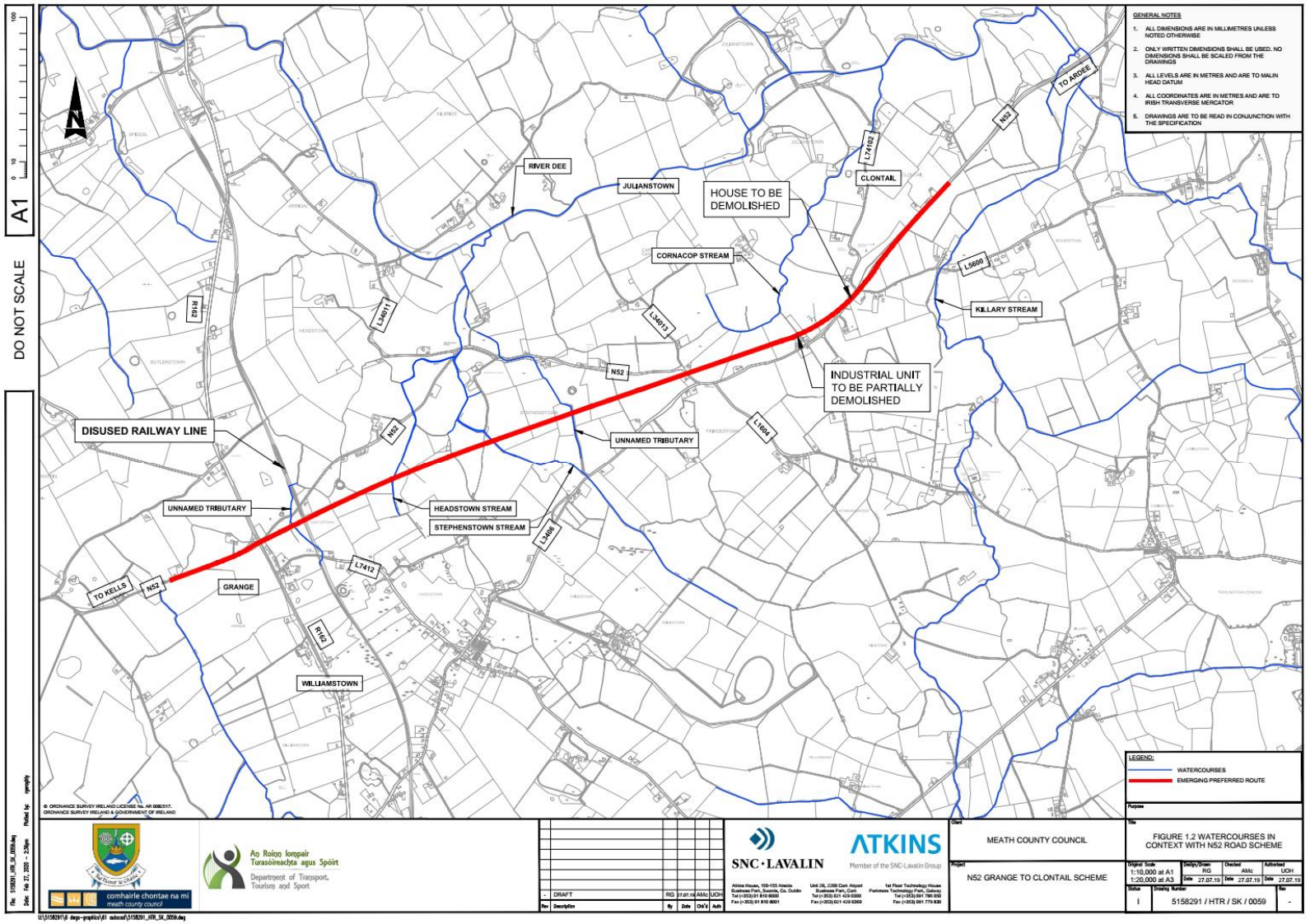

Figure 2-1 - Watercourses Intercepted by The Proposed Scheme and Proposed Demolition Locations

2.5. Construction Methodology

The final construction methodology will be subject to the conditions of planning, the construction procurement process and also the methodology adopted by the main Contractor who will be responsible for constructing the scheme. Notwithstanding this, an overview of the likely construction methodology based on the works requirements which have been developed as part of the scheme design process is provided as follows:

- The proposed scheme will be constructed in a single phase. The stages of construction will be determined by the Contractor during construction.
- Prior to the commencement of the works, the Contractor will be required to develop a Temporary Traffic Management Plan. To allow the construction phase to proceed as safely and efficiently as possible, temporary traffic management measures will be required where the work will cross or run adjacent to local public roads. The temporary traffic management measures will be designed carefully to enable the works to progress and to manage the safety of workers and the passing public, and to minimise disruption to the general public;
- The Contractor will commence the construction phase by mobilising the construction team on site. This will involve setting up a site compound in an area which will minimise potential impacts to the environment and public, whilst providing a suitable location from a construction logistics and safety viewpoint;
- 2no. properties will require demolition prior to the scheme being developed; 1no. residential building at chainage 4020 and the partial demolition of a commercial premises at chainage 3610;
- Works will commence with clearing and removing (off site) all redundant items such as road signage, boundary treatment, and the temporary storage of topsoil. The works will be completed using a combination of operatives using hand tools and also mechanical excavators, dumper trucks and other plant typical to road construction schemes;
- To facilitate the main works, underground utilities which conflict with the main works will be uncovered using mechanical excavators (and hand digging where appropriate) and identified. The Low Voltage Overhead ESB Cables are proposed to be removed when crossing the carriageway due to height restrictions and underground services provided as a replacement.
- The site has one High Voltage (110kV) Overhead ESB line (east of Stokes Cross) but the proposed road level has been set to give adequate construction clearance thus negating the need to amend this line. The 38kV Overhead ESB west of the proposed N52/R162 roundabout is to be left in situ and protected throughout construction.
- The existing ESB Substation positioned east of the proposed roundabout is currently on the line of the proposed N52, and as such will need to be relocated. The proposed position of the ESB Substation is to be at a location which will be a redundant section of carriageway (currently the N52). This will allow access to the proposed Sub-station from the existing N52 for maintenance (the existing N52 will be re-classified as a local road at this location). This proposed position of the substation, and associated works, have been agreed in principle with ESB.
- With the utilities safely identified and diverted, the initial construction phase will be ready to commence in that area. This will include the excavation and removal of soil to proposed design levels along the scheme. The excavation will be largely undertaken by mechanical excavator, with spoil arisings loaded into HGV tipper trucks for removal off site or reuse on the scheme where testing confirms its suitability. Earthwork embankments, where not constructed from site-won material, will require the importation of acceptable fill material, which will be placed by mechanical means;
- Culverts and underpass structures will be constructed using pre-fabricated structural elements; which shall be back filled with imported suitable fill.
- Pavement construction will be undertaken by mechanical means, using excavators to lay sub-base, graders, rollers and pavement laying machines for asphalt materials;
- Road sign poles will be erected to carry the scheme road signage. This will include statutory signage, warning signage and information signage. With the poles erected, the signs will be mounted by hand and cleaned to complete the signage installation;
- The finished surface course will be swept using a mechanical road sweeper and immediately followed by the application of road markings, which are likely to be applied using a vehicle

mounted road marking machine. The individual Stop, Yield and cycle markings are likely to be laid by hand; and,

- The later works tasks will include landscaping, safety barrier installations, and the installation of public lighting equipment. The installation process will be followed by a period of testing and commissioning. With the testing and commissioning phase complete, all temporary traffic management installations will be removed, and the scheme will be opened to the public for its operation and maintenance phase (either on a phased basis as sections are completed, or in its entirety).

The following construction proposals are anticipated at this stage. These construction methodologies may be subject to changes during the detailed design of the proposed scheme.

Accommodation under-bridges and culverts

New culverts shall be required where the new scheme crosses existing drainage ditches and watercourses. New culverts are required at the following locations:

- Unnamed Stream (1) crossing at Chainage (MC00) 250m;
- Headstown Stream crossing at Chainage (MC00) 930m;
- Stephenstown Stream crossing at Chainage (MC00) 1604m; and,
- Unnamed Stream (2) crossing at Chainage (MC00) 2130m.

The proposed culverts will be a minimum of 900mm in diameter or height for ease of access and maintenance as agreed with the OPW and in accordance with OPW Section 50 requirements.

2no. accommodation underbridges will be provided for severed lands. These shall be 2.7m clear span in size with an internal width of 2.7m and headroom of 4.0m.

Flood Risk Assessment

Flood water levels have been established as part of the Flood Risk Assessment (FRA) for the four main watercourse crossing locations for the 1 in 100-year rainfall event. These confirmed the presence of a 1 in 100-year fluvial floodplain of the Stephenstown Stream which the OPW had demonstrated in their Preliminary Flood Risk Assessment (PFRA).

The results demonstrated that the finished and formation levels (based on a 725mm pavement construction depth) of the proposed road are higher than the 1 in 100-year flood level (inclusive of climate change) at all four watercourse crossing locations. A minimum of 300mm freeboard from the 1 in 100-year flood level is also provided.

Other drainage proposals (attenuation ponds, oil / petrol interceptors etc.)

In order to mitigate the negative impact on the receiving environment by stormwater runoff, the discharge from the carriageway and adjacent areas will be restricted to the greenfield runoff rates through the use of attenuation basins and flow control devices. The attenuation basins provide a degree of protection against accidental spillage on the road reaching the watercourse and can provide an additional method for the removal of detritus and hydrocarbon contamination.

The preliminary design of the drainage system has been undertaken in accordance with the TII Publications (DN-DNG-03022). The key recommendations of that Publication are outlined below, which have been applied in the preliminary design:

- Longitudinal sealed carrier drains must be designed to accommodate a 1 in 1-year storm event, full bore without surcharge;
- The design will be checked against a 1 in 5-year storm event to ensure that surcharge levels do not exceed the levels of chamber covers; and,
- The rainfall intensities used in the design of drainage systems must be increased by 20% in order to allow for the future effects of climate change.

The preliminary design of the detention basins has been undertaken in accordance with industry best practice guidance ‘CIRIA The SuDS Manual’ which informs the design principles applicable for various SuDS features. The below design parameters have been applied to the detention basins:

- Total attenuation storage provided for the 1 in 100 year storm event + 20% allowance for climate change;

- Maximum discharge restricted to the 1 in 100 year greenfield runoff rate;
- Sized to take ‘greenfield’ earthworks embankments;
- Detention basin side slopes at 1 in 3;
- Detention basin depth of 1.3m; and,
- Detention basin freeboard of 300mm (therefore maximum water level at 1.0m depth).

Construction Location

The Contractor will establish the site area, including site compound, set down area for vehicles, works areas, temporary set-down areas for material removed etc. prior to commencing work on the development. The Contractor will determine an appropriate location for the site compound in agreement with MCC. The compound will provide for parking, welfare facilities, canteen, site offices, storage areas and temporary utilities / services. These areas will be fenced to keep the public out of the work area and secured as appropriate to prevent pollution risk. Once appointed the Contractor will be obliged to take account of the content of this report when deciding on the fixed location of the site compound. The compound will be located away from sensitive areas such as watercourses, hedgerows / treelines which are considered important wildlife corridors, archaeological / architectural features, identified Japanese knotweed locations (*Fallopia japonica)* (outside of the red line boundary) and adjacent private properties. Accordingly, the positioning of the site compound will have no adverse environmental impacts during the construction phase. The temporary construction compound will be removed upon completion of the construction phase. Such areas are to be reinstated and all construction waste and / or scrapped building materials are to be removed from site on completion of the construction phase. Oil, fuel etc. storage areas are to be decommissioned on completion of the construction phase. Any remaining liquids are to be removed from site and disposed of at an appropriately licenced facility.

3. Climate Strategy

3.1. National Policy

In 2017 TII published the following document in order to develop a strategy to deal with potential impacts associated with climate change to road / rail improvements;

> '*Strategy for Adapting to Climate Change on Ireland's Light Rail and National Road Network, PSF-ENW-0003*' (TII, 2017).

According to TII '*Ireland's climate is changing with more intense rainfall events predicted for the future; therefore, Ireland's infrastructure needs to become more resilient to these predicted impacts'.* Flooding, erosion, pavement deterioration, bridge and culvert scouring, landslides, embankment failure, debris flow / rock fall, settlement, aquaplaning and decreased skid resistance are all identified as potential impacts to the national road network associated with climate change.

Given that flooding is considered to be the principle climate change threat to the national road network, TII have introduced a flood management protocol, based upon flood risk metrics and flood history derived from a strategic tool. The aim is to allow an individual appraisal of sites that have been highlighted as potentially being at risk of flooding. The process involves the following four phases of investigation and is centred on deriving a meaningful interpretation of the risk metrics, concluding with mitigation and management options;

- **Phase 1** is applied to all sites assessed and provides a review of the flood risk metrics and historic information;
- **Phase 2** (actual site visit) is triggered to assess a potential cause of flooding at the site (Culvert, Bridge or Drainage Assessment) or investigate the cause of flooding further if it is not initially clear from the Phase 1 appraisal;
- **Phase 3** consists of a bespoke detailed assessment with the aim of providing sufficient additional information as required to implement any mitigation or management scheme; and,
- **Phase 4** clearly states the resulting management and mitigation measures, and recommendations that have been developed as part of the phased assessment process.

3.2. Regional Policy

In July 2019, MCC declared a Climate and Biodiversity Emergency, and have recently published their '*Climate Action Strategy 2019 – 2024'* (MCC, 2019). The plan sets out the following targets;

- Reduction in MCCs emissions by 33% by 2020.
- Reduction in CO2 emissions from the county by at least 40% by 2030.
- Increased resilience through adapting to the impacts of climate change.
- Share knowledge and collaborate with fellow local and regional authorities within the EU and beyond.

This plan is linked to the County Development Plan and covers the period from 2019-2024. The following key areas have been identified by MCC as requiring action to deal with the climate emergency; economy, mobility, built environment, clean energy, resource management, water, natural resources, and planning. In developing this climate action plan MCC have adopted a phased approach as presented in Figure 3-1.

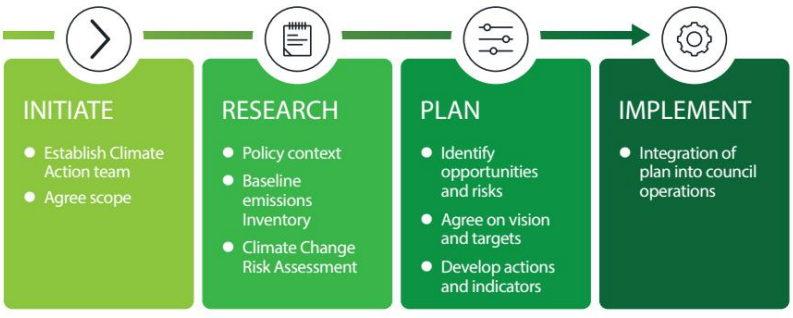

Figure 3-1 – Four stage approach to MCC climate action plan (MCC, 2019).

According to MCC transport constitutes the greatest percentage of total energy use (43.4%) within the county, followed by residential (28.1%). Transport is also the highest source of carbon emissions

(at 28.8%) within Meath. The report also finds that car ownership in Meath appears to be slightly higher than the national average. The report states that;

> *'It is apparent that the transport, residential and agricultural sectors are consistently contributing to a significant percentage of total emissions. It would therefore be most beneficial to target emission reducing actions in these areas, in order to enable County Meath to contribute effectively to the national requirement to reduce CO2 significantly.'*

The report sets out potential climate change impacts and risks, as well as MCCs vision and targets. This project has been designed with due regard to the plan.

3.3. Project Specific Climate Strategy

Climate impacts are addressed within this report under the following considerations; Flooding; and Air Quality.

3.3.1. Flooding

A flood risk assessment FRA has been prepared (Atkins, 2019). This is included in Appendix B. In accordance with Phase 1 of TIIs Climate Change Strategy (TII, 2017) the site has been assessed and a review of available flood risk metrics and historic information has been undertaken. The following conclusions have been made:

- The development proposals involve the realignment of circa 5.3km of the existing N52 road with the overall aim to remove a significantly sub-standard section (approximately 4.5km in total) of the existing N52 route;
- The proposed road development route is not located within Flood Zones A and/or B.
- The proposed road crosses four watercourses, the Headstown, Stephenstown and two unnamed streams as well as other smaller local field ditches;
- There is no evidence of historic flooding within the immediate vicinity of the development route, however, the PFRA flood maps indicate that the proposed road may be within the 1 in 100-year fluvial floodplain of the Stephenstown Stream;
- This FRA has demonstrated that the proposed road formation levels reside above the 1 in 100-year flood levels of all four watercourse crossings, with a provision of a minimum 300mm freeboard. Culverts have been sized sufficiently at the four watercourse crossing locations to ensure the existing flows with an allowance for climate change can be conveyed; and,
- The land use downstream of the site has been identified as agricultural, therefore the receptor vulnerability is classified as low.

The culvert sizes have been agreed with OPW and approvals granted on 19th December. The proposed culvert sizes are as follows:

- Culvert C001 60m of 900mm pipe at grade of 1 in 240;
- Culvert C002 75m of 1350mm pipe at grade of 1 in 46;
- Culvert C003 30m of 1650mm pipe at grade of 1 in 167; and,
- Culvert C004 75m of 900mm pipe at grade of 1 in 49.

The following recommendations will be taken into consideration during the design and construction of the proposed development:

- The proposed discharge for the storm-water drainage to the watercourses does not exceed the existing greenfield runoff rates unless where required otherwise as agreed and accepted by the relevant authority(s);
- The proposed discharge for the storm-water drainage to the watercourse should be designed in accordance with best practice to include natural treatment of surface water prior to discharge to watercourses;
- The Contractor will be required to prepare an emergency plan for managing flood risk during construction, which may include monitoring of weather conditions through consultation with Meath County Council; and,

- The Contractor is to ensure measures are in place to reduce any potential inundation due to flooding during the works.

The Meath Climate Action Strategy 2019 – 2024 states that transport infrastructure is at risk of future flooding arising from the effects of climate change. The Flood Risk Assessment (FRA) prepared by Atkins (2019) (Document Ref: 5158291DI0088) has accounted for an increase of 20% in the 1 in 100-year water levels at the 4no. watercourse crossings. Based on the design of the proposed scheme the Flood Risk Assessment has concluded the following;

> *' It can be concluded that the required culverts are sufficiently sized at each location to cater for the calculated Q100 flow rates (including 20% for Climate Change).'*

3.3.2. Air Quality

Meath Climate Action Strategy 2019-2024 (MCC, 2019) sets out the following objective in terms of reducing carbon emissions within the county;

> '*To explore policies to help the transition to a climate resilient low carbon society, with emphasis on transportation modes and types'*

Due to the nature and scale of the proposed scheme increased traffic flows (and accordingly carbon emissions) are anticipated. However, the need for this project has been set out previously; the key driver for the proposed scheme is to improve the safety of the existing N52. In addition, a comprehensive environmental assessment was undertaken of the four route options during route selection stage; this assessment included the preparation of an air quality route selection assessment (AWN Consulting Ltd., 2018). This assessment identified the number of sensitive receptors within 50m of the edge of all road links that would experience a significant change in traffic for each of the routes. Analysis was carried out using the methodology of TII using the UK DMRB air dispersion model. The proposed route was given a medium preference in terms of air quality impact.

This project does provide an opportunity to help achieve the following MCC (2019) objectives:

- **Objective M2.1 -** To develop a walking and cycling strategy that seeks to identify a strategic, coherent and high quality cycle and walking network across the county that is integrated with public transport and interconnected with cultural, recreational, retail, educational and employment destinations and attractions;
- **Objective M2.5** - Encourage safe cycling by supporting Minimum Passing Distance Law (MPDL), whereby motorists will be obliged to give at least a 1.5m gap when overtaking cyclists on rural roads and a 1m gap on urban roads; and,
- **Objective M2.6** - Develop a policy to support increased pedestrianisation schemes where appropriate.

The proposed scheme has been designed to include the provision of cycle and pedestrian facilities. There is currently no provision for cyclists or pedestrians along this section of the existing N52, and it is considered that this section of road would be particularly hazardous for these vulnerable road users. It is also noted that the facilities on the proposed N52 will tie-in with the proposed Boyne Valley to Lakelands County Greenway at the location of the at grade crossing with the disused Navan to Kingscourt railway line. Accordingly, the proposed scheme will contribute to the above key objectives of the Meath Climate Action Strategy 2019-2024 (MCC, 2019).

In addition, mitigation measures to reduce the risk of dust nuisance as detailed further in Chapter 5 – Air Quality of this report will be implemented during the construction phase of the proposed development.

Furthermore, an Outline Waste Management Plan (OWMP) has been prepared for the purposes of planning. The Contractor will develop this OWMP into a detailed Construction & Demolition (C&D) WMP. A core principle within both documents will be appropriate waste management via. the EU Waste Hierarchy of prevention, preparing for reuse, recycling, energy recovery and sustainable disposal.

3.3.3. Summary

Due to the nature and scale of the proposed scheme increased traffic flows (and accordingly carbon emissions) are anticipated. However, the proposed scheme has been designed to seek to minimise where possible, climate change impacts as follows:

- The scheme has been designed to allow for future increased storm water flows and volumes. A site specific flood risk assessment has been prepared by Atkins (2019) which takes account of climate change;
- The proposed route has been selected taking account of the findings of an air quality route selection assessment (AWN Consulting Ltd., 2018);
- The proposed scheme has been designed to include the provision of cycle and pedestrian facilities which are currently absent from this section of the existing N52;
- The proposed schemes pedestrian and cycle facilities will provide direct linkage to the proposed Boyne Valley to Lakelands County Greenway at the intersection point with an at grade crossing of the disused Navan to Kingscourt railway line.
- Standard mitigation measures will be implemented during the construction phase of the project to minimise potential dust nuisance; and,
- The proposed scheme will be delivered in accordance with the EU Waste Hierarchy of prevention, preparing for reuse, recycling, energy recovery and sustainable disposal.

The proposed scheme therefore recognises MCCs vison '*To make County Meath a climate ready region that supports jobs, growth and healthy lifestyles*'.

4. Air Quality

This section presents a preliminary overview of the receiving environment with regards to air quality, the identification of any potential constraints associated with the proposed scheme and proposed mitigation measures / recommendations. The review has been undertaken in accordance with relevant NRA guidance '*Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes'* (NRA, 2011).

A desk-based review of published information from the following sources has been undertaken:

- Ordnance Survey Ireland Online mapping (OSI, 2020);
- Environmental Protection Agency Online mapping (EPA, 2020);
- Environmental Protection Agency Report entitled '*Ambient Air Monitoring At Navan April 26th, 2007 – 28th February 2008;* and,
- Environmental Protection Agency Air Quality Data 'Ozone and Nitrogen Dioxide Levels Measured at Emo, Co. Laois' (EPA, 2019); and,
- '*N52 Grange to Clontail Route Selection Air Quality'* prepared by AWN Consulting (2018).

4.1. Receiving Environment

Four air quality zones have been defined in Ireland in order to assess and manage air quality (implemented under the Air Quality Standards Regulations 2011 (S.I. No. 180/2011) as amended (S.I. No. 659 of 2016)). The two key cities of Dublin and Cork have been classified as Zone A and Zone B respectively. Zone C comprises other cities and large towns across the country, with the remainder of the country (rural Ireland) classified as Zone D. The area of the proposed scheme is classified as '*Air Zone D: Remainder of the State Excluding Zones A, B and C'* (EPA, 2020).

The air quality in each zone is assessed and classified in accordance with upper and lower assessment thresholds as prescribed in the legislation for each pollutant by the EPA. The number of national monitoring locations is dependent on population size and ambient air quality concentrations with regards to the relevant assessment thresholds.

The closest air monitoring station to the proposed scheme is located in Navan, approximately 10km south of the scheme. Baseline ambient air monitoring was undertaken by the EPA in Navan town, Co. Meath from the 26th April 2007 until the 28th February 2008. According to the EPA (2008) the key findings during the monitoring period were as follows:

- Concentrations of particulate matter (PM10) exceeded the upper assessment threshold for this parameter; and,
- Concentrations of carbon monoxide, nitrogen dioxide, sulphur dioxide, benzene and lead were below their respective lower assessment thresholds.

Current ambient air monitoring data is available for Kilkitt Station, the closest rural Zone D location. According to the EPA (2020) ambient air quality at this station is deemed to be generally '*good*', based on current levels (including Nitrogen Oxide (NO_2), Ozone (O_3), Sulphur Dioxide (SO_2)) recorded at this site which are below the relevant threshold values.

The EPA's Air Quality Index for Health is a web-based index, developed in conjunction with the Health Service Executive, Met Éireann, Department of Communication, Climate Action and Environment (DCCAE) and Local Authorities and shows what the current air quality is across Ireland. The Air Quality Index for Health is a coloured scale of 1-10. The scale is divided into four bands: good, fair, poor and very poor. The Index is calculated hourly, represented on a colour coded map and provides information and health advice for both the general population and those who are more sensitive to air pollution, for example, people with heart or lung problems (EPA, 2019). According to the EPA (2020) the current baseline air quality index is '*2 - Good'* for the region in which the proposed scheme is located. It is noted that this index is based on information from monitoring instruments at representative locations in the region and may not reflect local incidents of air pollution. There are no IPPC / IED licenced facilities or EPA licenced waste facilities within the general vicinity of the proposed scheme (EPA, 2020).

At a national scale, following a recent review of Ireland's air quality monitoring data, the EPA (2019) have concluded that while Ireland is in compliance with the EU statutory limit and target values, national air quality fails to meet more stringent world health organisation (WHO) guideline values for a number of pollutants,

including PM_{10}, $PM_{2.5}$, ozone and NO_2. According to the EPA, it is particularly important to tackle $PM_{2.5}$ which is linked to the majority of premature deaths in Ireland associated with poor air quality. Key sources of pollutant $PM_{2.5}$ include the continued use of solid fuel burning for home heating purposes, along with pollution from transport and agriculture. This report also concludes that Ireland will likely exceed the EU annual NO_2 limit in the near future. Key sources of pollutants NO_2 are associated with the residential heating, energy, industry and transport sectors. According to the EPA, it is the transport sector which has the greatest impact on NO_2 concentrations, particularly in urban areas (EPA, 2019).

4.1.1. Potential Constraints

Baseline air quality in the regional context of the proposed scheme is generally considered to be good; however, a number of constraints have been identified, specifically in relation to dust nuisance. All occupants of residential properties and users of any commercial properties within the vicinity of the proposed scheme are identified as potential air quality sensitive receptors.

The EC Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the "Habitats Directive") requires an Appropriate Assessment to be carried out where there is likely to be a significant impact upon a European protected site. TII requires an Air Quality Specialist to liaise with an ecologist on schemes where there is a European protected site within 2km of the scheme. The closest designated area is significantly outside the 2km area of influence. Therefore, assessment of air quality impacts on sensitive ecosystems is not required for this particular scheme.

4.2. Impact Assessment

4.2.1. Construction phase

There is the potential for short term negative impacts to air quality in the vicinity of the proposed scheme during the construction phase of the development, as dust will likely be generated. However, the amount of dust likely to be produced during the construction phase can be adequately managed through the implementation of standard construction mitigation measures, as detailed below.

4.2.2. Operational phase

There are 8 no. air sensitive building receptors (all residential buildings) which may be permanently impacted by increased NO_X and PM_{10} exposure during the operational phase (AWN, 2018). However current baseline air quality is deemed to be good on a regional scale within the vicinity of the proposed development (EPA, 2019). The proposed scheme is located in an agricultural setting and aside from the existing section of the N52, there are no other significant sources of NO_X and PM_{10} in the area.

4.3. Recommendations

Standard measures shall be taken which will minimise dust from construction activities; at a minimum adhering to standard good practice which includes the Building Research Establishment (BRE) document entitled '*Control of Dust from Construction and Demolition Activities*'. Any potential dust nuisance which could arise during the construction period will be mitigated through the implementation of a site-specific Detailed Construction Environmental Management Plan (CEMP) by the Contractor. Dust minimisation measures which should be detailed further within the CEMP should include, but are not limited to, the following actions:

- Site access should be regularly cleaned and maintained using road sweepers as required;
- Dampening down of areas where dust may arise, as required, during dry and/or windy conditions; this also applies to vehicles delivering material with dust potential;
- Any stockpiling of materials shall be designed and laid out to minimise exposure to wind, and potential for dust nuisance; and,
- Any surplus soils removed from site shall be appropriately covered during transport to the relevant permitted / licenced disposal facility.

4.4. Summary

In summary, the proposed scheme will not significantly adversely impact sensitive residential or ecological receptors in terms of air quality. Taking account of the proposed mitigation measures detailed in section 4.3, it is anticipated that there will be no residual air quality impacts arising from the construction phase. There will be a residual impact to air sensitive receptors arising during the operational phase, however this impact is not anticipated to be significant.

5. Noise & Vibration

Noise and vibration is an important environmental consideration for the proposed scheme. A desk-based review of the receiving environment with regards to noise and vibration, and identification of any potential associated constraints along with the proposed mitigation measures / recommendations has been undertaken in accordance with the relevant guidance '*Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes'* (TII, 2014). Specifically, this assessment included a review of published information from the following sources: -

- Ordnance Survey Ireland Online mapping (OSI, 2020);
- Environmental Protection Agency Online mapping (EPA, 2020); and,
- Transport Infrastructure Ireland Strategic Noise Mapping (TII, 2019); and,
- *'N52 Grange to Clontail Scheme Route Selection Noise & Vibration'* prepared by AWN Consulting (2018).

5.1. Receiving Environment

According to the TII (2019) the primary source of noise in the general area of the scheme is the N2 to the east and the N3 to the west. Based on available baseline noise mapping from the TII (2019) day-time noise levels in excess of 74 dB are generated within the confines of these schemes. Along the same schemes i.e. N3 and N2, night time noise levels may decrease to 60-64 dB as reported by the TII (2019). Apart from the existing N52, no other significant regional noise sources are identified within the general area of the proposed scheme (TII, 2019). Regional and third class roads along with agricultural activities in the vicinity of the proposed scheme will contribute to the baseline noise environment.

MCC have published a Noise Action Plan 2013 (MCC, 2013); this document was prepared in accordance with Environmental Noise Regulations, 2006 (S.I. No. 140 of 2006). Within the Action Plan there are approximately 174km of national roads and 74km of regional roads which qualify as major roads for noise mapping. However, the N52 is not included within this list.

5.2. Potential Constraints

Available TII guidance (2014) recommends a phased approach in relation to noise and vibration impact assessment for national road schemes. The avoidance of noise and vibration impacts should therefore be the focus of the evolving proposed scheme. At this preliminary stage all residential properties and commercial properties within the area of the proposed scheme are identified as potential noise and vibration sensitive receptors. The noise & vibration assessment undertaken by AWN Consulting (Atkins, 2019) identified 7no. properties which are likely to require mitigation, however one of these properties will require demolition. The remaining 6no. properties are presented in Figure 5-1 below.

Figure 5-1 - Properties Likely Requiring Noise Mitigation

5.3. Impact Assessment

5.3.1. Construction phase

There is potential for short term negative impacts, to noise and vibration sensitive receptors during the construction phase of the development. However, the amount of noise and vibration likely to be produced during the construction phase will be limited and can be adequately managed through the implementation of standard construction mitigation measures, as detailed below.

5.3.2. Operational phase

Although there is potential for increased noise levels within the vicinity of the proposed scheme, it is not anticipated that these impacts will be significant in nature, providing that the mitigation measures as detailed below are implemented.

Relevant design guidelines are set out in Chapter 5 of the TII document "*Guidelines for the Treatment of Noise and Vibration in National Road Schemes (2004)"* and Chapter 2 of the TII document, "*Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (2014)*". In terms of operational noise, the Authority considers it appropriate to set the design goal for road traffic noise for new national roads in Ireland as a limit of 60dB L_{den} (free field) (day-evening-night).

AWN Consulting produced a noise report entitled '*N52 Grange to Clontail Scheme Route Selection Noise & Vibration'.* A preliminary noise contour model was developed to identify properties likely to require noise mitigation based on exceeding 60dB L_{den} during the operational phase. For the 6no. properties likely to be impacted during the operational phase, design mitigation measures as outlined below have been recommended.

5.4. Recommendations

All construction works should be undertaken in accordance with standard industry best practice methods. Any potential noise arising from the works will be short-duration and temporary in nature and will be managed through the implementation of a site-specific Detailed Construction Environmental Management Plan (CEMP) by the Contractor. Noise / vibration minimisation measures during the construction phase should include, but are not limited to the following:-

- Ensuring that mechanical plant and equipment used for the purpose of the works are fitted with effective exhaust silencers and are maintained in good working order;
- Careful selection of quiet plant and machinery to undertake the required work where available;
- All major compressors should be 'sound reduced' models fitted with properly lined and sealed acoustic covers which should be kept closed whenever the machines are in use;
- Any ancillary pneumatic percussive tools should be fitted with mufflers or silencers of the type recommended by the manufacturers;
- Machines in intermittent use should be shut down in the intervening periods between work or throttled down to a minimum. Generators, or any other plant, shall not be left running / operational after hours unless in an emergency, and agreed with the Employer's Representative;
- Ancillary plant such as generators, compressors and pumps should be placed behind existing physical barriers, and the direction of noise emissions from plant including exhausts or engines should be placed away from sensitive locations, in order to cause minimum noise disturbance;
- Handling of all materials should take place in a manner which minimises noise emissions; and,
- The Contractor should adhere to the codes and practices for minimising noise emissions from construction and if required any piling works.

In accordance with TII guidance ('*Good Practice for the treatment of noise during the planning of national road schemes'*, TII 2014), all required mitigation measures must be taken to minimise noise and/or vibration impacts during construction activities.

During the operational phase in order to address potential noise impact to the 6no. identified noise sensitive receptors the following mitigation measures should be adopted;

- A low noise road surface (LNRS) would be recommended which would potentially reduce noise levels for the scheme overall;

- Noise barriers / bunds would be recommended at the location of the 6no. identified noise sensitive receptors ; and,
- In order to identify the specific mitigation requirements for each property, a detailed noise impact assessment will be required during the detailed design stage.

5.5. Summary

In summary, in terms of noise and vibration, taking account of proposed mitigation measures, it is anticipated that there will be no residual impact arising from the construction phase. There will be a residual impact to 6no. identified noise sensitive receptors during the operational phase, however appropriate mitigation measures will be implemented as required, and this impact is not considered to be significant.

6. Land, Soils and Geology

This section presents a preliminary overview of the receiving environment with regards to land, soils and geology, the identification of any potential constraints associated with the proposed scheme and proposed mitigation measures / recommendations. Ground conditions have been assessed through the completion of a desk-based study, a walkover survey and a geotechnical ground investigation contract along the route of the proposed scheme. This assessment has been undertaken in accordance with relevant best practice guidance from the Institute of Geologists of Ireland (IGI, 2013).

The desk-based study involved reviewing information from the following sources:

- Geological Survey of Ireland (GSI) webpage using the online mapping tool (GSI, 2020);
- Ordnance Survey of Ireland (OSI) webpage to assess the surface topography, landforms and historic mapping (OSI, 2020);
- Trial pit and borehole logs for exploratory ground investigation works carried out between March 2019 and August 2019 (Priority Geotechnical 2019) included in Appendix C;
- Meath County Council (MCC) Development Plan 2013-2019;
- Atkins N52 Grange to Clontail Scheme Option Selection Report (2018);
- Atkins N52 Grange to Clontail Scheme Phase 3 Design Report (2020); and,
- Various Agronomy Reports for specific agricultural lands prepared by Philip Farrelly and Co. (2019).

The approximate total land take area is 28.98ha.

6.1. Receiving Environment

The proposed scheme is underlain primarily by deep well drained mineral till, with some minor portions of lacustrine–type soils, sands and gravels including localised esker deposits, alluvium and a very localised area of peat in the west. Bedrock underlying the proposed scheme also comprises the Cruicetown Group along the western portion, the Navan Beds Formation beneath the central portion, and the Clontail Formation along the eastern portion of the scheme.

There are no reported Karst features or landslides along the proposed scheme with the closest karst feature a borehole located ca. 9.5km north east. There are no reported Geological Heritage Sites along the proposed scheme. The closest reported Geological Heritage Area is Kilbride Quarry (Site Code: MH021), located 1.5km north of the proposed scheme (GSI, 2020).

Historical land-use beneath the proposed scheme is agricultural in nature. Localised areas of small-scale quarrying and historical / architectural features including a church and graveyard and a castle are located to the north of the proposed scheme. The Navan to Kingscourt disused railway crosses the proposed scheme, and a commercial shed reportedly used for the small-scale manufacture of concrete products which is situated in the path of the proposed scheme is scheduled for partial demolition. A residential building is also to be demolished as part of the works.

No other land uses associated with historic or recent potential sources of contamination, including industrial land-use, waste facilities, or historic mines, are identified along the proposed scheme or its immediate vicinity.

There are no IPPC / IED licenced facilities or EPA licenced waste facilities within the general vicinity of the proposed scheme (EPA, 2020).

6.1.1. Potential Constraints

It is estimated that ca. 137,900 of unsuitable material will be excavated during the construction of the proposed scheme. The total import volume is anticipated to be ca. 91,900m^3. Excavated material will be reused onsite where possible, as detailed further in the Outline C&D Waste Management Plan (Atkins, 2020) prepared for this planning application. Final anticipated waste soils volumes will be determined during the detailed design stage of the project.

Contaminated soil may be encountered in the vicinity of the railway crossing.

Rock outcrops can be difficult to engineer and require increased effort to excavate and are therefore a potential constraint. Although areas of bedrock outcrop have not been reported by GSI (2020) beneath the proposed scheme, areas of bedrock outcrop have been identified within close proximity of the scheme. Therefore, the potential for bedrock outcrop to underlie the proposed scheme exists. According to the GSI (2020),

groundwater vulnerability rating in the vicinity of the proposed scheme is '*Moderate'* in the western portion and '*High'* in eastern portion with a small area of '*Extreme'* and '*Rock at or near Surface or Karst'* intercepted in the west indicating that bedrock and accordingly groundwater is shallow in this area and therefore highly vulnerable to potential contamination.

The Ground Investigation conducted along the proposed scheme (Priority Geotechnical 2019) identified that that the site is generally underlain by glacial tills including sandy gravelly clay and sands and gravels. There are isolated pockets of peat and soft ground. Level of rockhead varied across the site from ca. 53mOD in the western portion of the site, ca 43mOD across the centre of the site and ca 61mOD in the eastern portion of the site.

The Ground Investigation indicates that there is a low likelihood that bedrock will be encountered during the construction phase, however as published GSI data has indicated rock outcrops near the site bedrock may be encountered in localised areas.

6.2. Impact Assessment

6.2.1. Construction phase

The majority of the scheme will be constructed within agricultural lands. Within the proposed scheme there are eight main embankment areas along the route, with the largest extending to heights of approximately 8 to 9m. The maximum depth of excavation is anticipated to be 11m bgl. No major structures are proposed during the construction of the proposed scheme other than culverts and underpasses which will be largely pre-fabricated. Waste management during the construction phase is detailed further within Chapter 7 - Material Assets. Therefore, the proposed scheme will not have a significant adverse effect on local soils and geology during the operational phase.

A number of potential risks to local soils and underlying bedrock during the construction phase have been considered as follows; accidental leaks or spillages of fuel, oil, paint or varnish; soils compaction, slope stability and contaminated land. However, these potential risks will be addressed through the implementation of standard construction mitigation measures, as detailed below.

6.2.2. Operational phase

A number of potential risks to local soils and any areas of shallow bedrock during the operational phase have been considered as follows; accidental fuel leaks or spillages; and accidental leaks of fuel, oil or paint during road maintenance works.

However, all storm water run-off will be attenuated, and pollution control measures will be put in place prior to discharge. Any maintenance works required are likely to be of short duration and temporary in nature. Therefore, the proposed scheme will not have a significant adverse effect on local soils and geology during the operational phase.

6.3. Recommendations

The final scheme design will be informed by all available site-specific geotechnical information.

The employment of good construction management practices will serve to minimise the risk of pollution from construction activities at the proposed development in line with the Construction Industry Research and Information Association (CIRIA) publication entitled, '*Control of Water Pollution from Construction sites, Guidance for Consultants and Contractors, CIRIA - C532*' (2001) which are also detailed in Chapter 7 - Water.

Specifically, with regard to soils and geology, the following will be adhered to:

- Fuels, lubricants and hydraulic fluids for equipment used on the construction site, as well as any solvents, oils, and paints will be carefully handled to avoid spillage, properly secured against unauthorised access or vandalism, and provided with spill containment according to best codes of practice;
- Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the scheme for appropriate disposal;
- Any spillage of fuels, lubricants or hydraulic oils will be immediately contained and the contaminated soil removed from the proposed development and properly disposed of;
- All site vehicles used will be refuelled in bunded areas in the construction compound;
- Strict supervision of Contractors will be adhered to in order to ensure that all plant and equipment utilised on-site is in good working condition. Any equipment not meeting the required standard will not be permitted

for use within the site. This will minimise the risk of soils and bedrock becoming contaminated through site activity;

- Soils on the proposed development may become unnecessarily compacted by machinery during construction. In order to protect against this accesses, and haulage roads will be clearly defined;
- In the event that contaminated ground (i.e. soils, perched water or weathered bedrock) is encountered during the construction works the following specific environmental management procedures will be adhered to: -

Any contaminated material will be fully characterised in terms of lateral and vertical extent, and a detailed assessment of the potential environmental and human health impacts will be undertaken in accordance with industry standard best practice.

- Remediation works will be undertaken as required, to address any potential identified environmental or human health risks which may be associated with the contamination. Any waste generated during the works will be managed in accordance with relevant waste legislation. Any contaminated material requiring offsite disposal will be transported and disposed of to a suitably licenced waste facility.
- Validation sampling will be undertaken as required to verify that the remediation works have been successfully completed and no residual environmental or human health risks associated with the site condition remain.
- The following general precautionary measures will also be implemented:
    - All excavated materials will be stored away from any excavations, in an appropriate manner at a safe and stable location. The maximum height of temporary stockpiles will be 3m; and,
    - A comprehensive monitoring and supervisory regime including monitoring of excavations and stability assessments as required will be put in place to ensure that the proposed construction works do not constitute a risk to the stability of the site.
- All of the above mitigation measures will form part of a site-specific Construction Environmental Management Plan (CEMP) to be prepared by the Contractor in advance of commencing the works.

6.4. Summary

The mitigation measures as outlined in section 6.3 will reduce any potential (residual) impacts on land, soil and geology. Therefore, there are no significant impacts anticipated on land, soils and geology from the proposed scheme.

7. Material Assets

Material assets are defined by the EPA (2017) as, built services and infrastructure and any such assessment involves a review of the following: Built Services, Waste Management, and Roads and Traffic. Roads and Traffic are considered further within Chapter 10 – Traffic.

7.1. Built Services

Existing services within the proposed scheme extent includes ESB and EIR. Potential service conflicts will involve the diversion of EIR services and ducting the ESB services beneath the carriageway to facilitate the proposed alignment of the scheme.

Table 7-1 Summary of Service Conflicts and Proposals

Utility Provider	Service Conflicts and Proposals
EIR	Service conflict for EIR ducts at R162/ N52 heading Southbound. Recommend diverting the EIR Ducts along R162 to follow the alignment of the grass verge along proposed road/ roundabout and connect again on North side of proposed N52. This will provide a carriageway crossing perpendicular to the proposed carriageway. The existing ducts that divert away from R162 heading Westbound will intersect the proposed roundabout. Recommendation is to divert ducts around grass verge and reconnect west of the proposed roundabout. Existing EIR Ducts heading Southwest along existing N52 will intersect proposed new alignment. Recommend diverting EIR ducts to proposed carriageway crossing for Southbound ducts from R162. At Stokes Cross Overhead Eir services will be undergrounded until reconnecting with overhead Eir services either side of the staggered junction.
ESB	The existing Sub Station intersects with the proposed alignment of the mainline and will need to be relocated as per agreed location with ESB. Any Low Voltage Overhead ESB Services will be ducted under the carriageway and reconnected to existing overhead services where necessary. High Voltage 110kV Overhead ESB Service will not be affected. 38kV Voltage Overhead ESB Service will not be affected. At Stokes Cross proposed ESB will run the length of the road until reconnecting with overhead services before next junction (heading Eastbound). Proposed ESB Mini Pillar for supply of proposed public lighting located on East verge of roundabout.
Irish Water	No services within the area.
ITS	No conflicts, only provision of ducts for ITS (TCC communications) and Third-Party Users. Recommended to keep Eir and TCC Communication ducts separate, and chambers separate to prevent any conflicts in shared use and access. 4 x 100mm ducts in total to be provided for.
Bord Gáis	Bord Gáis have not indicated if any services are to be provided for, and so provision has not been considered as a requirement.
Public Lighting	No existing Public lighting. Provision of Public lighting columns, LED Luminaires around proposed roundabout and on approach roads. Proposed ESB mini Pillar and Public lighting pillar to connect to public lighting from Low voltage supply East of proposed roundabout.

Aside from the above utilities, there will be minor service interaction and diversions required to provide continued service to landowners (water supplies, septic tanks, agricultural supplies, electrical supplies etc.)

7.2. Waste Management

The maximum excavation depth is anticipated to be approximately 11m. It is anticipated that the construction works will generate ca. 137,900m3 of unsuitable material with ca. 91,900m3 of imported fill required. In addition to excavated soils, the construction phase of the development will generate waste such as construction and demolition (C&D) waste, Mixed Municipal Waste (MMW), Recyclables such as plastic wrapping, wooden pallets, paper and/or waste electrical and electronic equipment (WEEE).

C&D waste will be generated from the demolition of the 1no residential property and the partial demolition of 1no commercial property.

All waste streams will be managed in accordance with the following key objectives from the Meath Development Plan 2013-2019 (MCC, 2013): -

> **'*WM POL 1*** *To adopt the provisions of the waste management hierarchy and implement policy in relation to the county's requirements under the current or any subsequent waste management plan. All prospective developments in the county will be expected to take account of the provisions of the regional waste management plan and adhere to the requirements of the Plan. Account shall also be taken of the proximity principle and the inter-regional movement of waste as provided for under appropriate Minister Directives from time to time.*
>
> ***WM POL 7*** *To encourage the recycling of construction and demolition waste and the reuse of aggregate and other materials in future construction projects*.
>
> ***WM OBJ 17*** *To require developers to prepare construction and demolition waste management plans for new construction projects over certain thresholds which shall meet the relevant recycling/recovery targets for such waste in accordance with the national legislation and national and regional waste management policy'.*

An Outline Waste Management Plan (OWMP) for the scheme has been developed by Atkins as part of this planning application (Atkins 2020). This plan aims specifically to ensure the guiding principles of responsible waste management, including, prevent, reuse, recycle, recover, are implemented throughout the project, thereby limiting the volume of waste disposed of to landfill. All potential waste streams arising from the construction phase of the proposed scheme are detailed within this plan.

The OWMP will be adopted by the preferred Contractor and developed into a site specific Waste Management Plan (WMP) in accordance with '*Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Waste Projects*' (2006)[2] and Transport Infrastructure Ireland's, '*The Management of Waste from National Road Construction Projects*' (2017). The Guidelines promote an integrated approach to the management of this waste stream, and are designed to promote sustainable development, environmental protection and the optimum use of resources. The Guidelines introduce the concept of integrated waste management planning for construction projects above certain thresholds. Given the nature and scale of the proposed scheme, it is likely this project will exceed the following threshold and therefore the Contractor will be obliged to prepare a detailed Project C&D Waste Management Plan;

> *'In particular, Project C&D Waste Management Plans should be prepared for projects in excess of any of the following thresholds…Civil Engineering projects producing in excess of 500m^3 of waste, excluding waste materials used for development works on the site.'*

Specifically, in relation to waste soils, excavated soils will generally comprise native soils with some Made Ground (fill material). Native soils will be reused onsite where possible. Any surplus soils including unsuitable fill material will be disposed of offsite in accordance with all requirements of the relevant waste management regulations, (Waste Management Acts, 1996 to 2011) and all subsequent amendments. Any encountered made ground / waste soil requiring offsite disposal will also be transported and disposed of in accordance with all relevant waste management legislation. All waste soils / material removed from site will need to be classified in accordance with EPA guidelines (2015) [3]; soils testing will be required; the results of which should inform the preparation of a waste classification tool, (determine the appropriate List of Waste (LoW) code) and then screened against relevant waste acceptance criteria to determine the appropriate regulated disposal / recovery facility for each waste stream. All other construction waste will be segregated and removed from site for disposal or recycling, in accordance with all relevant Waste Management Legislation.

The potential risk to soils and underlying bedrock from accidental leaks or spillages of fuel, oil, paint or varnish during the construction works will be mitigated by the implementation of site-specific control measures, as

[2] https://www.dccae.gov.ie/documents/Final%20C%20and%20D%20Guidelines%20-%2022%20June%20%202006.pdf
[3] http://www.epa.ie/pubs/reports/waste/stats/wasteclassification/EPA_Waste_Classification_2015_Web.pdf

detailed in Chapter 6 – Land, Soils and Geology. These will be set out in the Construction Environment Management Plan (CEMP) which will be prepared by the Contractor prior to construction works commencing.

7.3. Impact Assessment

7.3.1. Construction Phase

There will be a requirement to relocate utility services as outlined in Section 7.1 within the proposed scheme extent which. Potential service conflicts will involve the diversion of EIR services and ducting the ESB services beneath the carriageway to facilitate the proposed alignment of the scheme. It is envisaged that this will largely be limited to replacing the existing overhead lines across the proposed scheme with underground lines and reconnecting to existing services, relocating the existing ESB substation to a redundant section of carriageway. Any residual risks associated with utility diversions will be further developed at the detailed design stage.

7.4. Recommendations

- The Contractor should undertake pre-demolition surveys for all properties and infrastructure scheduled for demolition including an asbestos survey.
- A Project C&D Waste Management Plan (WMP) must be prepared by the Contractor in accordance with '*Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Waste Projects'* in advance of commencing the works, as the proposed scheme likely exceeds the relevant thresholds for the preparation of such plans. The C&D Waste Management Plan should take full account of the Outline WMP (Atkins, 2020) prepared as part of this planning application;
- A detailed Demolition Plan shall be prepared by the appointed Contractor and included as an integral part of the Project C&D Waste Management Plan. A principal objective of the Demolition Plan will be to ensure that where a building or structure requires demolition, the sequence of operations to be followed is predetermined and documented, thereby ensuring that an appropriately selective dismantling/demolition methodology is employed and,
- All waste soils / material removed from site will need to be classified in accordance with EPA guidelines (2015); soils testing will be required; the results of which should inform the preparation of a waste classification tool (to determine the appropriate List of Waste (LoW) code), and then screened against relevant waste acceptance criteria (to determine the appropriate regulated disposal / recovery facility for each waste stream). All other construction waste should be segregated and removed from site for disposal or recycling, in accordance with all relevant Waste Management Legislation.
- All waste-related control measures set out in Chapter 6 – Land, Soils and Geology will apply during the construction phase.

7.5. Summary

Taking account of the waste management controls which will apply to the construction phase of the proposed scheme, waste generated during the proposed works will not have a significant effect on the receiving environment.

8. Water

This section presents a preliminary overview of the receiving environment with regards to flood risk screening, hydrology and hydrogeology, the identification of any potential constraints associated with the proposed scheme and proposed mitigation measures / recommendations. This desk-based assessment has been completed in accordance with relevant best practice guidance from the Institute of Geologists of Ireland (IGI, 2013).

The desk-based study involved reviewing information from the following sources:

- Geological Survey of Ireland (GSI) Datasets Public Viewer and Groundwater web mapping (www.gsi.ie) (GSI, 2020);
- Environmental Protection Agency (EPA) web mapping (www.epa.ie) (EPA, 2020);
- Office of Public Works (OPW) National Flood Hazard mapping web site (OPW, 2020);
- National Parks and Wildlife Service (NPWS) Map Viewer (NPWS, 2020);
- Water Framework Directive Ireland web mapping (http://www.wfdireland.ie/ (WFDI, 2020);
- Meath County Council (MCC) Development Plan 2013-2019;
- Trial pit and borehole logs for exploratory ground investigation works carried out between March 2019 and August 2019;
- Atkins N52 Grange to Clontail Scheme Option Selection Report (2018); and,
- Meath County Council (2019) Meath Climate Action Strategy 2019 – 2014.

8.1. Receiving Environment

8.1.1. Flood Risk Screening

A Flood Risk Assessment (FRA) prepared by Atkins (2019) (Document Ref: 5158291DI0088) concluded that *'there is no evidence of historic flooding within the immediate vicinity of the development scheme, however, the Preliminary Flood Risk Assessment (PFRA) flood maps indicate that the proposed road may be within the 1 in 100-year fluvial floodplain of the Stephenstown stream. This FRA has demonstrated that the proposed road formation levels reside above the 1 in 100-year flood levels of all four watercourse crossings, with a provision of a minimum 300mm freeboard. Culverts have been sized sufficiently at the four watercourse crossing locations to ensure the existing flows with an allowance for climate change can be conveyed. The land use downstream of the site has been identified as agricultural, therefore the receptor vulnerability is classified as low'* (Atkins, 2019).

- The proposed road development route is not located within Flood Zones A and/or B.
- The proposed road crosses four significant watercourses, the Headstown, Stephenstown and two unnamed streams as well as other smaller local field ditches;
- There is no evidence of historic flooding within the immediate vicinity of the development route, however, the PFRA flood maps indicate that the proposed road may be within the 1 in 100-year fluvial floodplain of the Stephenstown Stream;
- This FRA has demonstrated that the proposed road formation levels reside above the 1 in 100-year flood levels of all four watercourse crossings, with a provision of a minimum 300mm freeboard. Culverts have been sized sufficiently at the four watercourse crossing locations to ensure the existing flows with an allowance for climate change can be conveyed; and,
- The land use downstream of the site has been identified as agricultural, therefore the receptor vulnerability is classified as low.

Accordingly, potential flood risk has been screened out and does not warrant further consideration as part of this assessment.

8.1.2. Hydrology

The key surface water features in the vicinity of the scheme comprise the Headstown stream, Stephenstown stream and 2no, unnamed streams as shown on Figure 8-1 below. The 2no. unnamed streams were identified from a site walkover.

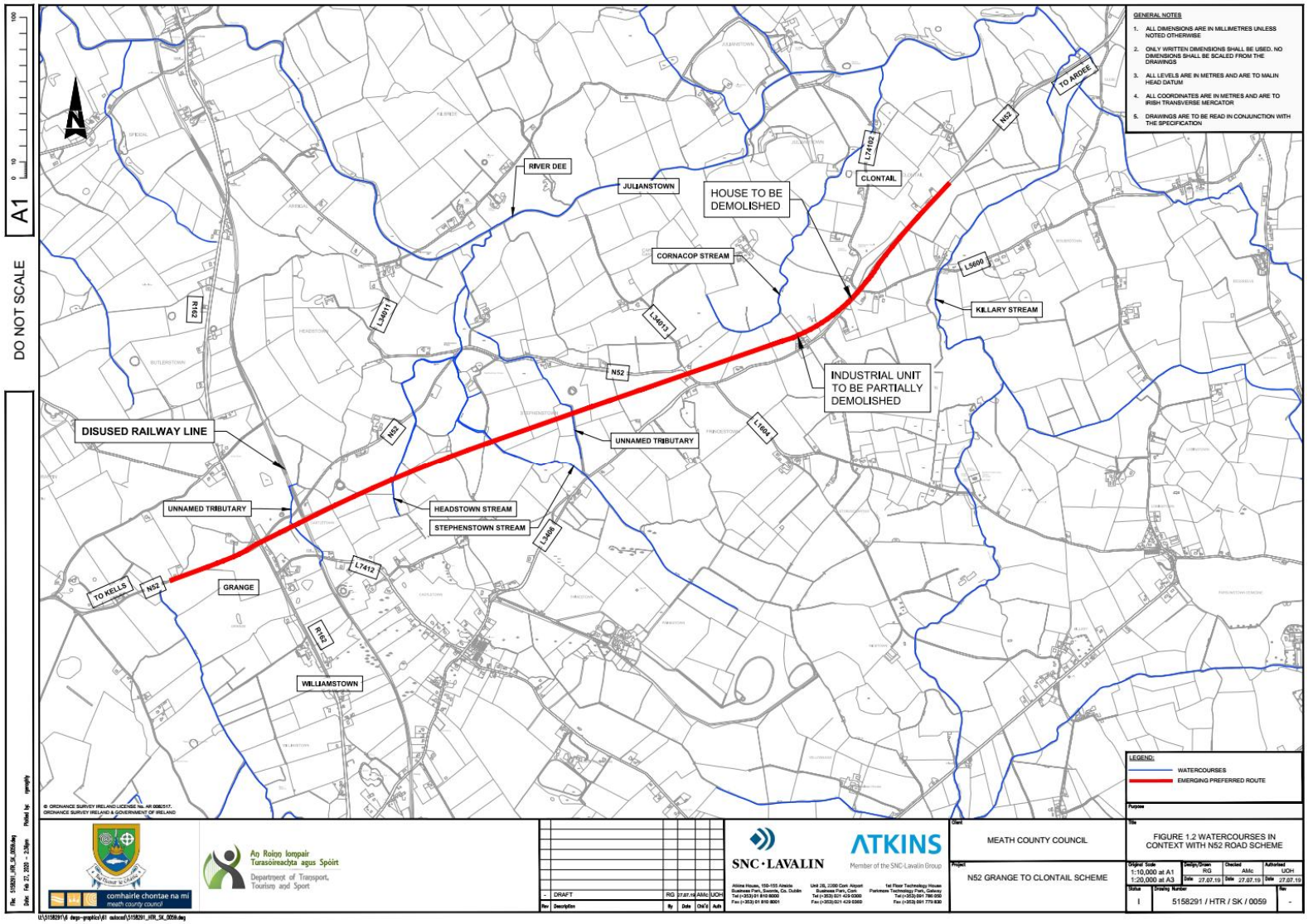

Figure 8-1 - Hydrological features within the proposed scheme

These watercourses flow in a northernly direction through the proposed scheme before discharging to the River Dee, which in turn discharges to Dundalk Bay SAC and SPA.

The Headstown and the Stephenstown streams have been assigned 'Good' status in accordance with the Water Framework Directive (WFD) with the River Dee assigned a '*Good*' WFD status for the 2013 – 2018 monitoring period (EPA, 2020)

8.1.3. Hydrogeology

The GSI (2020) classifies the bedrock aquifer beneath the western portion of the proposed scheme as a *'locally Important aquifer – bedrock which is generally moderately productive'* and the eastern portion of the scheme as a *'Poor Aquifer – Bedrock which is Generally Unproductive except for Local Zones'* shown in Figure 8-2. There is a fault running through the middle of the proposed scheme. Approximately 30% of this scheme is underlain by the locally important bedrock aquifer, with approximately 70% underlain by a poorly productive bedrock aquifer. There are no reported gravel aquifers beneath the general vicinity of the scheme (GSI, 2020).

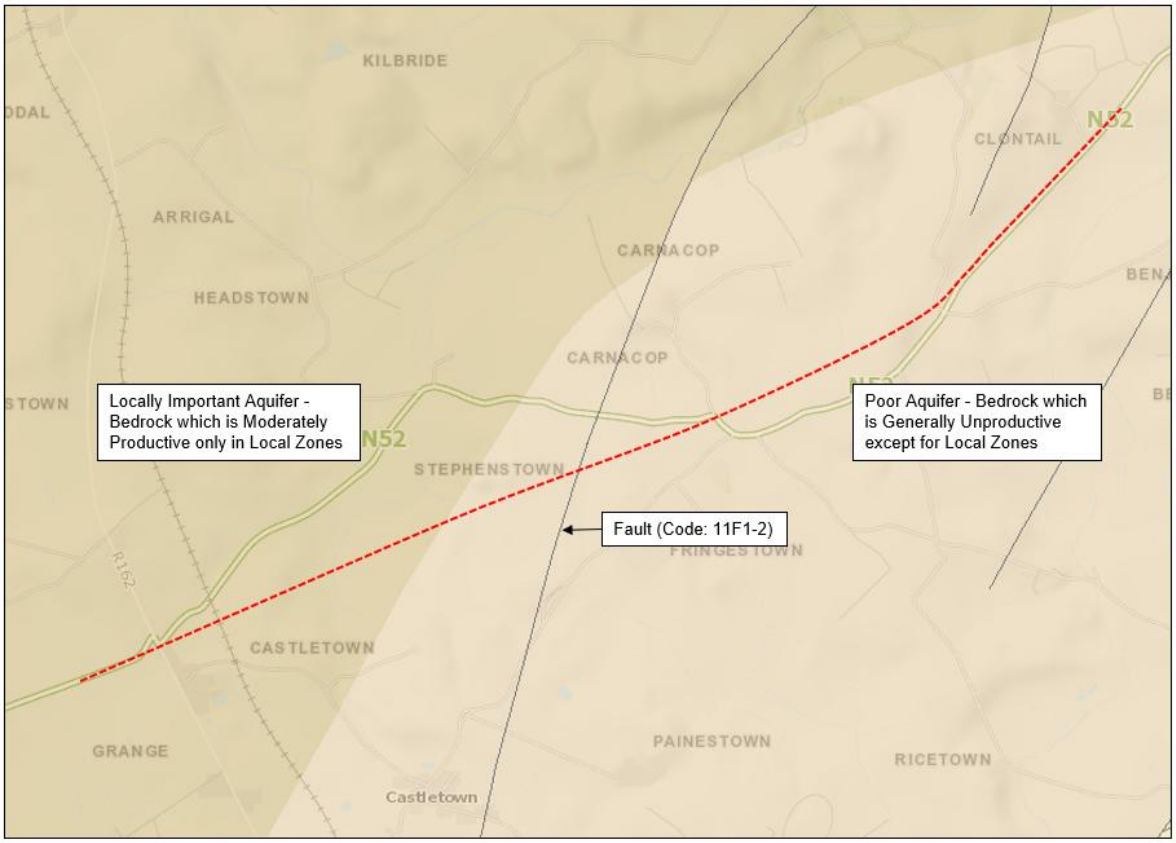

Figure 8-2 - Bedrock aquifer beneath the proposed scheme

Groundwater vulnerability beneath the general vicinity of the scheme is '*moderate'* in the western portion and '*high'* in the eastern portion with a small area of '*extreme'* and '*rock at or near surface or karst'* intercepted in the middle and east of the scheme, shown in Figure 8-3 (GSI, 2020).

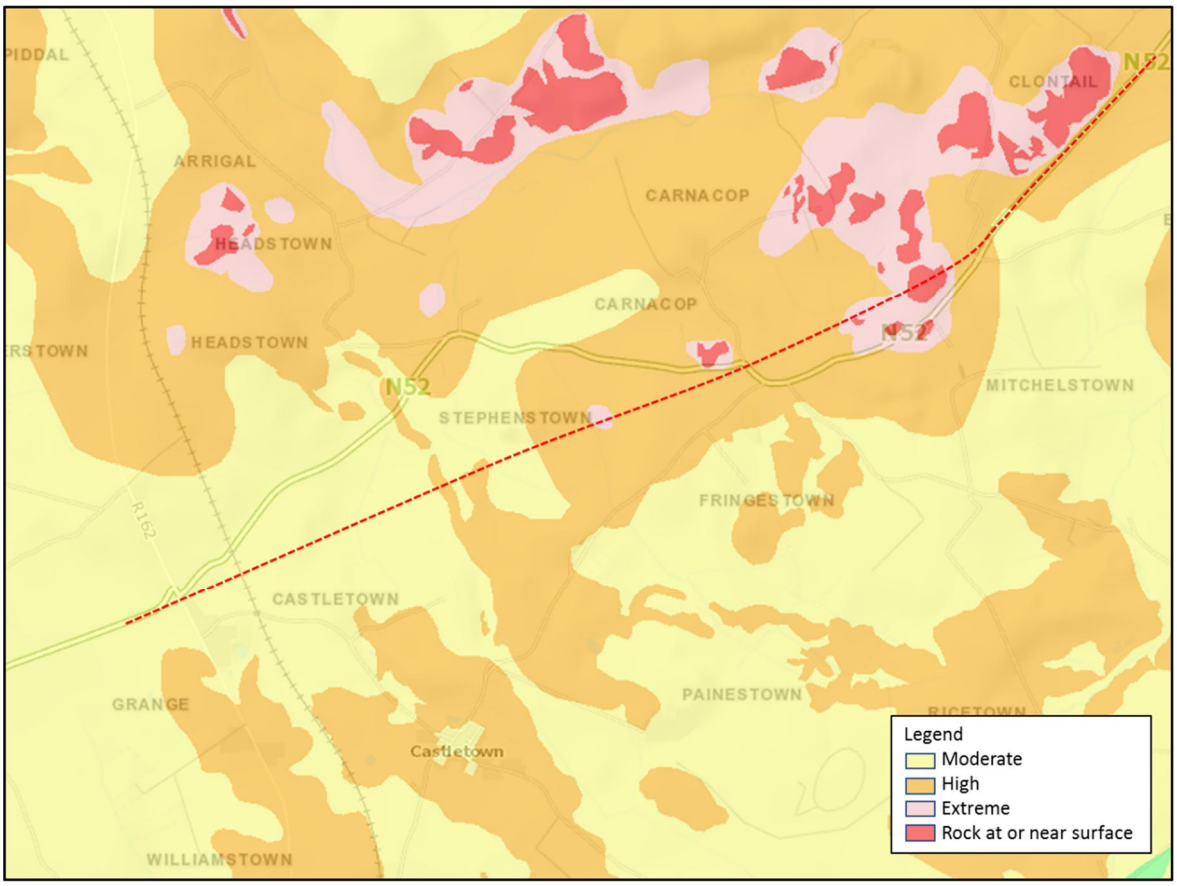

Figure 8-3 - Ground water vulnerability within the scheme

There are 2no. wells within the scheme; one well is located to the west of the scheme (GSI Reference: 2627NEW037) with an unknown purpose and a poor yield. The second well which is located to the east of the scheme (GSI Reference: 2627NEW026) is reportedly used for domestic purposes with a poor yield (refer to Figure 7.4 (GSI, 2020)). There are 4no. public supply wells (Meath County Council) within the vicinity of the proposed scheme shown in Figure 8-4. The circles on Figure 8-4 below indicate the approximate locations of one or more wells.

The closest public well (GSI Reference: 2627NEW076) is ca. 0.25km south of the proposed scheme in the west, and the following public supply wells are also located within vicinity of the scheme:

- public well (GSI Reference: 2627NEW083), ca. 0.36km north of the proposed scheme in the west;
- public well (GSI Reference: 2627NEW082), ca. 0.45km north of the proposed scheme to the centre; and,
- public well (GSI Reference: 2627NEW117), ca. 0.25km north of the proposed scheme to the east

4no. land parcels within the vicinity of the scheme have been identified as having private supply wells within various Agronomy reports prepared by Philip Farrelly and Company (2019). It is assumed that all properties within vicinity of the scheme are on private well supply. Based on available information there is no evidence that the reported public supply wells are currently in use; it is also noted that these wells are not intercepting the proposed scheme.

There are no drinking water protection (Public Supply Source Protection) areas within a 2km radius of the proposed scheme. The Nobber public water supply (PWS) Inner Source Protection Area is located ca. 3.2km north of the proposed scheme shown in Figure 8-4 (GSI, 2020).

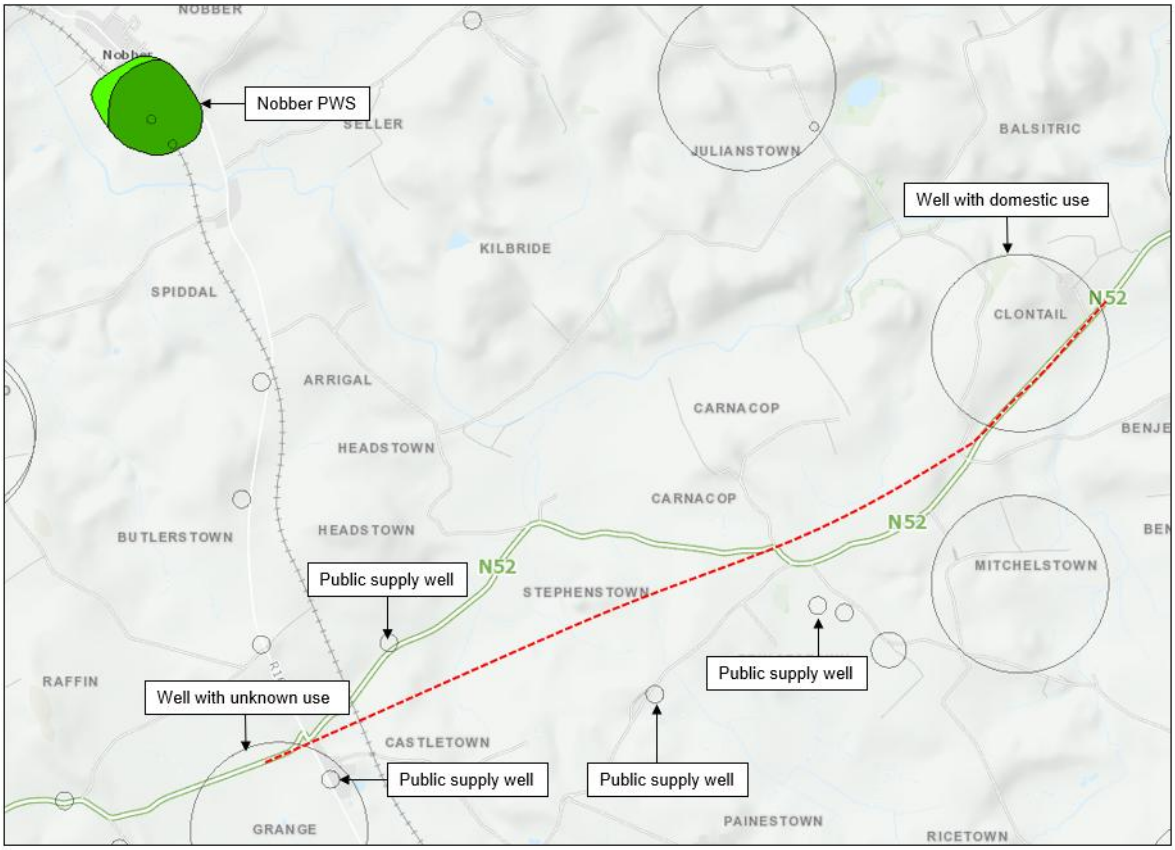

Figure 8-4 - Wells within the vicinity of the proposed scheme

The proposed scheme is within 3no. different groundwater bodies (GWB). The ground investigation undertaken along the scheme indicates that groundwater will likely be intercepted by the proposed scheme. A very small portion of the scheme to the west is within the Moynalty GWB (EPA Code: IE_EA_G_015), west of the scheme is within the Ardee GWB (EPA Code: IE_NB_G_018) and east of the scheme is within the Louth GWB (IEGBNI_NB_G_019). The groundwater status for the 3no. GWBs within the vicinity of the scheme has a '*good*' ecological status for the Water Framework Directive (WFD) for the 2013-2018 period (EPA, 2020). The Moynalty GWB, in accordance with the EU WFD, is *'not at risk'* of failing to achieve good ecological status (EPA, 2020). The risk of the Ardee and Louth GWB not achieving good ecological status is currently under '*review*' (EPA, 2020).

Water was encountered during the GI across the site from 1.3m- 6m bgl. To date no ongoing monitoring data is available to determine whether this water is groundwater or perched water.

8.2. Impact Assessment

8.2.1. Construction Phase

Potential impacts during the construction phase have been considered in terms of quality surface water / groundwater and resources surface water levels and flows, groundwater supply.

There are 4no. proposed culverts within the proposed scheme. These culverts will be precast; therefore, no concrete pouring will take place adjacent to the water courses. The Contractor's compound will include self-contained welfare facilities and no potential risks to surface water or groundwater quality associated with the temporary compound are identified. A number of potential risks to local surface water and groundwater quality during the construction phase have been considered as follows; accidental leaks or spillages of fuel, oil, paint or varnish; slope stability and contaminated land. However, these potential risks will be addressed through the implementation of standard construction mitigation measures, as detailed below. There is a potential risk to groundwater quality / resources on a very localised scale, given that it is assumed all residences and farms in the vicinity of the proposed scheme are on private well supply.

Based on the proposed design there will be no change to the current flow rates of the Headstown stream, Stephenstown stream and unnamed streams, as a result of the proposed construction works. There will be no impact to regional groundwater resources in the vicinity of the proposed scheme. Accordingly, the proposed scheme will not result in a significant adverse effect on surface water

quality, river flow rates or regional groundwater resources in the receiving environment, albeit a potential risk has been identified to local surface water and groundwater quality, and local groundwater resources.

8.2.2. Operational Phase

All watercourses which will be intercepted by the proposed scheme will be culverted. Storm water discharge will be attenuated to greenfield run-off rates; therefore, the proposed scheme will not impact baseline surface water flows in the vicinity.

A number of potential risks to local surface water and groundwater during the operational phase have been considered as follows;

- accidental fuel leaks or spillages along the road;
- accidental leaks of fuel, oil or paint during maintenance works; and,
- impacts to groundwater quality and groundwater levels at private supply wells which may be present in the immediate vicinity of the proposed scheme.

However, all storm water run-off will be attenuated, and pollution control measures will be put in place prior to discharge. Any maintenance works required are likely to be of short duration and temporary in nature. Therefore, the only residual potential impacts which could arise during the operational phase relate to potential impacts to private supply wells on a local scale. A survey will be undertaken prior to the detailed design stage to address this potential risk, as detailed further below.

8.3. Recommendations

A pre-construction door to door survey should be undertaken in advance of the commencement of any construction works. A register of all identified wells (for potable, agricultural or commercial use) and septic tanks within 150m of the scheme should be provided to the design team in order to identify any well protection or accommodation works required.

The construction management of the site will take account of the recommendations of the '*Construction Industry Research and Information Association (CIRIA) guides Control of Water Pollution from Construction sites'* (2001) to minimise as far as possible the risk of pollution. With regard to water impacts the following mitigation measures are proposed;

- In the unlikely event that contaminated shallow perched water / groundwater is encountered during the construction phase, works will immediately cease. Advice will be sought from a qualified environmental consultant regarding the appropriate management of contaminated water, and any emergency containment measures required. Appropriate measures as set out under section 6.4 (Land, soils and Geology) will be implemented. The following specific mitigation measures regarding temporary oil / chemical storage and refuelling should be adhered to:
    - All oils, paints and varnishes stored on site will be kept in a locked and bunded area.
    - Generators, pumps and similar plant will be placed on drip-trays to prevent contamination by oil.
    - All site vehicles used will be refuelled in bunded areas.
    - All temporary construction fuel tanks will also be located in a suitably bunded area and all tanks will be double skinned. In addition, oil absorbent materials will be kept onsite in close proximity to any fuel storage tanks or bowsers during proposed site development works.
    - All deliveries to on-site oil storage tanks will be supervised.
    - Records will be kept of delivery dates and volumes.
    - Every piece of equipment associated with the storage of fuel on site will be designed and installed to recognised BS codes.
    - All valves should be of steel construction and the open and close positions should be clearly marked.
- The production, transport and placement of all cementitious materials should be strictly planned and supervised. Site batching/production of concrete will not be carried out on-site

and therefore these aspects will not pose a risk to local waterbodies present, namely the Headstown and Stephenstown streams and unnamed streams.

- The Ground Investigation undertaken along the scheme indicates that groundwater will likely be intercepted by the proposed scheme. Groundwater is likely to be a potential constraint during the construction of the proposed scheme. In the event that dewatering is required, the Contractor will be required to prepare a detailed water management plan in advance of any dewatering works taking place. This plan should clearly set out where dewatering is likely to be required, anticipated volumes and duration, proposed treatment and disposal options as well as required consents and licences.
- These mitigation measures will form part of the site-specific Construction Environmental Management Plan (CEMP) which will be in operation during the construction phase.

8.4. Summary

Taking account of the proposed mitigation measures the scheme will not have a significant adverse effect on hydrology or hydrogeology within the receiving environment.

9. Archaeology Architectural and Cultural Heritage

This section provides a description of the receiving environment with respect to Archaeological Architectural and Cultural Heritage, identification of any potential constraints associated with the proposed scheme and proposed mitigation measures / recommendations. This assessment is based on the findings of a desk-based review of available information from the following sources: -

- National Inventory of Architectural Heritage (NIAH) Historic Environment Public Viewer;
- National Monuments Service - Archaeological Survey of Ireland Public Viewer;
- 'N52 Grange to Clontail Scheme, Archaeological, Architectural and Cultural Heritage Route Selection Report (Moore Group 2018);
- Geophysical Survey (APS, July 2019); and,
- '*Cultural Heritage Impact Assessment for N52 Realignment, Grange to Clontail, County Meath'* prepared by Moore Archaeological & Environmental Services Limited (Moore Group 2019).

9.1. Receiving Environment

Based on a search of available information NMS, 2018, conducted for the Options Selection Process there are numerous recorded Sites and Monuments Records (SMR) and National Inventory of Architectural Heritage (NIAH) features within the general area of the proposed scheme (see Figure 9-1 below). An archaeological, architectural and cultural heritage assessment was carried out for the options selection phase.

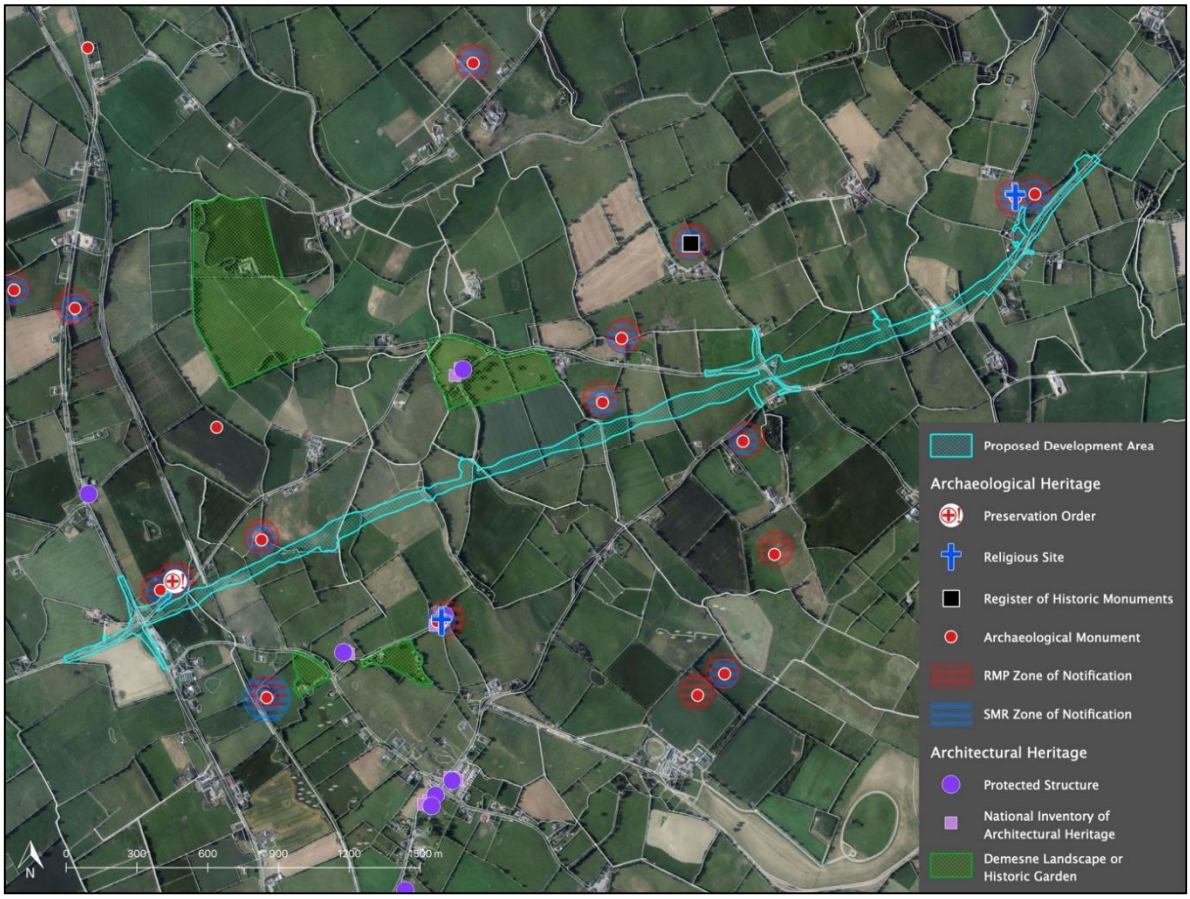

Figure 9-1 - SMR and NIAH Within the General Area of the Scheme (Moore Group 2019)

In addition to this a geophysical survey was carried out for the proposed scheme in July 2019. Further targeted archaeology testing surveys were also carried out in August 2019 to address the findings of the geophysical survey.

The following information was obtained from the Cultural Heritage Impact Assessment for N52 Realignment, Grange to Clontail, County Meath (Moore Group 2019). This report is included as Appendix D.

Based on a comprehensive scope of works which included the preparation of a desk top study, site visit, geophysical surveys and targeted testing, the following conclusion has been made by Moore Group (2019);

> *'There will be no direct impact on any recorded archaeological monuments by the proposed development. The road alignment runs close to (within 100m of) six recorded monuments and impacts with the* Zone of Notification *(ZoN) of three of these monuments There is potential for archaeological material associated with the recorded monuments to extend into the proposed development area (PDA), and which therefore may be impacted by the development.*

Archaeological monuments which could potentially be impacted by the scheme are presented in Table 9-1.

Table 9-1 – Features Potentially Impacted by the Proposed Scheme

ID number	Site type	Description	Townland	Relation to land-take
CHS01-02	SMR	Rath ME012-012	Castletown (Morgallion)	Adjacent (28m north)
CHS01-03	SMR	Rath ME012-013	Castletown (Morgallion)	Adjacent (38m north)
CHS04-04	SMR	Rath ME012-014	Castletown (Morgallion)	Adjacent (51m north)
CHS12-02	SMR	Rath ME012-004	Stephenstown	Adjacent (89m north)
CHS20-04 & 5	SMR	Church ME012-007& Graveyard ME012-007001	Clontail	Adjacent (53m north) & Adjacent (31m north)
CHS20-06	SMR	Castle ME012-007	Clontail	Adjacent (69m north)

The Cultural Heritage Impact Assessment also states as follows:

> *'There are no recorded archaeological sites/monuments located within the boundary of the preferred route option. However, there are 22 archaeological (RMP) monuments, equating to 16 sites, within 1km of the preferred route option. Of these, six are within 100m of the preferred route option (ME012-004----, ME012-007----, ME012-008----, ME012-012----, ME012-013---- and ME012-014----), three of which have Zones of Notification that extend into the preferred route option.*
>
> *Following the review of information and the field survey, it is concluded that there will be an impact on the setting of these six archaeological sites. The impact on four of these sites is 'minor/low'. The impact on the setting of two of these sites (ME012-004---- and ME012-014----) is classed as 'medium'.'*

The assessment also found:

> *'On the basis of results from geophysical surveys, ground survey and test excavations, it is established that there are previously unrecorded (undesignated) archaeological features within the preferred route option. Test excavations have confirmed the presence of three ditched enclosures (two entirely within the proposed route and one very close); geophysical survey located a number of other potential archaeological features including possible pits, a possible fulacht fiadh/burnt mound, a building foundation, and linear trends; and field and desk survey recorded additional potential sites including a mound, trackways, historic townland boundaries and a hollow near to a raised rath. In total, 48 archaeological sites or undesignated potential cultural heritage sites have been identified (Table 8 of the Moore Group report). These sites will be directly impacted upon by the proposed development. The*

report concluded that the impact on two of these features, ditched enclosures in Castletown townland identified by geophysics and subsequently confirmed by test excavation, would be significant.

The sites potentially significantly impacted by the scheme are extracted from the Cultural Heritage Impact Assessment (Moore Group 2019) and included in Table 9-2 below.

A summary location drawing showing all areas where geophysical surveys were carried out is presented in Figure 9.1. For a detailed overview of the works completed and key findings during each phase of the archaeological assessment refer to the Cultural Heritage Impact Assessment Report (Moore Group, 2019) included in Appendix D of this report.

With regards to architectural heritage the Cultural Heritage Impact Assessment states as follows

There are no Protected Structures or NIAH register sites within the preferred route option or adjacent to the route alignment. However, there are a number of undesignated vernacular features including historic townland boundaries and field boundaries formed by ditches, hedges and walls and the embankment and bridge of the disused Navan and Kingscourt railway. Therefore, while there is likely to be no direct impact on any Protected Structures or NIAH sites, some undesignated historical and vernacular features are likely to be impacted. In most cases, the impact is major within the land take, but is small in relation to the overall feature, for example, a 40m section of the railway embankment will be impacted.'

Table 9-2 – Features Potentially Significantly Impacted by the Proposed Scheme (Moore Group 2019)

Area	ID number	Site type	Description	Townland	Relation to land take	Confidence	Sensitivity	Magnitude of Impact	Impact Significance	Mitigation	Residual Impact
5	CHS05-01	Geophysics and test excavation	Ditched enclosure (geophysics response no. 16); sections identified during test excavation	Castletown (Morgallion)	Within	Strong	Moderate	High	Significant	Excavation	None
5	CHS05-02	Geophysics and test excavation	Ditch (geophysics response no. 17), located during test excavation	Castletown (Morgallion)	Within	Strong	Moderate	High	Significant	Excavation	None

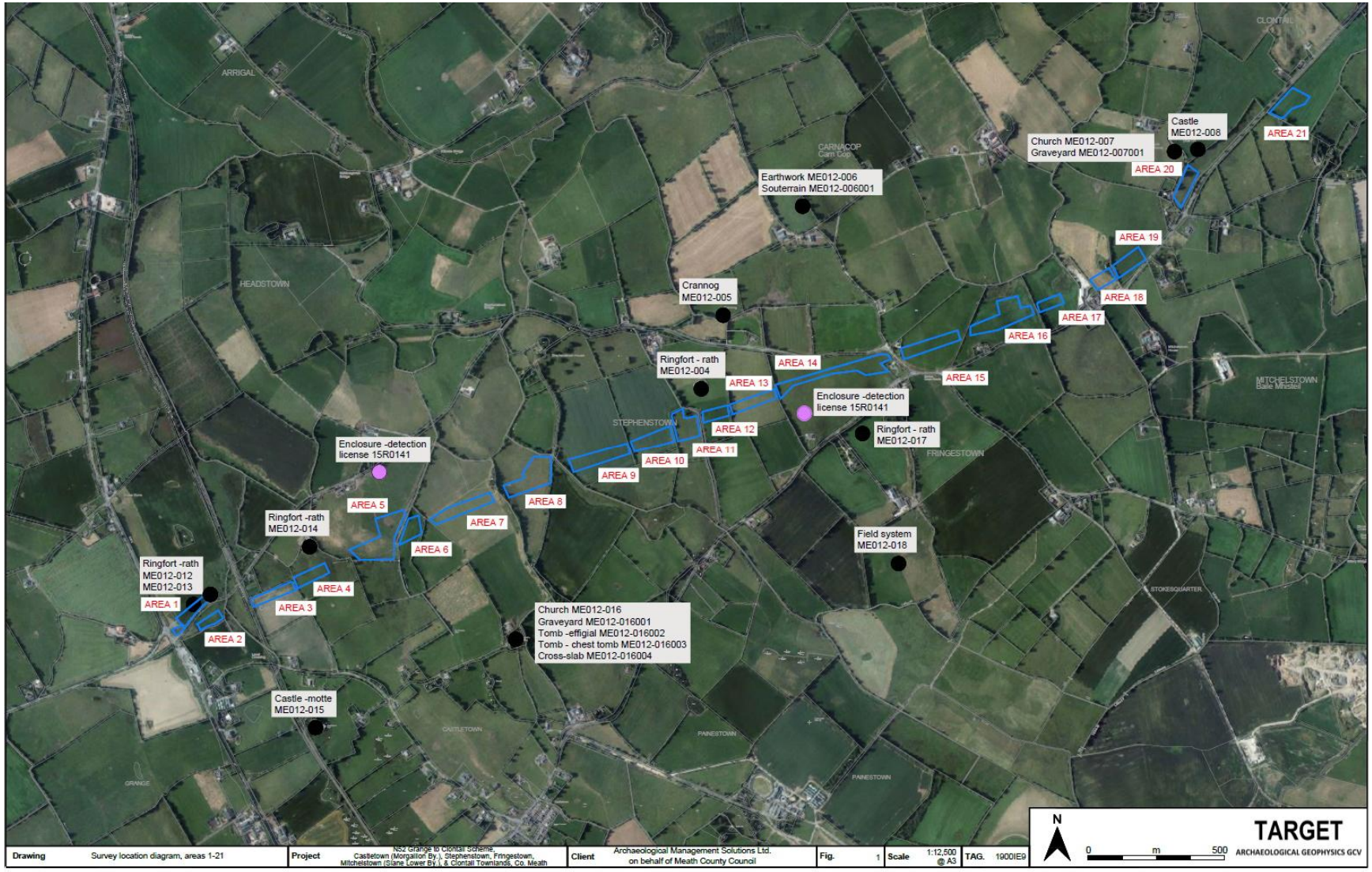

Figure 9-2 - Outline of Geophysical Survey Areas (Moore Group 2019).

9.2. Impact Assessment

9.2.1. Construction Phase

Although noted as a *'worst case scenario'* within the Cultural Heritage Impact Assessment (Moore Group, 2019), '*construction work could potentially negatively impact previously unknown sites resulting in the loss or damage of archaeological artefacts and features'.* In such a scenario potential impacts on unrecorded archaeological monuments are anticipated to be direct and negative. However, mitigation measures detailed further below will be implemented in order to address such impacts.

9.2.2. Operational Phase

It is not anticipated that there will be any significant impacts to cultural heritage sites / features during the operational phase of the proposed scheme providing the mitigation measures outlined below are implemented in full.

9.3. Recommendations

The following recommendations are set out in the Cultural Heritage Impact Assessment (Moore Group, 2019) and will be implemented during the construction phase of the proposed development. They will also form part of the site specific Construction and Environmental Management Plan;

- Excavation – of verified ditched enclosures in Areas 5 and 15, and any other archaeological sites located as part of further testing.
- Targeted testing – of likely archaeological features identified from geophysical survey and ground survey. Identified archaeological sites may require full excavation.
- General testing – of the whole road alignment. This typically will involve testing of 12% of the land-take using central line trenches with off-sets. Identified archaeological sites may require full excavation.
- Survey recording – of identified features such as townland boundaries – by means of measured survey, photography, collection of spatial data and written description.
- Table 9-2 below outlines the mitigation measures required for each area of the scheme determined during the geophysical investigations, preliminary archaeological testing and cultural heritage assessment.

Table 9-3 - Summary of Impacts and Mitigation Per Area of the Proposed Development Area

Area	Townland	Identified sites	Impacted sites	Mitigations recommended
1	Castletown (Morgallion)	3	0	None
2	Castletown (Morgallion)	4	4	Targeted testing, general testing, survey recording
3	Castletown (Morgallion)	3	3	General testing
4	Castletown (Morgallion)	4	3	General testing
5	Castletown (Morgallion)	5	5	Excavation, general testing
6	Castletown (Morgallion)	3	3	Targeted testing, general testing, survey recording
7	Castletown (Morgallion)	2	2	General testing, survey recording
8	Stephenstown	1	1	General testing
9	Stephenstown	1	1	General testing, survey recording
10	Stephenstown	0	0	General testing
11	Stephenstown	2	2	General testing
12	Stephenstown	2	1	General testing
13	Stephenstown	2	2	General testing, survey recording

Area	Townland	Identified sites	Impacted sites	Mitigations recommended
14	Fringestown	3	3	Targeted testing, general testing
15	Fringestown	4	4	Excavation, targeted testing, general testing
16	Fringestown	1	1	General testing
17	Fringestown	2	1	General testing
18	Mitchelstown	1	1	General testing
19	Mitchelstown	3	2	Targeted testing, general testing
20	Clontail	5	3	Excavation, targeted testing, general testing
21	Clontail	1	0	None

The above recommendations are subject to the approval of the National Monuments Section at the Department of Culture, Heritage and the Gaeltacht.

Additionally, permanent fencing may be required to remain around a number of sites / features during the operational phase, to eliminate impact of noise / vibration and to eliminate access to these sites / features by the general public.

9.4. Summary

The Cultural Heritage Impact Assessment (Moore Group, 2019) has concluded that '*while there is likely to be no direct impact on any Protected Structures or NIAH sites, some historical and vernacular features are likely to be impacted'.* The assessment also concluded that *'Archaeological research and fieldwork identified 54 sites or possible sites within and in the immediate vicinity of the N52 Grange to Clontail road alignment. Six of the 54 sites are recorded archaeological monuments which are close to the alignment and will not be directly physically impacted by the development. The remaining 48 sites or possible sites, two of which are confirmed as ditched enclosures, are within the alignment and will be impacted by the development* Suitable mitigation measures recommended in section 3 of the Cultural Heritage Impact Assessment will be implemented to minimise potential impacts.

10. Traffic

This section of the report reviews the current receiving environment in terms of existing road traffic characteristics and quantifies the associated baseline scenario whilst undertaking an assessment of the proposed development to identify its likely effects on the traffic environment.

10.1. Receiving Environment

10.1.1. Site Location

The scheme is located in a rural environment in Co Meath, extending from the townlands of Grange to Clontail, as shown in Figure 10-1.

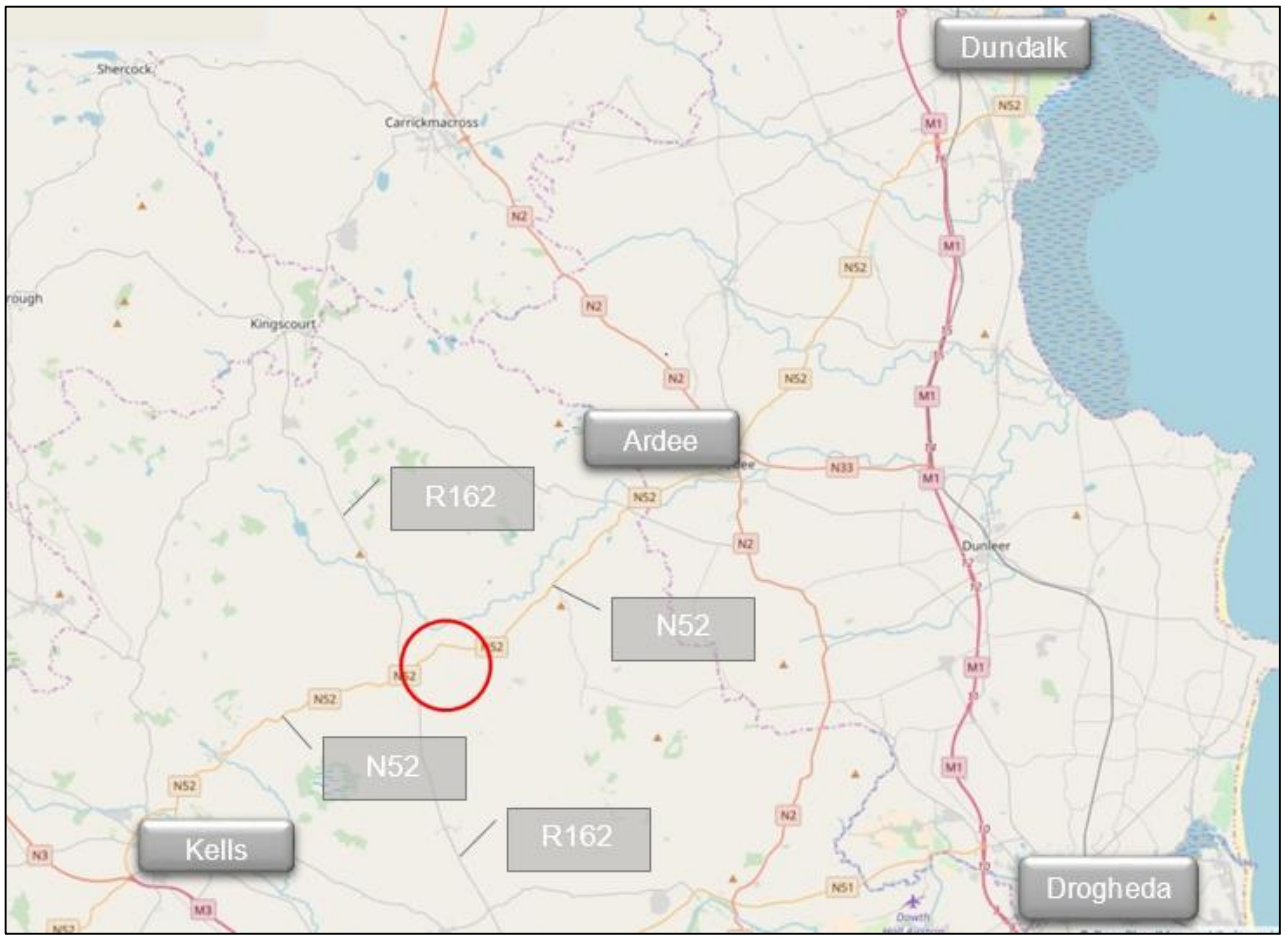

Figure 10-1 - Scheme Location

10.1.2. Pedestrian and Cyclist Facilities

There is no provision for cyclists or pedestrians on the existing N52, and it is considered that this section of road would be particularly hazardous for these vulnerable road users, due to the nature of the geometry of the road and the exiting narrow cross section.

10.1.3. Existing Public Transport

This section of the existing N52 under consideration carries mainly traffic accessing private dwellings and local townlands in addition to long distance traffic travelling between the larger settlements of Ardee and Kells and Dundalk to Mullingar. Figure 10-2 below identifies public transport routes within the scheme and surrounding environs. It is evident that the scheme is poorly serviced by public transport and this is due mainly to its rural location. The closest bus route is along the R162 and the nearest rail network is along the east coast, servicing the towns of Drogheda, Ardee and Dundalk. The surrounding landscape is rural in nature with the largest settlement of Castletown to the south west of the Study Area. There are no major settlements or alternative national secondary road networks in close proximity to the scheme.

There are no specific current objectives for future public transport services in terms of rail networks or public bus routes to service the Study Area.

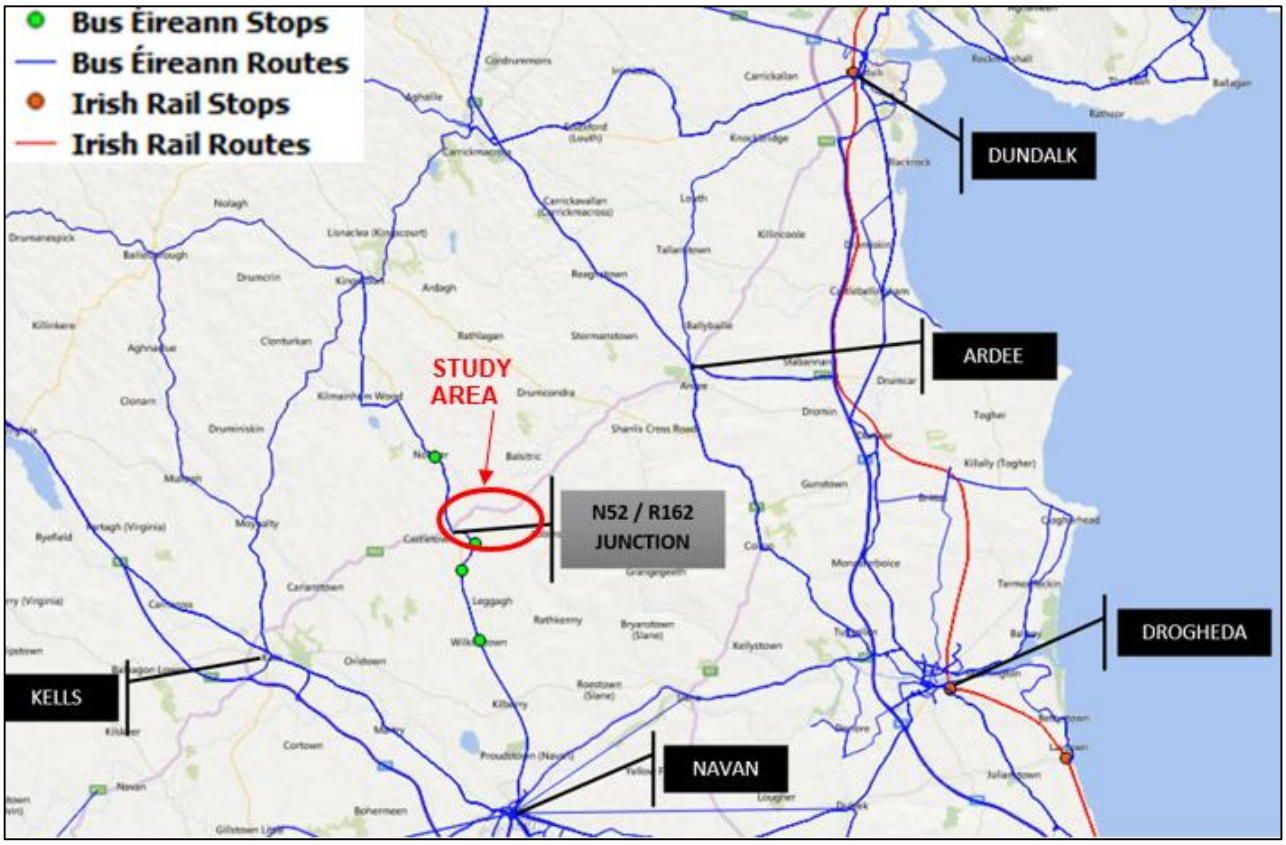

Figure 10-2 - Public Transport Routes

10.1.4. Existing Road Network

The existing section of the N52 from Grange to Clontail is characterised by the following features:

- The existing alignment within of the N52 is a non-engineered single carriageway road of approximately 5.8km in length and generally 6.0m in width. The route does not have a hard shoulder or hard strip incorporated into the cross section;
- The existing alignment is well signed with chevron boards, speed limits and warning signs.
- The road cross section is restricted and has poor vertical and horizontal alignment resulting in reduced forward stopping sight distance;
- There are numerous private property entrances and field accesses along the route. In addition, there are six local road junctions along the route. These junctions are closely spaced and often poorly arranged with sub-standard visibility splays;
- There are many road side hazards along the route including but not limited to; poles, walls, signage, trees, fence posts, low walls, ditches and at least three stream crossings;
- There are limited overtaking opportunities along the length of the section of the N52 under consideration;
- There are several poorly aligned bends for which current geometry does not meet desirable minimum design standards;
- Surface water run-off is at present untreated and also not attenuated in any way; and,
- No pedestrian or cyclist facilities are provided.

Within vicinity of the scheme, from Grange to Clontail there are numerous private property entrances along the route, local road junctions and direct field accesses on the existing N52. The road junctions are closely spaced and often poorly arranged with sub-standard visibility splays. In the townland of Grange, the existing junction between the R162 Regional Road and the N52 National Road is anomalous in that it offers priority to the R162 over the N52.

The combined effects of these features result in the common occurrence of traffic incidents, a poor driving quality experience, slow travel speeds, delayed journey times and an overall lower level of safety for all road

users. In addition, the slow travel speeds and delayed journey times have negative economic impacts reducing the route's adequacy as a 'strategic linking network'.

10.1.5. Junction Turning Counts

The data collection required as part of the Traffic Surveys identified for this scheme included Manual Classified Counts (MCCs), Automatic Traffic Counts (ATCs) and Journey Time Assessments, at the locations as shown in Figure 10-3 below.

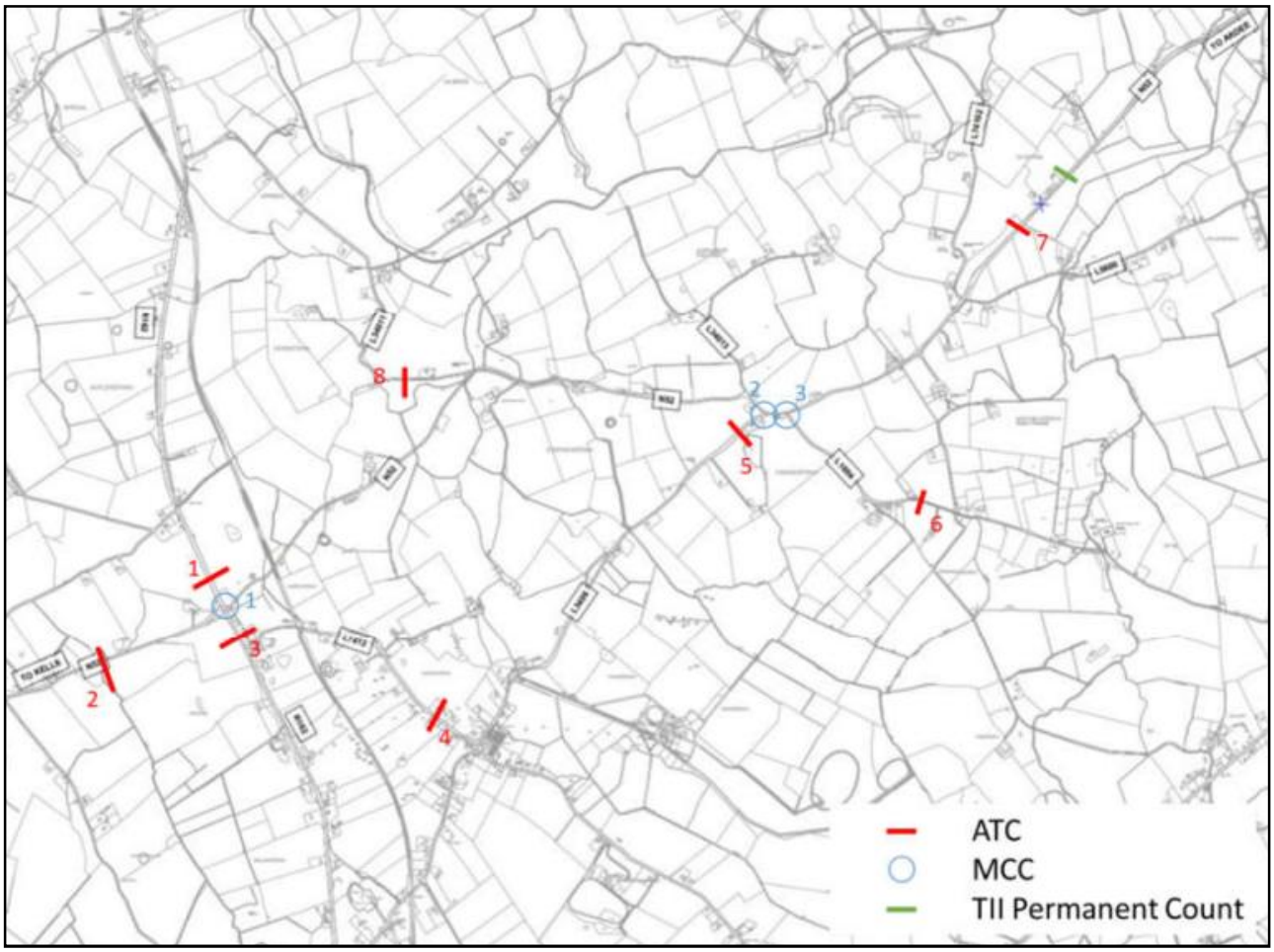

Figure 10-3 - Location of survey counts

10.2. Proposed Scheme

The proposed scheme will provide a road which is designed to comply with current TII design standards and does not present drivers with unexpected or substandard layouts. The routes will be designed to comply with the requirements of TII standards and technical publications.

The proposed scheme has the following characteristics:

- Length of proposed mainline: 4.8 km;
- Proportion online / offline: approximately 700m online / 4,100m offline;
- Mainline cross-section: Type 2 Single Carriageway, as detailed shown in Figure 10-4. This road type consists of an overall paved road width of 8.0m which comprises 2 No. 3.50m trafficked lanes and 2 No. 0.5m hard strips along each verge, with provision for an off-line cycle track in one of the verges;
- Number of mainline junctions: 1 No roundabout, 2 No. staggered cross-roads; and,
- Side roads realigned (from west to east): R162, L3406, L34013, L5600 and L74102.

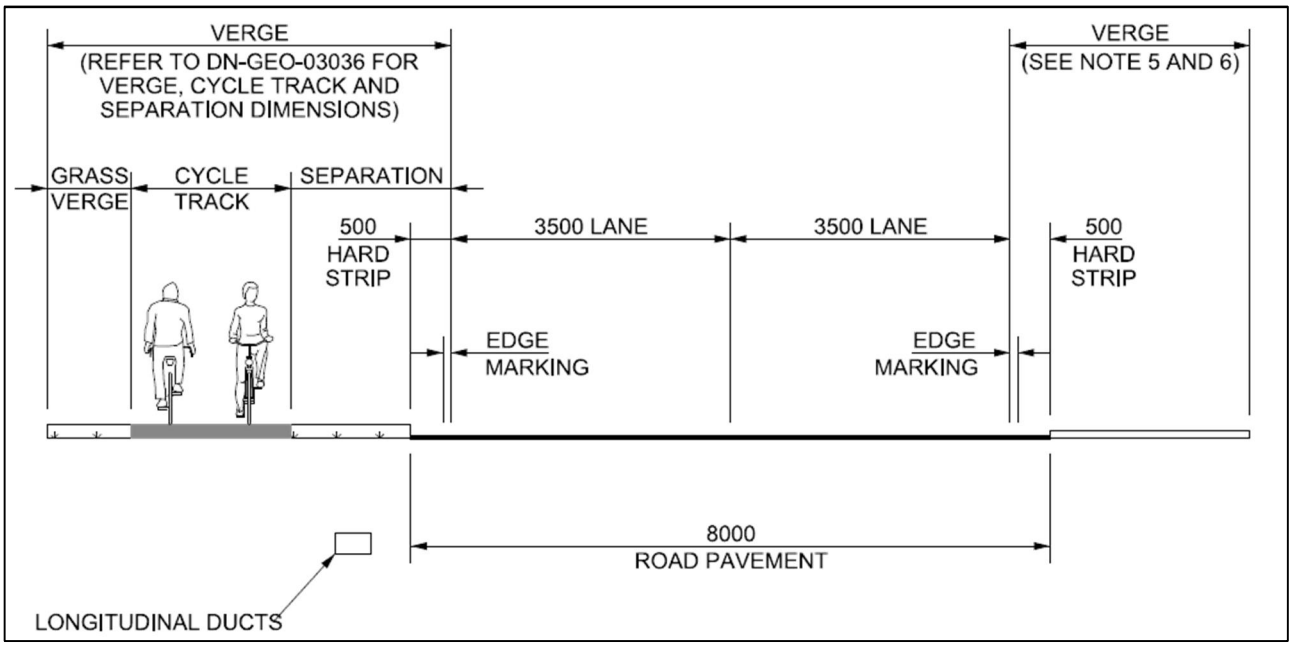

Figure 10-4 - Type 2 Single Carriageway (extract from TII's CC-SCD-00002)

The drawings showing the alignment of the Proposed Scheme are contained within Appendix A.

10.3. Impact Assessment

10.3.1. Construction phase

During the Construction phase there will be an increased level of traffic on the National, Regional and Local Road networks, due to the requirement to import and export materials for the scheme.

All construction activities will be managed and directed by a Construction Traffic Management Plan (CTMP). The details of the CTMP will be agreed with the roads department of the Local Authority in advance of construction activities commencing on-site. The objective of the CTMP is to ensure that the impacts of all related construction activities generated during the construction phase of the proposed development upon both the public off-site and internal on-site construction workers environments are fully considered and proactively managed and scheduled with full consideration of the requirements of key stakeholders. This will ensure that the safety, health and well-being of both the public's and construction workers is maintained at all times.

The duration of the construction period is anticipated to be in the region of 18 to 24 months. The number of staff on site will fluctuate over the construction phase of the subject development. Consequently, it is expected that two-way vehicle traffic generation during the construction phase would be of a low level during the peak AM and PM periods over the construction period of the works. It should also be noted that construction workers will typically make use of shared transport thereby further reducing traffic generation. The levels of construction traffic will be greatest during the period when mass earthworks, structural works and pavement works are being undertaken.

In terms of deliveries to the site, these would likely be expected to arrive at a steady rate during the course of the day over the entire duration of the construction phase. The majority of delivery's would be expected to be rigid HGV's with inert material. The main haul routes for deliveries will generally arrive from the direction of the existing national or regional road network. It shall be noted that the Regional Road associated with this (R162) is of a standard similar to the N52, and hence can cater for construction traffic.

The potential impact during the construction phase is considered to have a short-term slight impact on the surrounding network. The implementation of the CTMP and active management of traffic generated by construction workers and deliveries will reduce these potential impacts.

10.3.2. Operational phase

10.3.2.1. Establishment of the Traffic Model

In November 2017 a Project Appraisal Plan was submitted to the TII Strategic Planning Unit outlining the proposed traffic modelling methodology, the data requirements and appraisal methodology appropriate for the proposed scheme. The proposed scheme is classified as a Minor Project (€5m to €20m) in accordance with the TII Project Appraisal Guidelines. Therefore, in terms of project complexity and given that this scheme is in a rural area and primarily concerns online or offline improvements, a simple traffic model based on manual

assignment was proposed and agreed to cover the proposed modelling years necessary for the appropriate appraisal of this scheme. The traffic modelling assessment was carried out for each year identified below for the time periods of three peaks; AM, Inter Peak and PM peak hour.

- Base Year 2017;
- Opening Year 2023;
- Design Year (opening year +15 yrs.) 2038; and
- Forecast year (opening year +30 yrs.).

The data collection required as part of the Traffic Surveys identified for this scheme included Manual Classified Counts (MCCs), Automatic Traffic Counts (ATCs) and Journey Time Assessments which are described within a Traffic Modelling Assessment Report (submitted as part of the Phase 2 Option Selection Report, ref. *5158291DG0044*). The Traffic Modelling assessment report summarises the strategic modelling approach and assumptions made for the assessment of the Do-Minimum and Do-Something Scenarios. The Do-Something Scenario included the four Phase 2 Stage 2 Route options – of which one was ultimately selected as the Emerging Preferred Route i.e. the red route as described in Section 10.2 previously.

Base modelling was undertaken to assess the current operation of three priority junctions within the study area. The junctions modelled were those where 2017 MCC counts were collected during the traffic data collection. The following junctions were modelled for the AM, Inter-peak and PM peak hours:

- R162 / N52 staggered junction;
- N52 / Castletown Court priority T-junction; and
- N52 / Road to Fringestown junction.

Junction modelling was undertaken using TRL ARCADY and PICADY software, the industry standard for modelling priority roundabouts and junctions.

10.3.2.2. Summary of Findings

The 2017 base model for the R162 / N52 staggered junction indicated that the junction is currently operating well within capacity. The base model results for the N52 / Castletown Court and Fringestown priority T-junctions indicate that both junctions operate well within practical capacity in all peak hours. The models indicate that there is very little queuing and delay at both junctions with a Level of Service rating of A in all peak hours for all approaches.

10.3.2.3. Traffic Flows

Forecast year traffic flows for Do-Minimum scenario for opening year 2023, design year 2038 and forecast year 2053 are shown in Table 10-1.

Table 10-1 Summary of traffic flows for Base and Do-Minimum Forecast Years

	Traffic entering the network				Traffic exiting the network			
	Base year (2017)	Do-Minimum (2023)	Do-Minimum (2038)	Do-Minimum (2053)	Base year (2017)	Do-Minimum (2023)	Do-Minimum (2038)	Do-Minimum (2053)
AM peak (8 - 9am)	961	1057	1255	1410	820	1054	1251	1399
Interpeak (3 to 4pm)	848	937	1131	1299	735	933	1126	1285
PM peak (5 to 6pm)	973	1066	1259	1409	825	1064	1257	1400

Forecast year traffic flows for Do-Something scenarios for opening year 2023, design year 2038 and forecast year 2053 are shown in Table 10-2.

Table 10-2 Summary of traffic flows for base year and Do-Something at forecast years

	Traffic entering the network					Traffic exiting the network		
	Base year (2017)	Do-Something (2023)	Do-Something (2038)	Do-Something (2053)	Base year (2017)	Do-Something (2023)	Do-Something (2038)	Do-Something (2053)
AM peak (8 - 9am)	961	1057	1255	1414	820	1056	1254	1413
Interpeak (3 to 4pm)	848	936	1130	1298	735	933	1127	1289
PM peak (5 to 6pm)	973	1066	1259	1409	825	1064	1257	1402

10.3.2.4. Junction Modelling

Junction options were assessed with priority junctions determined most appropriate throughout, with the exception of the N52/R162 where a roundabout junction was concluded as the most appropriate type of junction to be used.

The proposed junction arrangement are as follows a 4-arm roundabout at the N52/R162 junction; a T-junction at the existing N52/R162; a staggered cross-roads at Stoke's Cross; and staggered cross-roads at Mitchelstown Cross). The junction arrangements can be seen in the drawings in Appendix A.

10.4. Recommendation

All construction activities shall be managed and directed by a Construction Traffic Management Plan (CTMP), as produced by the appointed Contractor. The details of the CTMP will be agreed with the roads department of the Local Authority in advance of construction activities commencing on-site.

Recommendations set out in Chapter 4 – Air Quality & Climate and Chapter 5 – Noise & Vibration will also apply.

10.5. Summary

The proposed scheme will improve journey time savings for the strategic traffic and improve road user safety, and thus bring a positive impact in this regard. Given the nature of the scheme i.e. rural road improvement / realignment traffic volume increases, due to standard growth over the appraisal period of 30 years are not considered to be significant and all proposed road network and junction strategy are considered to be of significant capacity to cater for the predicted traffic. Therefore, it is not anticipated that the proposed scheme will have a significant impact on traffic.

11. Ecology

The following section contains the findings of desk-based studies and site visits (undertaken in August 2018) which identify the potential ecological constraints associated with the scheme. Recommendations and proposed mitigation measures are also outlined within this section of the report. This has been prepared in line with the guidance set out in "*Guidelines for Assessment of Ecological Impacts of National Road Schemes"* (NRA, 2009). The sources of data used to undertake the desk based review and inform the ecological site surveys include the following: -

- National Parks and Wildlife Service (NPWS);
- Information on sites designated for nature conservation, including spatial data;
- Habitats and species data;
- National Biodiversity Data Centre (NBDC);
- Species records;
- Environmental Protection Agency;
- Water quality data;
- Geological Survey of Ireland;
- Underlying geology, soils and hydrogeology
- Ordnance Survey Ireland;
- Historic mapping;
- Wetland Surveys Ireland; and,
- Wetland Habitat Records.

11.1. Ecological Site Setting

The scheme is primarily through agricultural lands with some sections of the route aligned along the existing N52 road at various junctions.

The route intersects 4 no. watercourses. These are as follows; The Headstown stream (EPA code; 06H01), the Stephenstown stream (EPA code; 06S02) and 2 no. unnamed streams, all of which flow scheme in a general northernly direction before discharging to the north of the scheme into the River Dee. The Water Framework Directive (WFD) has assigned a '*Good'* water quality status to Headstown stream and Stephenstown stream and has further identified them as being at '*Risk'* of not achieving good water quality status (2013-18).

The surface water drainage system of the scheme is proposed to outfall into the 4 no. of watercourses and subsequently downstream into the River Dee.

11.2. Sites Designated for Nature Conservation

Sites designated for nature conservation within the "*Zone of Influence*" of the scheme were reviewed during the preparation of this assessment. The 'zone of influence' (ZoI) for a project is the area over which ecological features may be subject to significant effects as a result of the proposed N52 Road Scheme and associated activities. This is likely to extend beyond the project site, for example where there are ecological or hydrological links beyond the site boundaries. The zone of influence will vary for different ecological features depending on their sensitivity to an environmental change (CIEEM, 2018).

A distance of 15km is currently recommended in the case of plans, as a potential zone of influence, and this distance is derived from UK guidance (Scott Wilson et al, 2006). For certain projects, the distance could be much less than 15km, and in some cases less than 100m, but National Parks and Wildlife Service guidance advises that this must be evaluated on a case-by-case basis with reference to the nature, size and location of the project and the sensitivities of the ecological receptors.

11.2.1. Natura 2000 Sites

The Natura 2000 network is comprised of both Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) for birds; these sites are designated for the protection of biodiversity across the European Union. SACs are designated under the EU Habitats Directive (92/43/EEC), as transcribed into Irish law by the European Communities (Birds and Natural Habitats) Regulations, 2011, while SPAs are designated under the EU Birds Directive (79/4089/EEC; and as amended 2009/147/EC). SACs are sites of international importance due to the presence of Annex I habitats and/or Annex II species listed under the EU Habitats Directive (92/43/EEC). SPAs are designated for the protection of bird species listed on Annex I of the Birds Directive (2009/147/EC), regularly occurring populations of migratory species and areas of international importance for migratory birds.

There are 3 no. Natura 2000 Sites identified within 15km of the scheme; 2 no. SACs and 1 no. SPA. There are also 2 no. Natura 2000 sites; 1 no. SAC and 1 no. SPA, outside of the 15km range which are indirectly linked to the scheme through surface water pathways. Natura 2000 sites with the *ZoI* of the scheme as presented below in Table 11-1.

Further details on the connectivity of these sites to the scheme are included in the Screening for Appropriate Assessment of the scheme route, Document Ref: 5158291DG0161 (Atkins, 2020).

Table 11-1 Natura 2000 Sites within 15km of the of the proposed scheme

Natura 2000 Site	Context with proposed scheme	Site Code	Qualifying Interests
River Boyne and Blackwater SAC	9.6km south west	002299	• Alkaline fens [7230] • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0] • *Lampetra fluviatilis* (River Lamprey) [1099] • *Salmo salar* (Salmon) [1106] • *Lutra* (Otter) [1355]
River Boyne and Blackwater SPA	10.2km south west	004232	• Kingfisher (*Alcedo atthis*) [A229]
Killyconny Bog (Cloghbally) SAC	14.5km west	000006	• Active raised bogs [7110] • Degraded raised bogs still capable of natural regeneration [7120]
Dundalk Bay SAC	Linked via watercourses - 37km east	000455	• Estuaries [1130] • Mudflats and sandflats not covered by seawater at low tide [1140] • Perennial vegetation of stony banks [1220] • Salicornia and other annuals colonising mud and sand [1310] • Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] • Mediterranean salt meadows (*Juncetalia maritimi*) [1410]
Dundalk Bay SPA	Linked via watercourses - 37km east	004026	• Great Crested Grebe (*Podiceps cristatus*) [A005] • Greylag Goose (*Anser anser*) [A043] • Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] • Shelduck (*Tadorna tadorna*) [A048]

Natura 2000 Site	Context with proposed scheme	Site Code	Qualifying Interests
			• Teal (*Anas crecca*) [A052] • Mallard (*Anas platyrhynchos*) [A053] • Pintail (*Anas acuta*) [A054] • Common Scoter (*Melanitta nigra*) [A065] • Red-breasted Merganser (*Mergus serrator*) [A069] • Oystercatcher (*Haematopus ostralegus*) [A130] • Ringed Plover (*Charadrius hiaticula*) [A137] • Golden Plover (*Pluvialis apricaria*) [A140] • Grey Plover (*Pluvialis squatarola*) [A141] • Lapwing (*Vanellus vanellus*) [A142] • Knot (*Calidris canutus*) [A143] • Dunlin (*Calidris alpina*) [A149] • Black-tailed Godwit (*Limosa limosa*) [A156] • Bar-tailed Godwit (*Limosa lapponica*) [A157] • Curlew (*Numenius arquata*) [A160] • Redshank (*Tringa totanus*) [A162] • Black-headed Gull (*Chroicocephalus ridibundus*) [A179] • Common Gull (*Larus canus*) [A182] • Herring Gull (*Larus argentatus*) [A184] • Wetland and Waterbirds [A999]

11.2.2. Natural Heritage Areas

There are no Natural Heritage Areas (NHAs) located within 15km of the proposed scheme. There are however 11no. proposed Natural Heritage Areas (pNHAs) within 15km; the closest of which is the Mentrim Lough pNHA (Site Code: 001587), located ca. 5km north east. None of the pNHAs within the 15km buffer were determined to share direct or indirect connectivity to the scheme.

11.2.3. Other Sites of Ecological Value

No other internationally or nationally important conservation sites are noted within the *ZoI* of the scheme.

A review of Wetland Survey Ireland records identifies one area of wetland habitat within the immediate vicinity of the scheme. Castletown Ponds West is located ca. 250m south of the proposed scheme and habitats in this area include artificial pond, wet grassland, marsh and scrub. There is no direct or indirect connectivity from the proposed scheme to this or any other wetland habitat.

A habitat survey was undertaken along the alignment of the route in August 2018. The findings of the survey are detailed in Appendix E; Habitat Survey: N52 Grange to Clontail Scheme.

11.2.1. Hedgerows / Treelines

As the scheme is located within agricultural lands, there are numerous field boundaries formed by hedgerows and / or treelines which will be intercepted by the proposed scheme. There are no woodland or afforested areas intersected by or within the immediate vicinity of the route. There are no Tree Preservation Orders within the vicinity of the proposed scheme (MCC, 2013).

11.2.2. Documented Rare and Protected Species

A number of bird species which have been designated for Protection under the Wildlife Acts and European Birds Directive have been identified within the vicinity of the proposed scheme, these include Barn Owl. Golden Plover, Mute Swan, Yellowhammer, Skylark, San Martin and Lapwing (non-exhaustive list). A bird survey was undertaken along the alignment of the route in August 2018. The findings of the survey are detailed in Appendix E Document Ref: 5158291DG0096; Bird Surveys: N52 Grange to Clontail.

A number of protected mammal species including bat species, badger and otter were also reported within the vicinity of the proposed scheme (NBDC, 2020). A mammal survey was undertaken along the alignment of the route in August 2018. The findings of the survey are detailed in Appendix E Document Ref. 5158291DG0095; Mammal Surveys: N52 Grange to Clontail Scheme. No badger setts were noted within the alignment of the route. Trees with potential to accommodate bats are identified within the site survey report.

11.2.3. Records of non-native species

A review of NBDC records and site surveys identifies floral invasive species; Japanese knotweed (*Fallopia japonica*) as being along the banks of a disused railway line which intersects the proposed road scheme. A stand of knotweed is noted to be ca. 80m north of the scheme alignment and is located at the base of the railway embankment adjacent to the existing N52 road. The knotweed stand has been treated with herbicide application which is having a significant effect on growth with an estimated 80-90% of the stand showing signs of die back and the remaining summer growth is showing signs of being stunted and distorted.

Japanese Knotweed was also noted ca. 550-600m north of the scheme. This small stand of knotweed is located on the verge of the west bound lane of the original N52 road and is also showing signs of be treated and controlled with herbicide application. The majority of the stand is showing signs of die back with only occasional new summer shoots evident.

A floral invasive species survey was undertaken during August 2018 which noted the aforementioned stands of Japanese knotweed. No other floral invasive species were noted along the alignment of the route during the survey period. The findings of the survey and recommendations are detailed in Appendix E Document Ref. 5158291DG0090;Invasive Species Survey: N52 Grange to Clontail Scheme.

11.3. Impact Assessment

11.3.1. Construction phase

There are 2 no. Natura 2000 sites within connectivity to the road scheme namely; Dundalk Bay SAC and Dundalk Bay SPA. Whilst indirect connectivity exists through surface water features, impacts on the qualifying interest of the SAC and SPA are not anticipated during the construction phase of the road scheme due to the distance of the road scheme to Dundalk Bay which is noted to be ca. 37km.

The proposed scheme does not intersect any other habitats of ecological importance e.g. protected wetland or woodland areas, nor is there indirect connectivity to any other habitats of ecological importance. As there is no connectivity to protected habitats, impacts on habitats of ecological importance are precluded.

The proposed works will consist of the culverting of the 4 no. watercourses intersected by the proposed scheme. Given that standard construction methodologies and mitigations are to be implemented no significant impacts on water quality or aquatic species are anticipated during the construction of the route.

The stands of Japanese knotweed noted during the surveys are considered to be of sufficient distance from the alignment of the scheme so as not to have the potential to impact on the scheme during the construction phase.

The construction phase will involve the removal of existing hedgerows and treelines which are important habitats and connecting corridors for a wide range of native species. The construction phase will have a negative impact on bird nesting and mammal foraging habitats and will potentially impact bat roosting habitat in a number of locations where hedgerows and treelines are to be lost. The loss of hedgerow and treeline habitat will be compensated for by the completion of the soft landscape design.

11.3.2. Operational phase

Potential impacts associated with the operational phase of the road scheme include pollution of the watercourses from contaminated road drainage e.g. surface water run-off contaminated with traffic generated hydrocarbons. Given that standard mitigation measures will be utilised during the design and construction of the drainage network (i.e. petrol interceptors, attenuation with treatment) no significant impacts on the watercourses are anticipated.

The route has the potential to impact the foraging and commuting routes of terrestrial and volant species through the physical barrier that the roadway will present. Given that ecological mitigation measures will be implemented, such as mammal underpasses and mammal resistant fencing, no significant impacts on protected fauna are anticipated. The provision of ecological mitigation measures shall be assessed as part of the detailed design.

11.4. Recommendations

The following industry standard measures will apply during the construction phase: -

- Pre-construction ecological surveys should be conducted along the proposed scheme by a suitably qualified ecologist. Surveys should be undertaken during the appropriate season.
- Pre-demolition surveys should be conducted of all buildings for demolition by a suitably qualified ecologist for potential bird, bat and invasive species.
- The Contractor should follow guidelines detailed by TII for protection of flora and fauna prior to and during the construction phase which include: -
    - Ecological Survey techniques for protected flora and fauna during the planning of national road schemes.
    - Guidelines for the crossing of watercourses during the construction of national road schemes (NRA).
    - Guidelines for the treatment of bats during to the construction of national road schemes (NRA).
    - Guidelines for the treatment of badgers prior to the construction of national road schemes (NRA).
    - Guidelines on the management of noxious weed and non-native invasive plant species on national roads (TII).
    - A guide to landscape treatment for national road schemes (NRA).
- A site-specific Construction Environmental Management Plan (CEMP) should be prepared by the Contractor in advance of commencing the works. The detailed CEMP should clearly set out all environmental controls which the Contractor will implement for the duration of the works to protect the Headstown Stream, Stephenstown Stream and unnamed stream. Such measures would include a daily plant and machinery check, strict re-fuelling procedures and secure bunded storage of any fuels, oils or chemicals. Control measures should be fully implemented as required throughout the construction phase. All mitigation measures set out in section 6.4 (for the protection of soils and geology) and section 8.3 (for the protection of water) also apply.
- Site clearance works should be undertaken during the appropriate season so as not to impact on bird nesting or bat roosting activity.
- In-stream works (if required) should be undertaken during the appropriate season so as to minimise impact on protected aquatic species.

11.5. Summary

A screening for Appropriate Assessment has been prepared by Atkins (2020) (Document Ref. 5158291DG0161) and concludes '*that the proposed N52 Grange to Clontail Scheme project, either individually or cumulatively, poses no likely significant effects on Natura 2000 sites'.* Similarly, no nationally important conservation sites will be impacted by the scheme.

- The route will cross 4 no. small watercourses and given standard mitigation measures will be implement no significant impacts on water quality or protected aquatic species are anticipated.

- No habitats of high ecological value will be impacted by the road scheme. The construction of the route will involve the loss of hedgerows and treelines and will potentially impact foraging and commuting routes of local fauna. Seasonally appropriate pre-construction ecological surveys should be carried out and recommendations and mitigations measures should be detailed prior to construction to be included in the final design of the scheme and also in the CEMP. Following completion of final design, consultation will be undertaken with NPWS in regard to proposed ecological mitigation measures.
- Four watercourses are to be intersected by the proposed route. Whilst no permeant watercourse diversions are envisaged, following completion of final design Inland Fisheries Ireland will be consulted in regard to any proposed culvert, any instream works and / or temporary watercourse diversions.

12. Landscape and Visual

This section provides a description of the receiving environment with respect to landscape and visual considerations, identification of any potential constraints associated with the proposed scheme and proposed mitigation measures / recommendations. This assessment is based on the findings of a desk-based review of available information from the following sources: -

- Meath County Council Development Plan 2013 – 2019; and,
- 'N52 Grange to Clontail, County Meath Route Selection Report – Landscape and Visual Impact Assessment' prepared by Eamonn Byrne Landscape Architects (EBLA, 2018).

12.1. Receiving Environment

The proposed scheme is located within the North Navan Lowlands Landscape Character Area and is characterised as follows (EBLA, 2018);

- A large area of agricultural land to the north of Navan contained in the east and west by the Rivers Blackwater and Boyne respectively and to the north by a more complex hilly landscape along the north Meath border.
- Complex geology of limestone, sandstone, shale and volcanic rock creating diverse landscape.
- For the most part well drained mineral soils formed from limestone and sandstone have been developed for agriculture.
- Predominantly agricultural fields, mix of pasture and arable crops.
- Ruined churches, castles throughout the area. Estate landscapes and protected structures.

As noted by EBLA (2018), the following statement is included within the Meath Landscape Character Assessment;

> '*The LCA[4] has medium landscape value, medium landscape sensitivity and has high potential capacity to accommodate new transport infrastructure'*

Based on available information the existing landscape within the general area of the proposed scheme is agricultural in nature with fields of medium to large scale which are '*rectangular and irregular in shape and enclosed by hedgerows and tree lines*' (EBLA, 2018). There are no Tree Preservation Orders within the vicinity of the proposed scheme (MCC, 2013).

12.2. Impact Assessment

It is anticipated that the following impacts will occur on the surrounding landscape;

- Most of the route travels through high quality greenfield lands and the route from chainage 0100 to 3000 would be visually prominent in long distant views
- Significant areas of cut and fill will be visually prominent in views from within the local landscape, and their adverse effects augmented with the straight road alignment.
- The majority of the route travels within tranquil lands south of the existing N52 Road corridor. There would be additional large adverse effects on rural tranquillity in lands south of the existing N52 Road corridor by the introduction of the road within this very attractive and peaceful landscape.
- There would be no loss of archaeological sites. However, the landscape setting of a large ringfort at Fringestown (SMR ME012-004) would experience large adverse effects from graded out fill. There would be adverse effects on the landscape setting of ringforts SMR ME012-012 and ME012-013 and ME012-014. There would be large adverse effects on the wider landscape setting of Stephenstown House and on the disused Navan Kingscourt railway line. Similarly, there would be some adverse effects on wider landscape setting of views to and from St. Patrick's (COI) Church and graveyard.

[4] LCA – Landscape Character Area

12.2.1. Construction and Operational Phases

Overall it is anticipated that (based on the considerations above) there will be slight to moderate adverse visual and landscape impacts as a result of the proposed scheme.

12.3. Recommendations

As recommended by EBLA (2018) the following non-exhaustive list of mitigation measures should be implemented during the construction phase of the scheme, to reduce the potential landscape and visual impacts of the proposed scheme;

- Embankment and cutting slopes should be graded out where possible and practical;
- New planting to restore severed field pattern;
- Replanting of trees and hedgerows, including off-site planting;
- Ensure planting species are appropriate to surroundings;
- Views to local landmarks such as the steeple at St. Patrick's Church (COI) to be maintained from the road and landscaping along the road should be designed to achieve this; and,
- Visual integration of noise barriers, signage and lighting into the landscape.

12.4. Summary

When the mitigation measures as outlined in section 12.3 are implemented there will be a moderate adverse visual and landscape impact associated with the proposed scheme.

13. Agronomy

This section provides a description of the receiving environment with respect to agronomy and agriculture, identification of any potential constraints associated with the proposed scheme and proposed mitigation measures / recommendations. This assessment is based on the findings site visits and site meetings carried out by Philip Farrelly & Co.(2019) and of a desk-based review of available information from the following sources: -

- Meath County Council Development Plan (2013 – 2019);
- Google Maps / Bing Maps; and,
- Agronomy Reports 'Regarding Impact of the N52 Fringestown Realignment' prepared by Philip Farrelly & Co. (2019).

13.1. Receiving Environment

The proposed scheme impacts 13no. land parcels. 2no. of these are dairy farms that will be impacted upon by the proposed scheme, as depicted in Figure 13-1 and included in Appendix F

A review of available agronomy reports prepared for each of the land parcels intercepted by the proposed scheme has identified that 4no. land holdings are supplied via. private well schemes. It is assumed that all of the properties within vicinity of the proposed scheme are supplied via. private wells albeit this will be confirmed prior to construction works commencing. Refer to Chapter 8-Water.

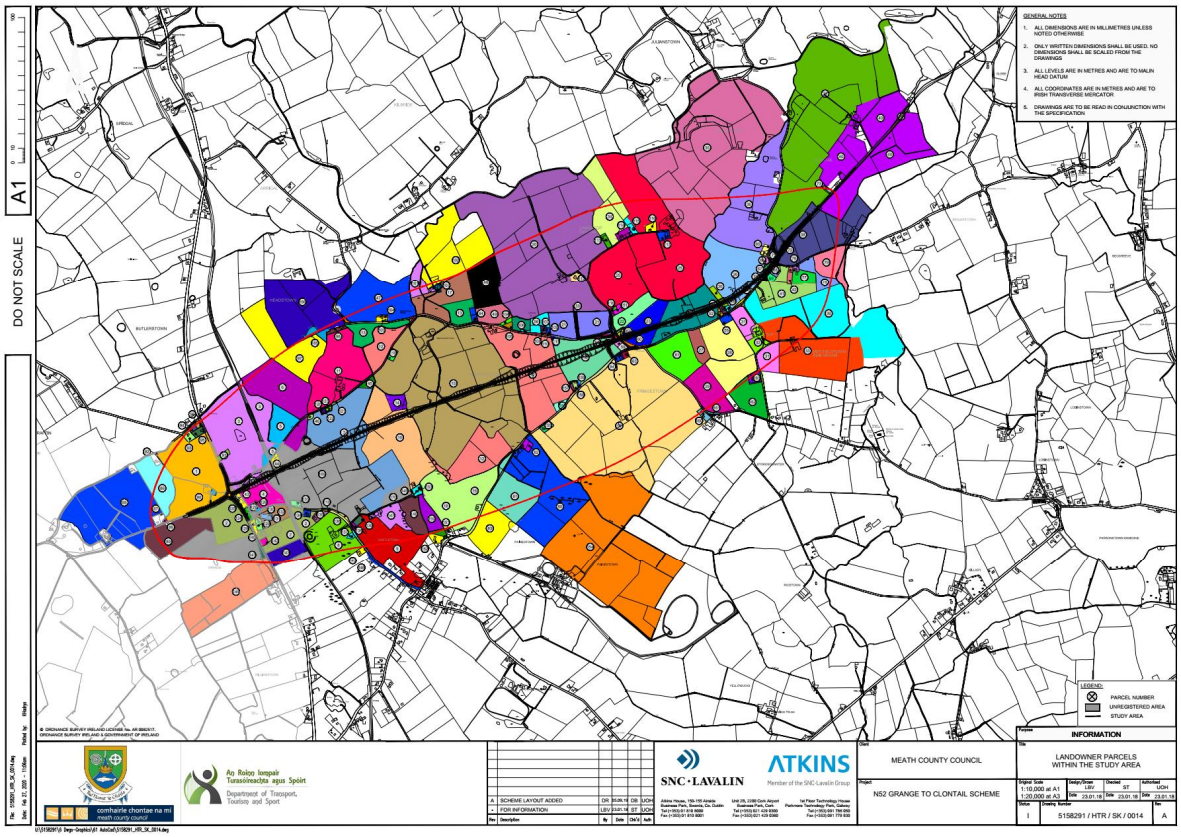

Figure 13-1 - Land parcels being intercepted by the proposed scheme

13.2. Impact Assessment

13.2.1. Construction Phase

The proposed scheme intercepts (and therefore impacts) 13no. land parcels. 2no. of which are dairy farms. Some of these land parcels will be negatively impacted during the construction phase of the development as access to lands could potentially be compromised in the short term.

13.2.2. Operational Phase

The following potential impacts apply during the operational phase, to the various land holdings that will be severed impacted by the proposed scheme.

- Removal of treelines / hedgerows;
- Impact on existing water supply wastewater treatment;
- Reduction in acreage due to land take;
- Severance of land parcels;
- Severance of land from yard and animal handling facilities;
- Impact on existing access point;
- Impact on existing farm roadway and paddocking system;
- Impact on main access to dwelling house and farmyard; and,
- Impact on farming operations

13.3. Recommendations

The following mitigation measures should be included within the design to ensure that all severed agricultural lands are catered for in terms of connectivity throughout entire land holdings.

Where applicable, the following are recommended for all of the 13no. land parcels being severed by the proposed scheme.

- Provide suitable access to the severed areas which will include allowance for daily movement of the dairy herd (where applicable);
- The farm infrastructure including farm / dwelling house access and/or roadway, water and power supply will need to be maintained and restored on the severed areas;
- The land drainage will need to be maintained and restored if affected;
- Ensure all of the lands remain stock proof;
- Provide animal handling facilities on severed area where the existing is not sufficient; and,
- Access to be maintained throughout the construction phase for all landowners

13.4. Summary

There will be an impact on a number of landholdings as a result of the proposed scheme; however it is considered that these impacts can be mitigated through the implementation of the recommendations outlined in section 13.3

14. Population & Human Health

This section provides a description of the receiving environment with respect to population and human health, identification of any potential constraints associated with the proposed scheme and proposed mitigation measures / recommendations. This assessment has been prepared taking account of the findings of relevant chapters of this report, and the findings of a desk-based review of the following sources: -

- Online Maps (2019); and,
- CSO (2019). Census 2016 Sapmap Area: County Meath.

14.1. Receiving Environment

Collisions

The N52 is included within TII's Road Collision Ranking database, proposed by the TII's safety department, for the 2012-2014 and 2014-2016 periods as part of the HD15 Network Safety Ranking. Numerous sections of the N52 are reported at least twice above the average collision rate (as described in TII Publication GE-STY-01022-Network Safety Analysis); three of which are located between Fringestown (Stokes Cross) and the junction of the N52 with the R162 (which are covered by the proposed realignment works).

Land-use

The surrounding land-use of the proposed scheme is predominantly agricultural in nature. There are a number of rural houses dispersed along the proposed scheme, with a number of farming landholdings / properties within vicinity of the scheme; 13no. of which will be impacted by the proposed scheme, as discussed further in Chapter 13 – Agronomy. 2no. properties will require demolition; 1no. partial commercial property and 1no. residential property. The commercial property is a small-scale precast manufacturing enterprise while the residential property is currently occupied. The owners of these properties have been consulted with and are aware of the proposed demolition works.

Population

The proposed scheme is located partly within the Castletown (052) electoral division. The population of this area in 2011 was reported as 1,017. The population size has fallen by 2.2% to 995 in 2016 (CSO (2019)).

Air Quality

The baseline air quality within the vicinity of the proposed scheme is generally considered to be good based on current Nitrogen Oxide (NO_2) and Ozone O_3 levels recorded at Emo Court Station, the closest rural Zone D location to the proposed scheme (EPA, 2020).

Noise

The primary source of noise within the general area of the proposed scheme is the N2 to the east and N3 to the west (TII, 2019). Based on available noise mapping from the TII (2019) day-time noise levels in excess of 74 dB are generated within the confines of these schemes with night-time noise levels reducing to 60-64 dB. There are no other significant regional noise sources identified within the general area of the proposed scheme (TII, 2019). Regional and third class roads along with agricultural activities in the vicinity of the proposed scheme will contribute to the baseline noise environment.

Water

4no. surface water features; Headstown Stream, Stephenstown Stream and 2no. unnamed streams will be crossed by the proposed scheme. All of these streams flow in a general northern direction to join with the River Dee, which flows in a general easterly direction to discharge to Dundalk Bay SAC and SPA. It is assumed that all properties within vicinity of the proposed scheme are on private well supplies.

Land, soils & geology

The proposed scheme is located in lands which are predominantly (historically and currently) agricultural in nature, with small portions of made ground intercepted by the proposed scheme.

14.2. Impact Assessment

The proposed scheme will be utilised by all of the local residents / workers within vicinity of the scheme as well as the regular users of the road, including commuters and heavy goods vehicles (HGVs).

It is anticipated that there will be a positive, long term impact on population and human health, as collision numbers will be reduced, cycle / pedestrian facilities will be provided for, public transport will be readily available along this stretch of road and journey times will be reduced for commuters and HGVs.

For the purposes of this report all residential properties and land holders within the vicinity of the proposed scheme are considered sensitive receptors with respect to potential changes in air quality and noise and vibration levels, land use and water (groundwater and surface water) quality and resources.

Following a review of the anticipated residual impacts of the proposed scheme on each of these environmental considerations (as detailed in previous chapters), the following impacts on human health and population have been considered during the construction and operational phases of the proposed scheme.

14.2.1. Construction Phase

During the construction phase it is anticipated that the proposed scheme could potentially have negative impacts on the receiving environment i.e. local residents of the proposed scheme, as follows:

- The proposed scheme will impact 13no. land holdings. These lands will be permanently changed in nature, impacting on access to, use of and maintenance of the landholdings and potentially agricultural practices. The proposed scheme has been designed in order to reduce the negative impacts on the land owners as much as is feasible;
- The proposed scheme will result in an increase of noise and vibration levels for all residential properties within the immediate vicinity. These impacts will be short term in nature and will be minimised so far as possible with site specific mitigation measures which will form part of the site-specific CEMP that will be prepared by the Contractor;
- The proposed scheme will result in an increase of dust levels during the construction phase. These impacts are anticipated to be short term in nature and will be minimised so far as possible with site specific mitigation measures which will form part of the site-specific CEMP that will be prepared by the Contractor;
- The proposed scheme is anticipated to have a minor impact on waste production. Any potential impacts on population and human health associated with waste production / removal will be minimised so far as possible via. the implementation of the Outline Waste Management Plan (WMP) prepared by Atkins (2020). It will be the responsibility of the Contractor to develop this WMP further into a site-specific WMP prior to construction works commencing;
- The proposed scheme may have potential impacts on groundwater quality and potentially resources within the vicinity of the proposed scheme during the construction works. It is assumed that all properties within vicinity of the scheme are on private well supplies. The Contractor will implement a site-specific CEMP which will detail the locations and specific mitigation measures required for all private wells within the vicinity of the scheme.
- It is anticipated that traffic may build up along the existing N52 during the construction phase of the proposed scheme. These impacts will be short-term in nature and minimised so far as possible through the implementation of a Traffic Management Plan which will be prepared by the Contractor; and,
- The proposed scheme will require the demolition of 2no. properties; partial demolition of 1no. commercial property (workshed for a precasting operation) and 1no. residential property (currently occupied). These property owners will be negatively impacted by the proposed scheme however, both are aware of the proposed scheme and that their properties will be demolished.

14.2.2. Operational Phase

During the operation phase of the proposed scheme it is anticipated that there will be a number of potential impacts on the receiving environment, as follows:

- Potential impact on groundwater quality and therefore private well supplies; however a pre-construction well survey will be carried out, which will be used to inform mitigation measures as required during both the construction and operational phases of the scheme.
- There are 8 no. air sensitive receptors, all residential buildings which may be impacted by increased NO_X and PM_{10} exposure during the operational phase. It is anticipated that any increases in exposure, although permanent, will be minor in nature.
- Land holdings will be impacted by the proposed scheme during the operational phase. Such impacts have been minimised so far as possible, within the design of the proposed scheme through the provision of accommodation works.
- An increase in noise levels for the residential properties within vicinity of the proposed scheme are anticipated for the operation phase. These impacts will be permanent, but provided that recommended mitigation measures are implemented, these impacts will not be significant in nature.

14.3. Recommendations

In order to minimise, as far as possible, potential impacts on population and human health the mitigation measures / recommendations set out in the following chapters will be implemented in full during the construction and operational phases of the scheme;-

- Chapter 4 - Air Quality;
- Chapter 5 - Noise & Vibration;
- Chapter 6 - Land, Soils and Geology; and
- Chapter 8 – Water

14.4. Summary

It is anticipated that any potential impacts associated with population and human health will be mitigated with the implementation of all recommendations outlined in the various chapters of this report.

15. Conclusions & Recommendations

MCC have appointed Atkins to prepare an Environmental Report to support a Part 8 Planning application for the proposed scheme. The Environmental Report which describes the existing situation, the proposed scheme and its potential impact on the surrounding environment for selected topics along with any mitigation measures required, has been prepared in accordance with relevant best practice environmental assessment guidance (EPA, 2017, EPA, 2015) and also discipline specific guidance where relevant, albeit it should be noted that this report is not an EIAR.

The key findings of this technical assessment are as follows:

- Whilst the need for the preparation of an EIAR for the proposed scheme has been screened out as detailed separately within the EIA Screening Assessment prepared to accompany this Part 8 Planning Application (Atkins, 2020), all pertinent environmental topics have been considered in this non-statutory Environmental Report.
- The following environmental topics have been evaluated with regards to potential impacts which could arise as a result of the construction or operational phases of the proposed scheme: Air Quality; Noise & Vibration; Land, Soils & Geology; Material Assets; Water (i.e. Hydrology and Hydrogeology); Archaeology and Architectural Heritage; Traffic; Ecology, Landscape and Visual and Population & Human Health.
- Based on all available information it can be concluded that any identified potential impacts to the receiving environment will not be significant, and can be managed through the implementation of mitigation measures during the detailed design, construction and operational phases as outlined in this report

All mitigation measures and recommendations within this report have been collated in Table 15-1 below and are required to be implemented in full as part of the proposed scheme.

It will be the Contractors responsibility to prepare a site specific Construction and Environmental Management Plan (CEMP) for the proposed scheme which will incorporate the following mitigation measures as well as any other required measures to eliminate the potential for significant environmental impacts arising from the proposed scheme.

Table 15-1 - Mitigation Measures to be Implemented

Item Reference	Environmental Topic	Mitigation Measures / Recommendations	Construction Phase	Operational Phase
1	Chapter 4 - Air Quality	Standard measures should be taken which will minimise dust from construction activities; at a minimum adhering to standard good practice which includes the Building Research Establishment (BRE) document entitled '*Control of Dust from Construction and Demolition Activities'*. Any potential dust nuisance which could arise during the construction period will be mitigated through the implementation of a site-specific Detailed Construction Environmental Management Plan (CEMP) by the Contractor. Dust minimisation measures which should be detailed further within the CEMP should include, but are not limited to, the following actions:	✓	
		• Site access should be regularly cleaned and maintained using road sweepers as required;	✓	
		• Dampening down of areas where dust may arise, as required, during dry and/or windy conditions; this also applies to vehicles delivering material with dust potential;	✓	
		• Any stockpiling of materials shall be designed and laid out to minimise exposure to wind, and potential for dust nuisance; and,	✓	
		• Any surplus soils removed from site shall be appropriately covered during transport to the relevant permitted / licenced disposal facility.	✓	
2	Chapter 5 - Noise & Vibration	All construction works should be undertaken in accordance with standard industry best practice methods. Any potential noise arising from the works will be short-duration and temporary in nature and will be managed through the implementation of a site-specific Detailed Construction Environmental Management Plan (CEMP) by the Contractor. Noise / vibration minimisation measures during the construction phase should include, but are not limited to the following:-	✓	
		• Ensuring that mechanical plant and equipment used for the purpose of the works are fitted with effective exhaust silencers and are maintained in good working order;	✓	
		• Careful selection of quiet plant and machinery to undertake the required work where available;	✓	
		• All major compressors should be 'sound reduced' models fitted with properly lined and sealed acoustic covers which should be kept closed whenever the machines are in use;	✓	
		• Any ancillary pneumatic percussive tools should be fitted with mufflers or silencers of the type recommended by the manufacturers;	✓	

Item Reference	Environmental Topic	Mitigation Measures / Recommendations	Construction Phase	Operational Phase
		• Machines in intermittent use should be shut down in the intervening periods between work or throttled down to a minimum. Generators, or any other plant, shall not be left running / operational after hours unless in an emergency, and agreed with the Employer's Representative;	✓	
		• Ancillary plant such as generators, compressors and pumps should be placed behind existing physical barriers, and the direction of noise emissions from plant including exhausts or engines should be placed away from sensitive locations, in order to cause minimum noise disturbance;	✓	
		• Handling of all materials should take place in a manner which minimises noise emissions; and,	✓	
		• The Contractor should adhere to the codes and practices for minimising noise emissions from construction and if required any piling works.	✓	
		In accordance with TII guidance ('*Good Practice for the treatment of noise during the planning of national road schemes'*, NRA 2014), all required mitigation measures must be taken to minimise noise and/or vibration impacts during construction activities.	✓	
		During the operational phase in order to address potential noise impact to the 6no. identified noise sensitive receptors the following mitigation measures should be adopted;		
		• A low noise road surface (LNRS) would be recommended which would potentially reduce noise levels at the property at chainage 4200;		✓
		• The use of LNRS and barriers would be required at the remaining properties; and,		✓
		• In order to identify the specific mitigation requirements for each property, a detailed noise impact assessment will be required during detailed design stage.		✓
3	Chapter 6 - Land, Soils & Geology	• The final scheme design should be informed by all available site-specific geotechnical information.		✓
		• The employment of good construction management practices will serve to minimise the risk of pollution from construction activities at the proposed development in line with the Construction Industry Research and Information Association (CIRIA) publication entitled, '*Control of Water Pollution from Construction sites, Guidance for Consultants and Contractors, CIRIA - C532*' (2001) which are also detailed in Chapter 8 - Water.	✓	
		• Specifically, with regard to soils and geology, the following will be adhered to:		
		o Fuels, lubricants and hydraulic fluids for equipment used on the construction site, as well as any solvents, oils, and paints will be carefully handled to avoid spillage, properly secured	✓	

Item Reference	Environmental Topic	Mitigation Measures / Recommendations	Construction Phase	Operational Phase
		against unauthorised access or vandalism, and provided with spill containment according to best codes of practice;		
		o Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the scheme for appropriate disposal;	✓	
		o Any spillage of fuels, lubricants or hydraulic oils will be immediately contained and the contaminated soil removed from the proposed development and properly disposed of;	✓	
		o All site vehicles used will be refuelled in bunded areas in the construction compound;	✓	
		o Strict supervision of Contractors will be adhered to in order to ensure that all plant and equipment utilised on-site is in good working condition. Any equipment not meeting the required standard will not be permitted for use within the site. This will minimise the risk of soils and bedrock becoming contaminated through site activity;	✓	
		o Soils on the proposed development may become unnecessarily compacted by machinery during construction. In order to protect against this accesses, and haulage roads will be clearly defined;	✓	
		o In the event that contaminated ground (i.e. soils, perched water or weathered bedrock) is encountered during the construction works the following specific environmental management procedures will be adhered to: -		
		▪ The contaminated material will be fully characterised in terms of lateral and vertical extent, and a detailed assessment of the potential environmental and human health impacts will be undertaken in accordance with industry standard best practice.	✓	
		▪ Remediation works will be undertaken as required, to address any potential identified environmental or human health risks which may be associated with the contamination. Any waste generated during the works will be managed in accordance with relevant waste legislation. Any contaminated material requiring offsite disposal will be transported and disposed of to a suitably licenced waste facility.	✓	
		▪ Validation sampling will be undertaken as required to verify that the remediation works have been successfully completed and no residual environmental or human health risks associated with the site condition remain.	✓	
		• The following general precautionary measures will also be implemented:		

Item Reference	Environmental Topic	Mitigation Measures / Recommendations	Construction Phase	Operational Phase
		o All excavated materials will be stored away from any excavations, in an appropriate manner at a safe and stable location. The maximum height of temporary stockpiles will be 3m; and, o A comprehensive monitoring and supervisory regime including monitoring of excavations and stability assessments as required will be put in place to ensure that the proposed construction works do not constitute a risk to the stability of the site.	✓ ✓	
4	Chapter 7 - Material Assets	• The Contractor should undertake pre-demolition surveys for all infrastructure scheduled for demolition including an asbestos survey. • A Project C&D Waste Management Plan (WMP) must be prepared by the Contractor in accordance with 'Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Waste Projects' in advance of commencing the works, as the proposed scheme likely exceeds the relevant thresholds for the preparation of such plans. The C&D Waste Management Plan should take full account of the Outline WMP (Atkins, 2020) prepared as part of this planning application; and, • All waste soils / material removed from site will need to be classified in accordance with EPA guidelines (2015); soils testing will be required; the results of which should inform the preparation of a waste classification tool (to determine the appropriate List of Waste (LoW) code), and then screened against relevant waste acceptance criteria (to determine the appropriate regulated disposal / recovery facility for each waste stream). All other construction waste should be segregated and removed from site for disposal or recycling, in accordance with all relevant Waste Management Legislation. • All waste-related control measures set out in Chapter 6 – Land, Soils and Geology will apply during the construction phase.	✓ ✓ ✓ ✓	✓
5	Chapter 8 – Water …	A pre-construction door to door survey should be undertaken by the Contractor in advance of the commencement of any construction works. A register of all identified wells (for potable, agricultural or commercial use) and septic tanks (within 150m of the scheme) should be provided to the design team in order to identify any well protection or accommodation works required. Such works should be carried out as required. The construction management of the site will take account of the recommendations of the 'Construction Industry Research and Information Association (CIRIA) guides Control of Water Pollution from Construction sites' (2001) to minimise as far as possible the risk of pollution. With regard to water impacts the following mitigation measures are proposed;	✓ ✓	✓

Item Reference	Environmental Topic	Mitigation Measures / Recommendations	Construction Phase	Operational Phase
		• In the unlikely event that contaminated shallow perched water / groundwater is encountered during the construction phase, works will immediately cease. Advice will be sought from a qualified environmental consultant regarding the appropriate management of contaminated water, and any emergency containment measures required. Appropriate measures as set out under section 5.4 (Land, soils and Geology) will be implemented. The following specific mitigation measures regarding temporary oil / chemical storage and refuelling should be adhered to:	✓	
		o All oils, paints and varnishes stored on site will be kept in a locked and bunded area.	✓	
		o Generators, pumps and similar plant will be placed on drip-trays to prevent contamination by oil.	✓	
		o All site vehicles used will be refuelled in bunded areas.	✓	
		o All temporary construction fuel tanks will also be located in a suitably bunded area and all tanks will be double skinned. In addition, oil absorbent materials will be kept onsite in close proximity to any fuel storage tanks or bowsers during proposed site development works.	✓	
		o All deliveries to on-site oil storage tanks will be supervised.		
		o Records will be kept of delivery dates and volumes.	✓	
		o Every piece of equipment associated with the storage of fuel on site will be designed and installed to recognised BS codes.	✓	
		o All valves should be of steel construction and the open and close positions should be clearly marked.	✓	
		• The production, transport and placement of all cementitious materials should be strictly planned and supervised. Site batching/production of concrete will not be carried out on-site and therefore these aspects will not pose a risk to local waterbodies present, namely the Headstown and Stephenstown streams and unnamed streams.	✓	
		• The Ground Investigation undertaken along the scheme indicates that groundwater will likely be intercepted by the proposed scheme. Groundwater is likely to be a potential constraint during the construction of the proposed scheme. In the event that dewatering is required, the Contractor will be required to prepare a detailed water management plan in advance of any dewatering works taking place. This plan should clearly set out where dewatering is likely to be required, anticipated	✓	

Item Reference	Environmental Topic	Mitigation Measures / Recommendations	Construction Phase	Operational Phase
		volumes and duration, proposed treatment and disposal options as well as required consents and licences.		
6	Chapter 9 – Archaeology and Architectural Heritage	• Excavation – of verified ditched enclosures in Areas 5, 15 and 20, and any other archaeological sites located as part of further testing.	✓	
		• Targeted testing – of likely archaeological features identified from geophysical survey and ground survey. Identified archaeological sites may require full excavation.	✓	
		• General testing – of the whole road alignment. This typically will involve testing of 12% of the land-take using central line trenches with off-sets. Identified archaeological sites may require full excavation.	✓	
		• Survey recording – of identified features such as townland boundaries – by means of measured survey, photography, collection of spatial data and written description.	✓	
		• Table 9-2 in Chapter 9- Archaeology and Architectural and Cultural Heritage outlines the specific mitigation measures required for each area of the scheme determined during the geophysical investigations.	✓	
		• Permanent fencing may be required to remain around a number of sites / features during the operational phase, to eliminate impact of noise / vibration and to eliminate access to these sites / features by the general public.	✓	✓
7	Chapter 10 - Traffic	All construction activities shall be managed and directed by a Construction Traffic Management Plan (CTMP), as produced by the appointed Contractor. The details of the CTMP will be agreed with the roads department of the Local Authority in advance of construction activities commencing on-site. Recommendations set out in Chapter 3 – Air Quality & Climate and Chapter 4 – Noise & Vibration will also apply.	✓	

Item Reference	Environmental Topic	Mitigation Measures / Recommendations	Construction Phase	Operational Phase
8	Chapter 11 – Ecology	The following industry standard measures will apply during the construction phase: -		
		• Pre-construction ecological surveys should be conducted along the proposed scheme by a suitably qualified ecologist. Surveys should be undertaken during the appropriate season.	✓	
		• Pre-demolition surveys should be conducted of all buildings for demolition by a suitably qualified ecologist for potential bird, bat and invasive species.	✓	
		• The Contractor should follow guidelines detailed by TII for protection of flora and fauna prior to and during the construction phase which include: -		
		o Ecological Survey techniques for protected flora and fauna during the planning of national road schemes.	✓	
		o Guidelines for the crossing of watercourses during the construction of national road schemes (NRA).	✓	
		o Guidelines for the treatment of bats during to the construction of national road schemes (NRA).	✓	
		o Guidelines for the treatment of badgers prior to the construction of national road schemes (NRA).	✓	
		o Guidelines on the management of noxious weed and non-native invasive plant species on national roads (TII).	✓	
		o A guide to landscape treatment for national road schemes (NRA).	✓	
		• A site-specific Construction Environmental Management Plan (CEMP) should be prepared by the Contractor in advance of commencing the works. The detailed CEMP should clearly set out all environmental controls which the Contractor will implement for the duration of the works to protect the Headstown Stream, Stephenstown Stream and unnamed stream. Such measures would include a daily plant and machinery check, strict re-fuelling procedures and secure bunded storage of any fuels, oils or chemicals. Control measures should be fully implemented as required throughout the construction phase. All mitigation measures set out in section 5.4 (for the protection of soils and geology) and section 7.3 (for the protection of water) also apply.		
		• Site clearance works should be undertaken during the appropriate season so as not to impact on bird nesting or bat roosting activity.	✓	

Item Reference	Environmental Topic	Mitigation Measures / Recommendations	Construction Phase	Operational Phase
		• In-stream works (if required) should be undertaken during the appropriate season so as to minimise impact on protected aquatic species.	✓	
9	Chapter 12 - Landscape & Visual	As recommended by EBLA (2018) the following non exhaustive list of mitigation measures should be implemented during the construction phase of the scheme, to reduce the potential landscape and visual impacts of the proposed scheme;		
		• Embankment and cutting slopes should be graded out. Temporary CPO of additional land should be considered so as to grade out steep embankments and cuttings into surrounding landform and return them to agricultural use;	✓	✓
		• New planting to restore severed field pattern;	✓	✓
		• Replanting of trees and hedgerows, including off-site planting;	✓	✓
		• Ensure planting species are appropriate to surroundings;	✓	✓
		• Views to local landmarks such as the steeple at St. Patrick's Church (COI) to be maintained; and,	✓	✓
		• Visual integration of noise barriers, signage and lighting into the landscape.	✓	✓
10	Chapter 13 – Agronomy	The following mitigation measures should be included within the design to ensure that all severed farms are catered for in terms of connectivity throughout entire land holdings.	✓	
		Where applicable, the following are recommended for all of the 13no. land parcels being severed by the proposed scheme.		
		• Provide suitable access to the severed areas which will allow for daily movement of the dairy herd;	✓	
		• The farm infrastructure including farm / dwelling house access and/or roadway, water and power supply will need to be restored on the severed areas;	✓	
		• The land drainage will need to be restored if affected;	✓	
		• Ensure all of the lands remain stock proof; and,	✓	
		• Provide animal handling facilities on severed area.	✓	

Item Reference	Environmental Topic	Mitigation Measures / Recommendations	Construction Phase	Operational Phase
11	Chapter 14 - Population & Human Health	In order to minimise, as far as possible, potential impacts on population and human health the mitigation measures / recommendations set out in the following chapters will be implemented in full during the construction and operation phases of the scheme;- Chapter 4 - Air Quality; Chapter 5 - Noise & Vibration; Chapter 5 - Land, Soils and Geology; and Chapter 8 - Water.	✓	✓

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Appendices

Appendix A. Design Drawings

Planning and Development Act 2000 as amended (Part XI)
Planning and Development Regulations 2001-2015 (Part 8)

N52 GRANGE TO CLONTAIL SCHEME

N52 GRANGE TO CLONTAIL SCHEME		
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5158291 / HTR / DR / 0000	PART 8 - COVER SHEET	D
5158291 / HTR / DR / 0001	PART 8 - SITE LOCATION MAP	D
5158291 / HTR / DR / 0101	PART 8 - HORIZONTAL & VERTICAL ALIGNMENT-MAINLINE - SHEET 1 OF 3	D
5158291 / HTR / DR / 0102	PART 8 - HORIZONTAL & VERTICAL ALIGNMENT-MAINLINE - SHEET 2 OF 3	D
5158291 / HTR / DR / 0103	PART 8 - HORIZONTAL & VERTICAL ALIGNMENT-MAINLINE - SHEET 3 OF 3	D
5158291 / HTR / DR / 0110	PART 8 - HORIZONTAL & VERTICAL ALIGNMENT-SIDE ROADS-SHEET 1 OF 4	D
5158291 / HTR / DR / 0111	PART 8 - HORIZONTAL & VERTICAL ALIGNMENT-SIDE ROADS-SHEET 2 OF 4	D
5158291 / HTR / DR / 0112	PART 8 - HORIZONTAL & VERTICAL ALIGNMENT-SIDE ROADS-SHEET 3 OF 4	D
5158291 / HTR / DR / 0113	PART 8 - HORIZONTAL & VERTICAL ALIGNMENT-SIDE ROADS-SHEET 4 OF 4	D
5158291 / HTR / DR / 0114	PART 8 - TYPICAL CROSS SECTION	D
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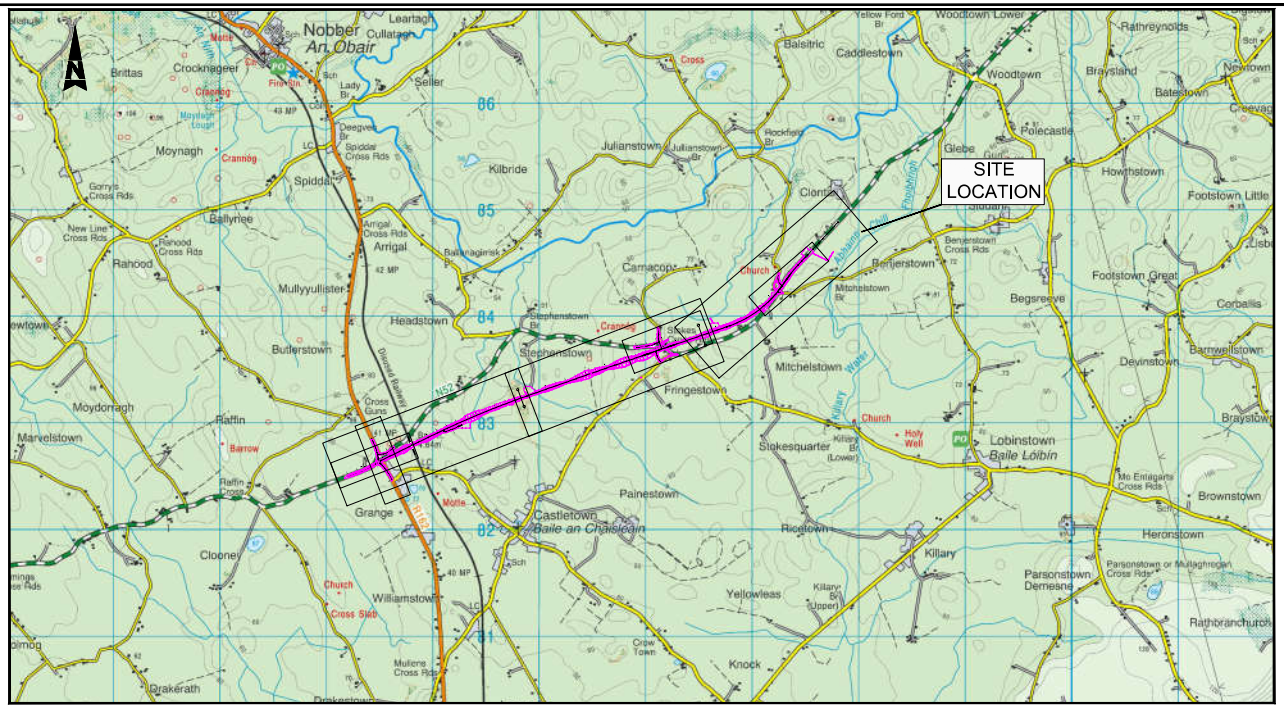

SITE MAP - N52 GRANGE TO CLONTAIL SCHEME

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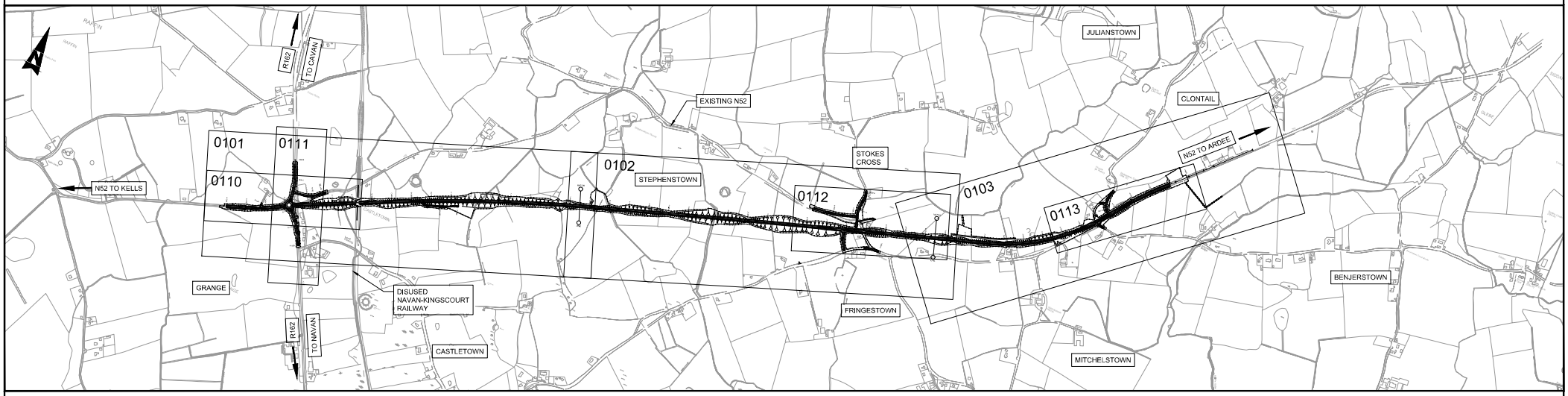

SITE PLAN - N52 GRANGE TO CLONTAIL SCHEME

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Client: MEATH COUNTY COUNCIL

Project: N52 GRANGE TO CLONTAIL SCHEME

Purpose: FOR PLANNING

Title: PART 8
SITE LOCATION PLAN

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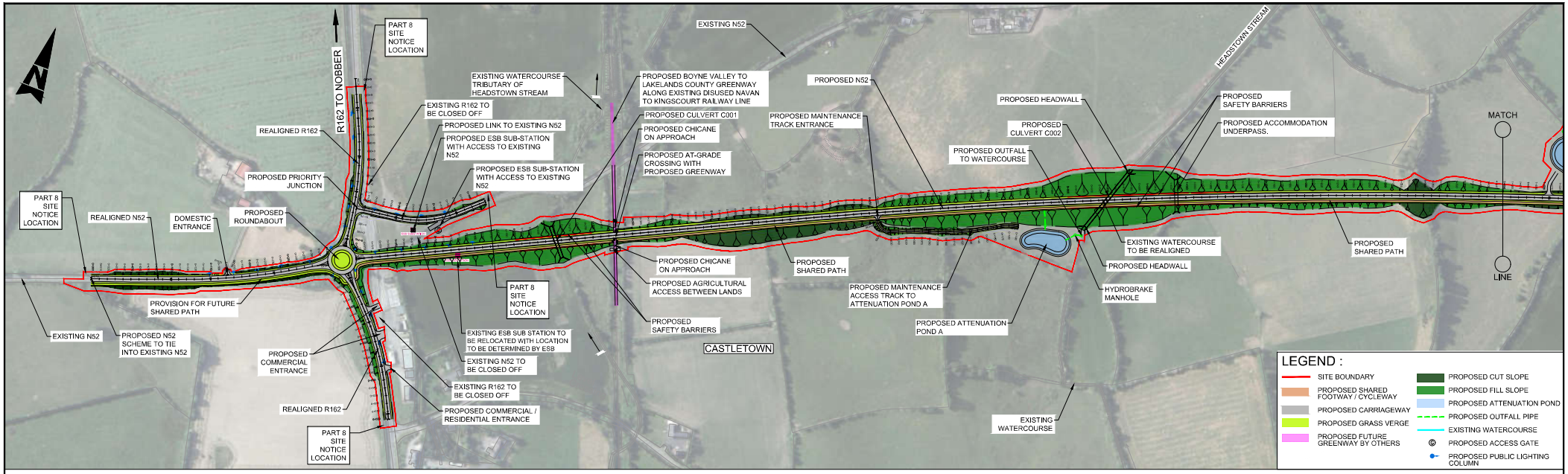

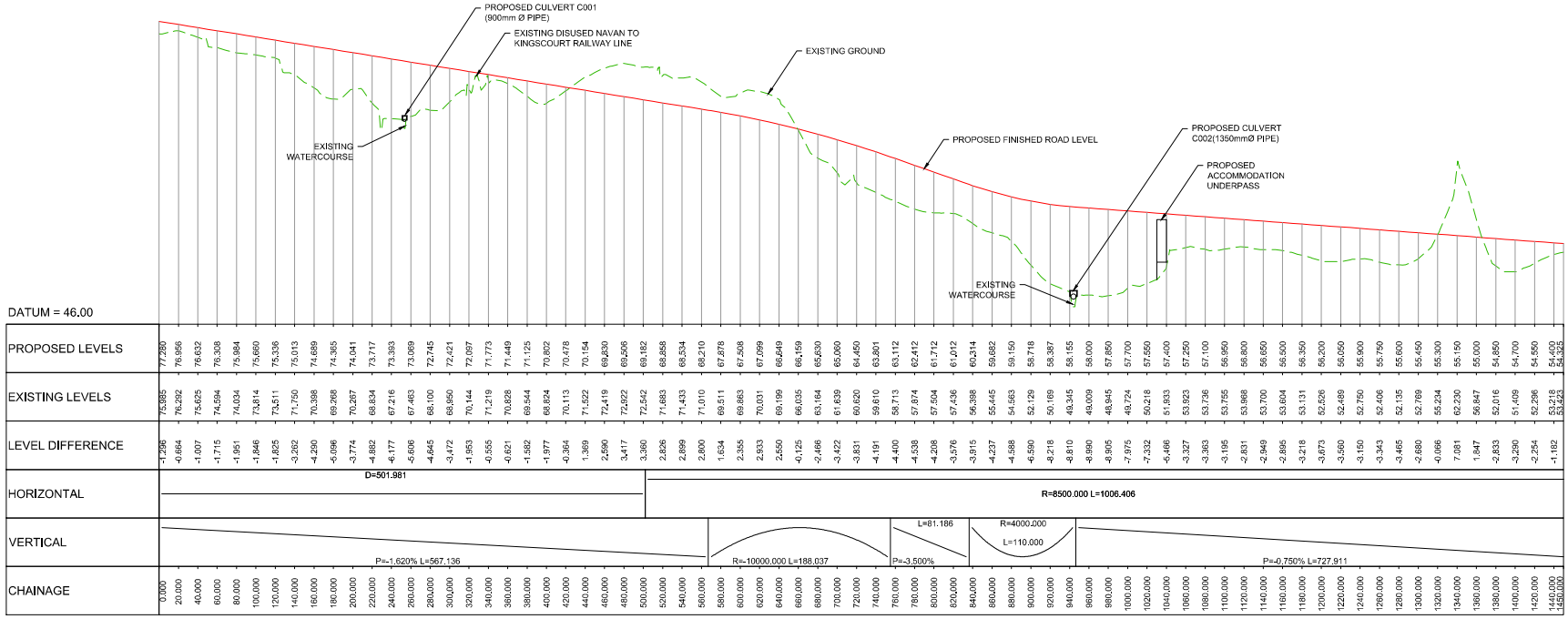

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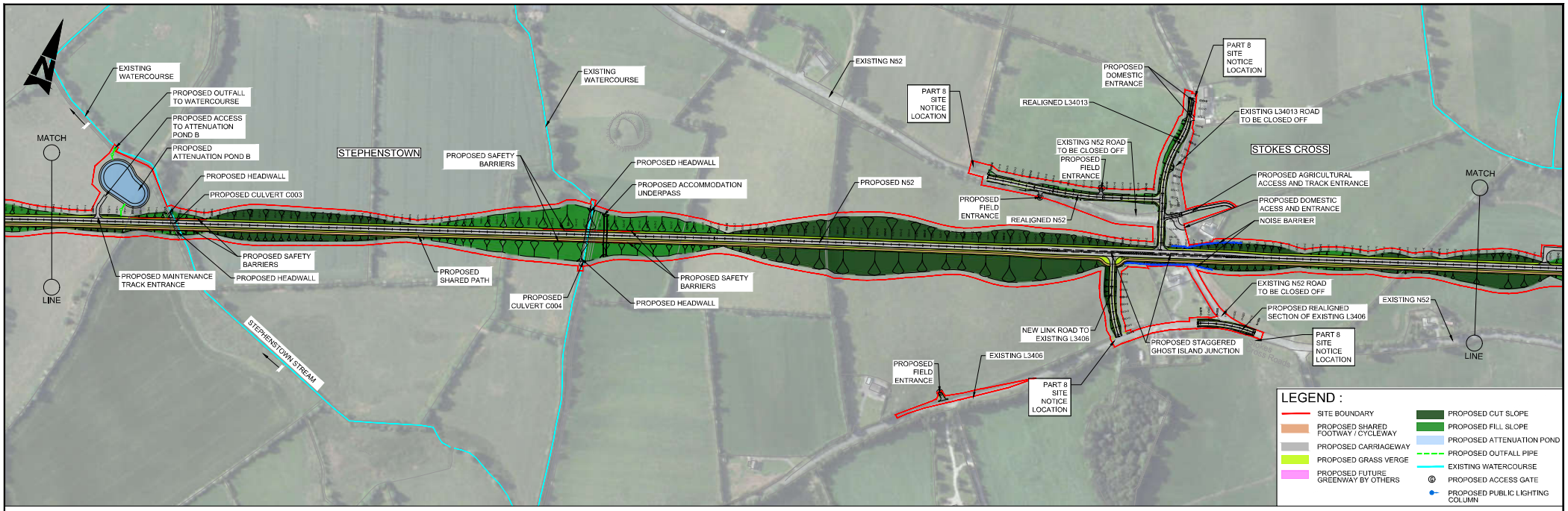

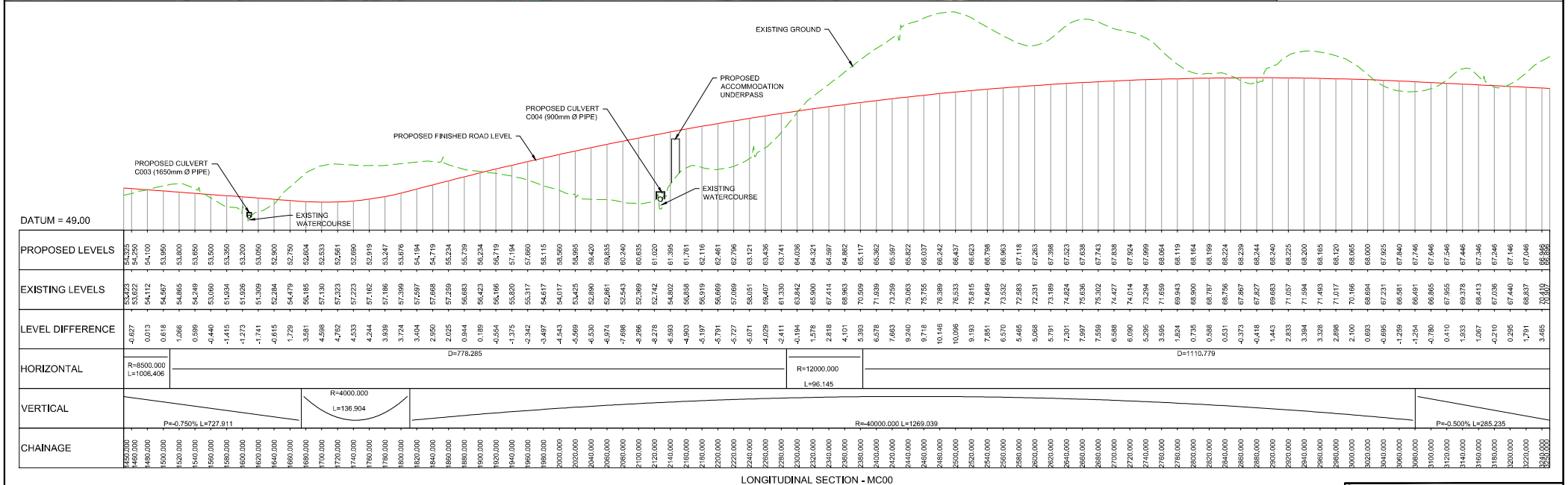

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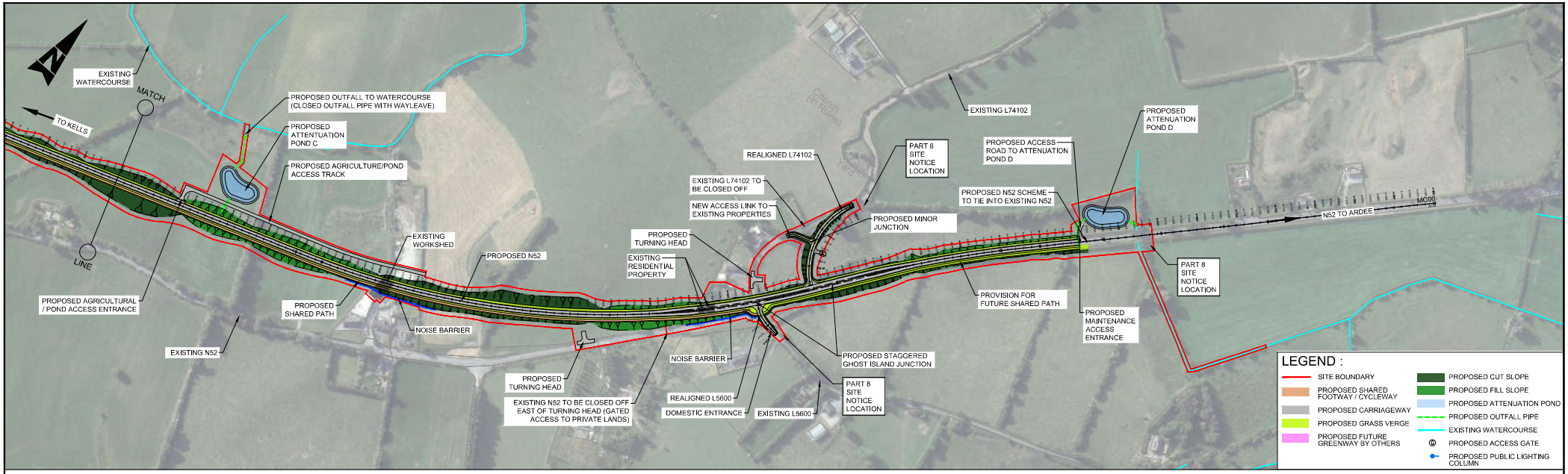

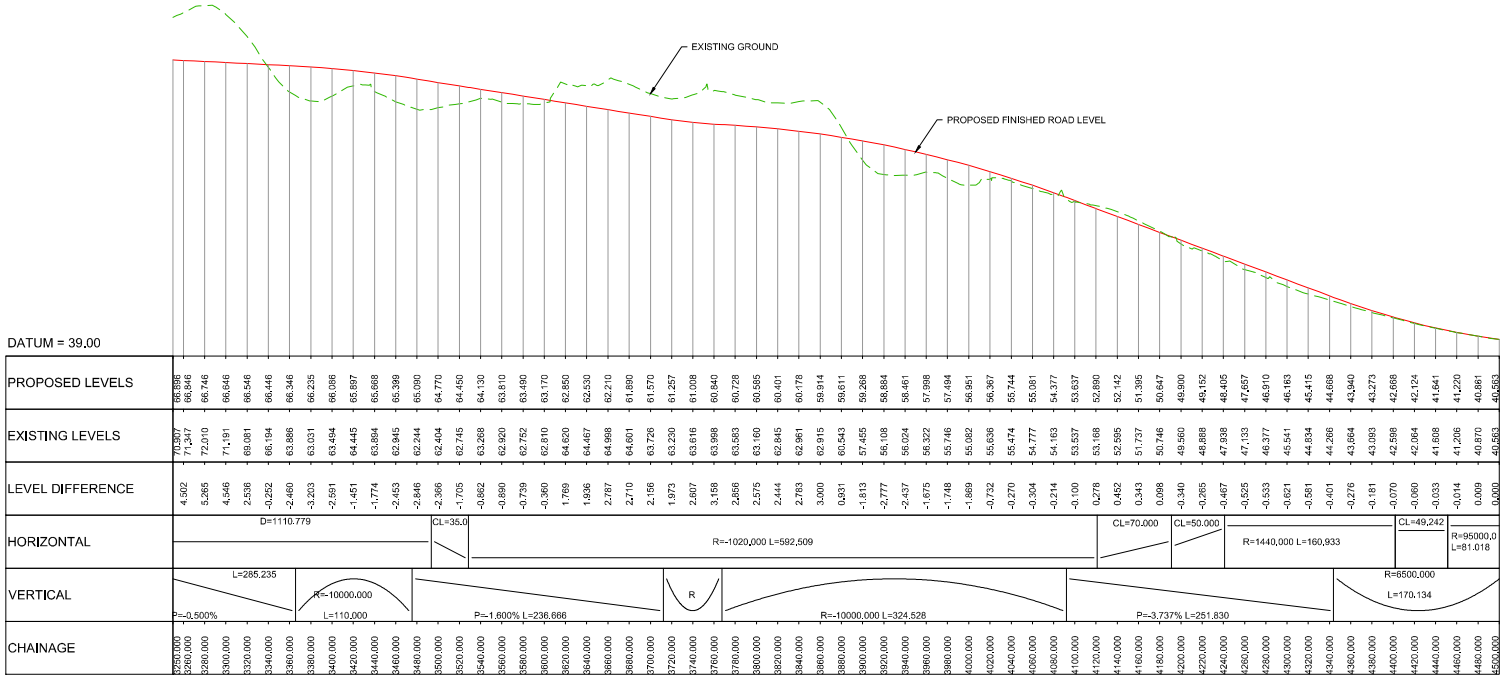

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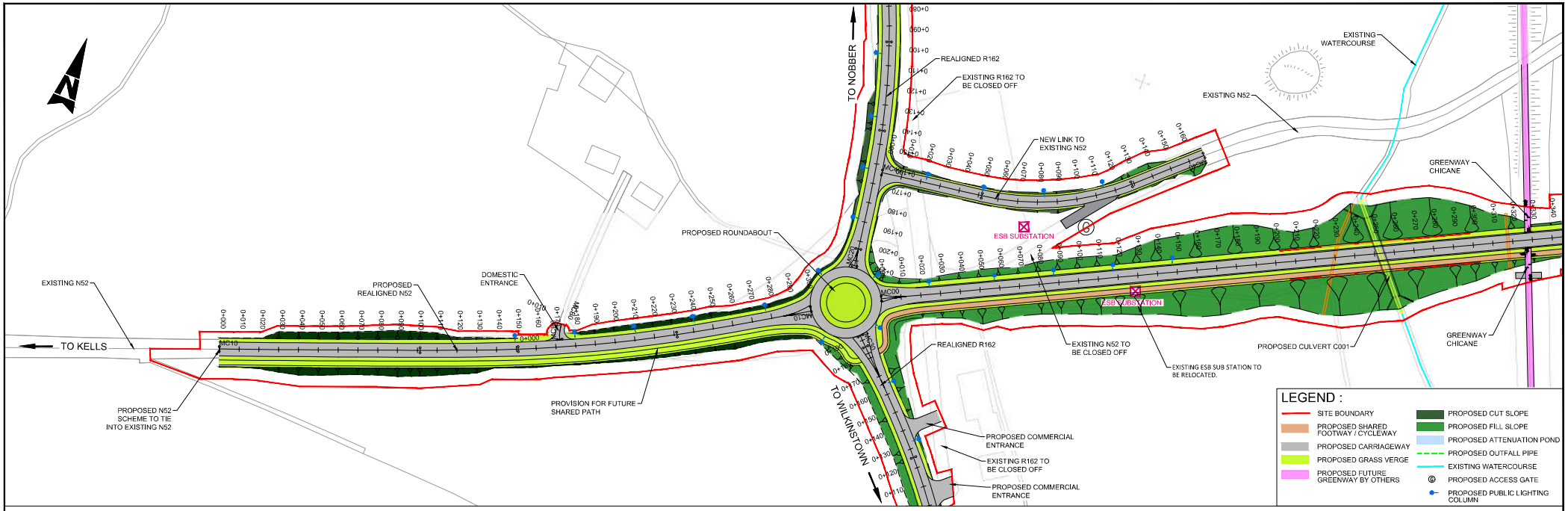

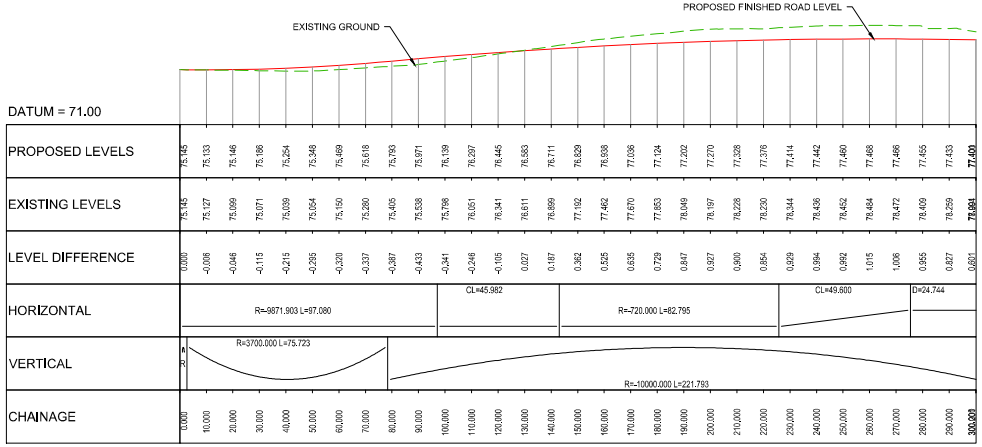

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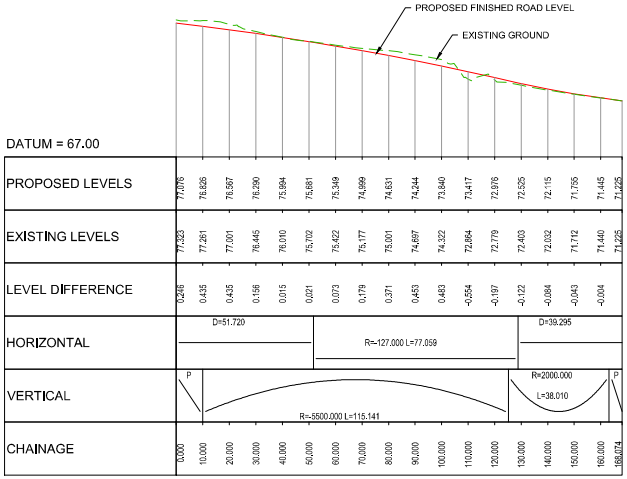

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Project: N52 GRANGE TO CLONTAIL SCHEME

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Title: PART 8
HORIZONTAL AND VERTICAL ALIGNMENT
SIDE ROADS - SHEET 1 OF 4

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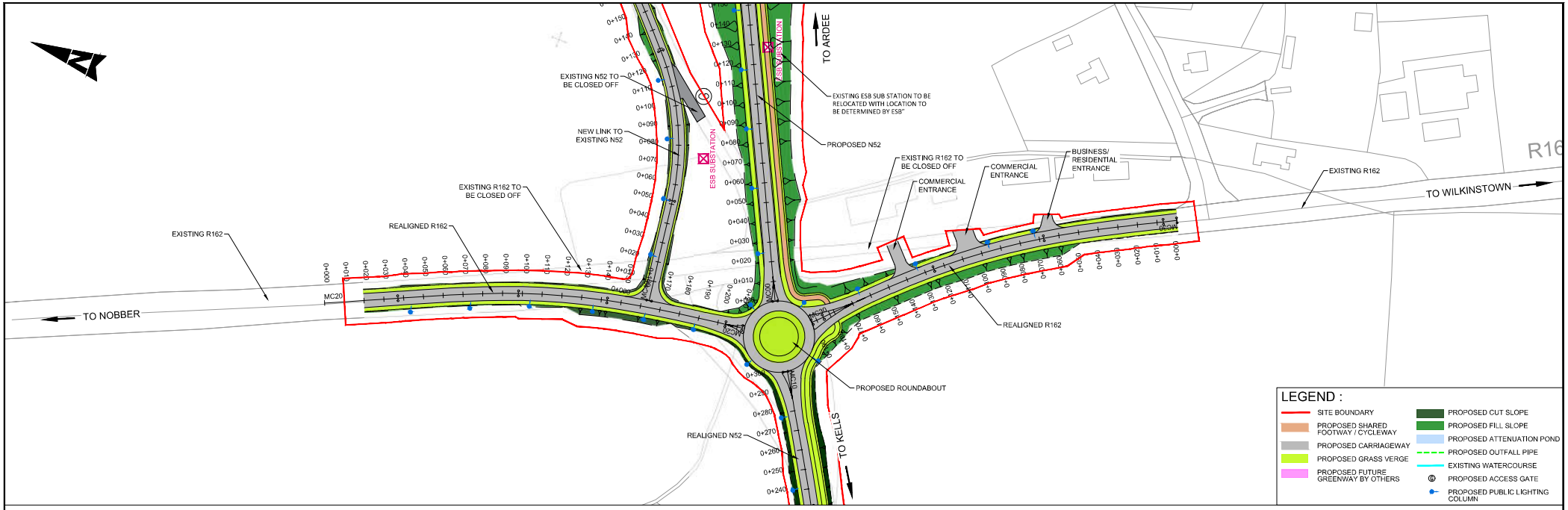

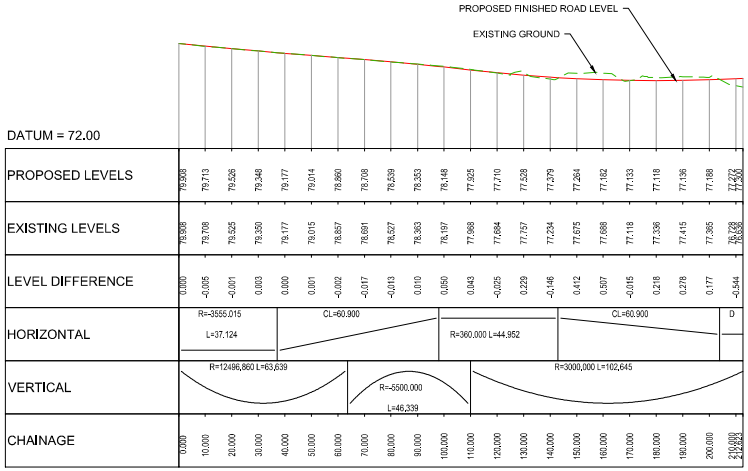

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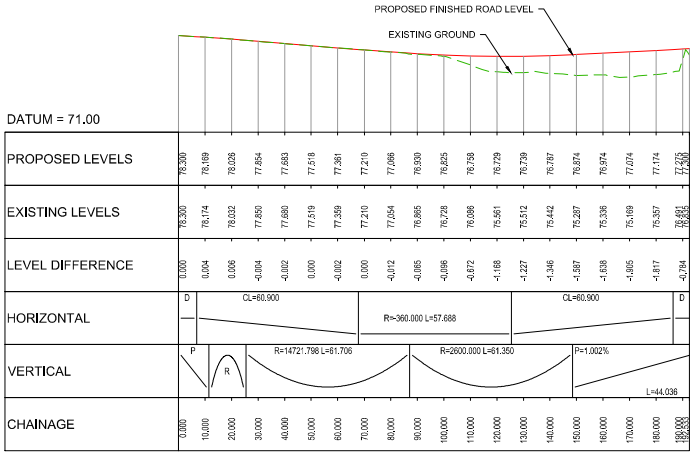

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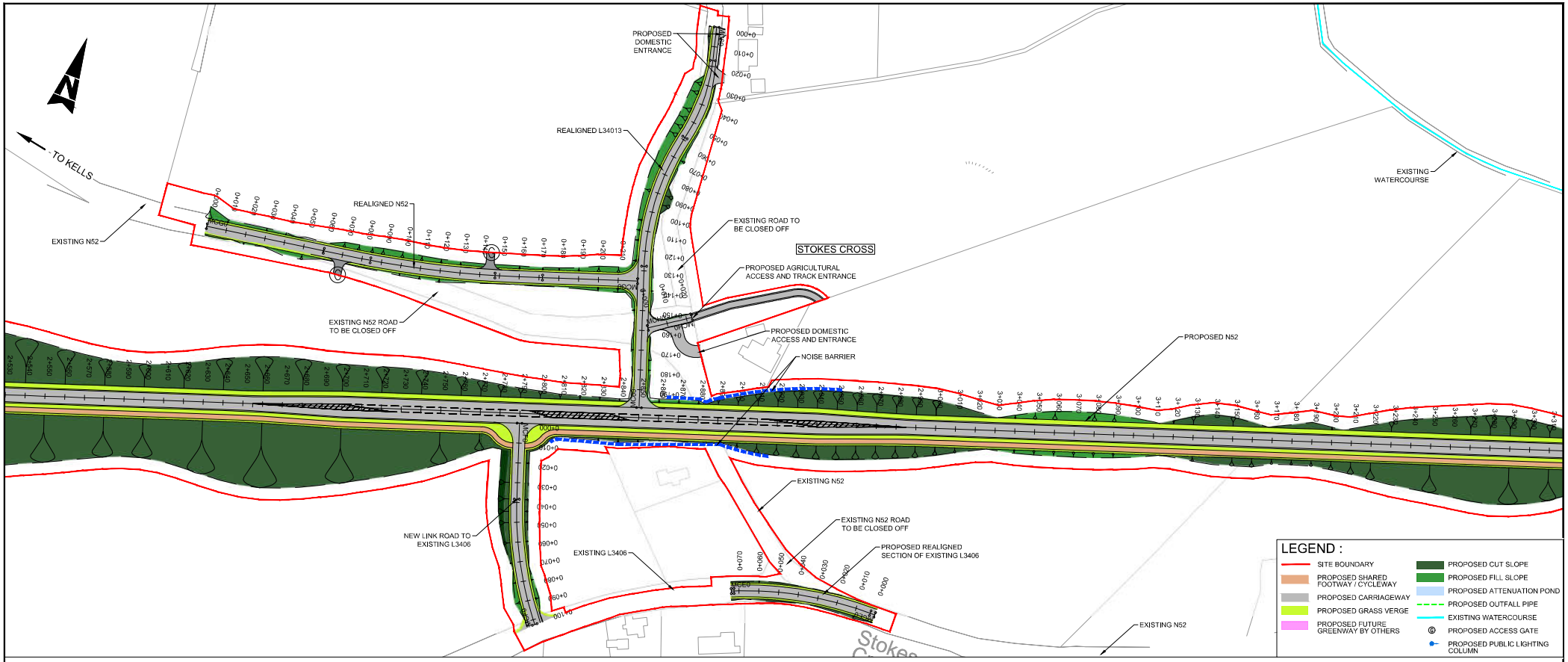

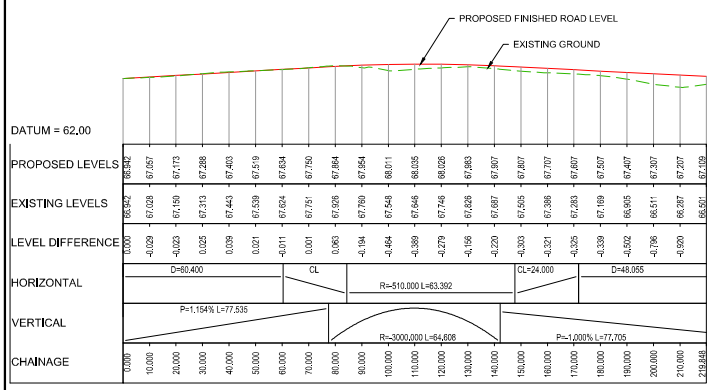

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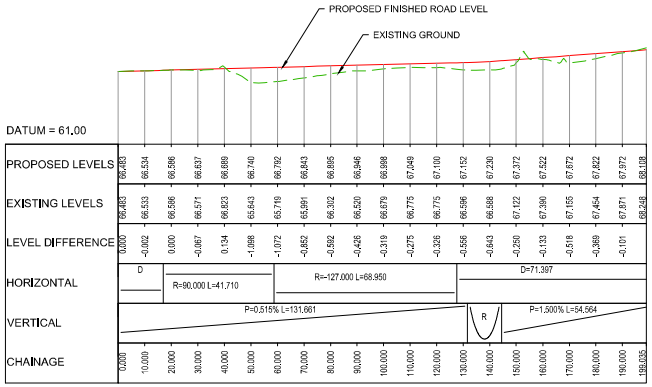

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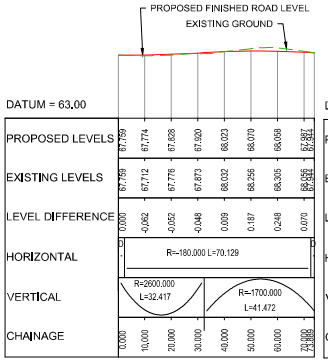

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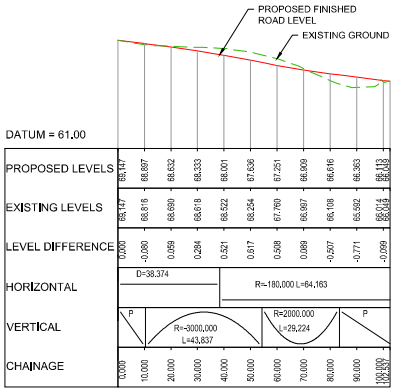

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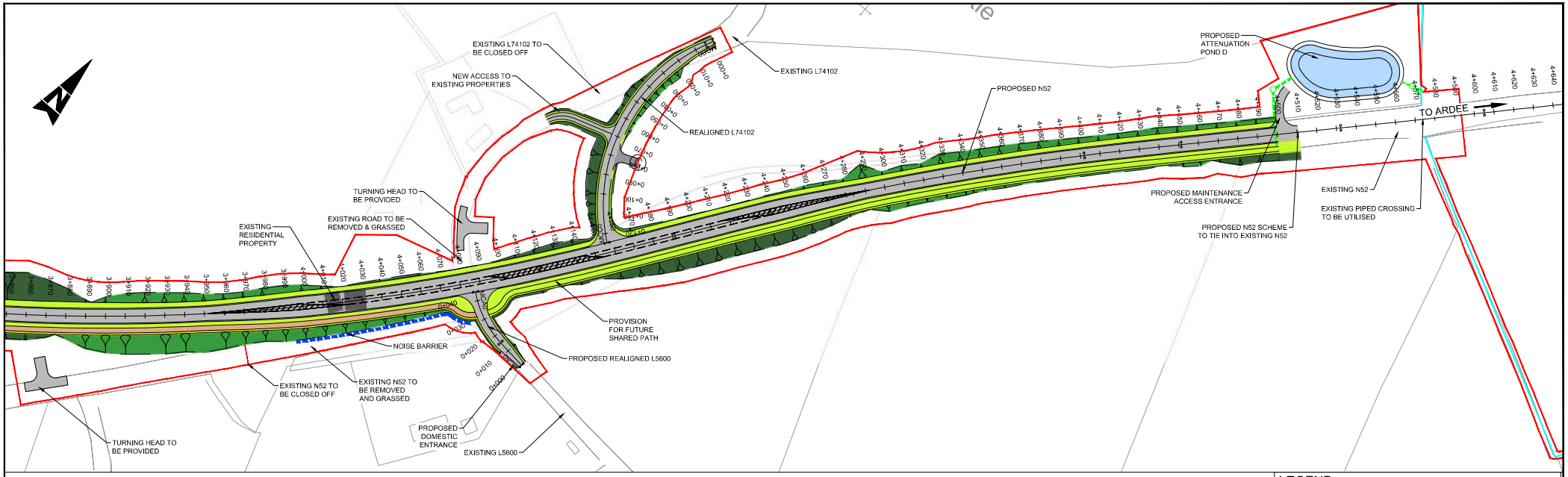
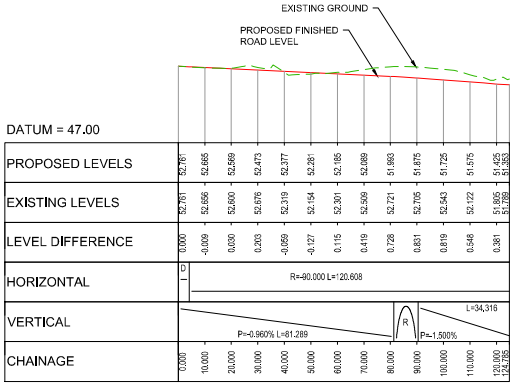


LEGEND :

- SITE BOUNDARY
- PROPOSED SHARED FOOTWAY / CYCLEWAY
- PROPOSED CARRIAGEWAY
- PROPOSED GRASS VERGE
- PROPOSED FUTURE GREENWAY BY OTHERS
- PROPOSED CUT SLOPE
- PROPOSED FILL SLOPE
- PROPOSED ATTENUATION POND
- PROPOSED OUTFALL PIPE
- EXISTING WATERCOURSE
- PROPOSED ACCESS GATE
- PROPOSED PUBLIC LIGHTING COLUMN



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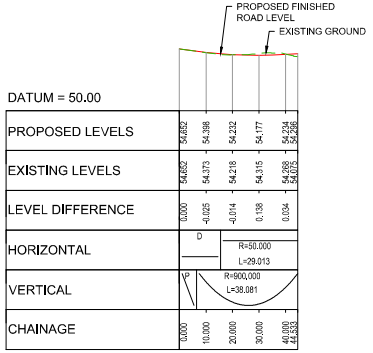

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Appendix B. Flood Risk Assessment

Refer to Appendix C of the Phase 3 Design Report being submitted as part of this application.

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N52 Grange to Clontail

Flood Risk Assessment

Meath County Council

Feb 2020

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Client signoff

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1. Introduction

Atkins was commissioned by Meath County Council to prepare a Flood Risk Assessment (FRA) to accompany a planning application for the proposal to construct a new section of road – the N52 Grange to Clontail Scheme.

The N52 serves the towns of Dundalk, Kells, Mullingar, Birr and Nenagh. In 2005, a national infrastructure plan targeted the N52 for upgrade works describing it as a 'strategic linking corridor'. The Westmeath, Meath and Louth County Development plans also earmark the N52 as a high priority component of their respective road networks needing to be upgraded.

1.1. Relevant Guidance

This FRA has been undertaken in consideration with 'The Planning System and Flood Risk Management – Guidelines for Planning Authorities' DOEHLG November 2009, which is the latest guidance document.

The guidance has been issued to ensure that flood risk is a key consideration for developers, planning & regional authorities and the public in preparing and submitting development proposals. The principles of the guidance are as follows:

- Avoid the risk, where possible
- Substitute less vulnerable users, where avoidance is not possible, and
- Mitigate and manage the risk, where avoidance and substitution are not possible

A staged approach is recommended within the guidance document in relation to identifying and assessing flood risk. The three stages of appraisal and assessment are as follows:

- Stage 1 Flood risk identification
- Stage 2 Initial flood risk assessment
- Stage 3 Detailed flood risk assessment (if required)

1.2. Flood Risk

Flood risk can be quantified by relating the probability of the flood event occurring to the consequence of the flood. Probability, in flood event terms, is gauged by potential annual occurrence/return period and flood consequence is dependent on the nature of the flood hazard and the vulnerability of the inundated area. The source-pathway-receptor model considers the components of flood risk.

The source is the hazard with the potential to cause harm through flooding (e.g. rainfall, high sea levels). The pathway is the mechanism by which the source can affect the receptor (e.g. inadequate drainage, overtopping of coastal defences) and finally, the receptor is anything which is affected by the flood event (e.g. people, infrastructure, property).

1.3. Causes of Flooding

The Planning System and Flood Risk Management Guidelines requires a FRA to consider all potential causes of flooding including the following:

- Coastal flooding
- Inland flooding
- Overland flow
- River flooding

- Flooding from artificial drainage systems
- Groundwater flooding

1.4. Floodplains

A river floodplain is a low-lying area which receives excess flood water when the flow within the watercourse exceeds the capacity of the channel. A coastal flood plain is an area which, during high tide or increased sea levels, becomes inundated with sea water.

2. Planning Context

The following planning policy documents are relevant to the assessment of the proposed development:

- The national planning Guidelines published by the OPW and the Department of the Environment, Heritage and Local Government in November 2009 entitled 'The Planning System and Flood Risk Management Guidelines for Planning Authorities'
- Meath County Development Plan 2013-2019

2.1. The Planning System and the Flood Risk Management Guidelines

2.1.1. Introduction

In November 2009, the Department of Environment, Heritage and Local Government and the Office of Public Works jointly published a Guidance Document for Planning Authorities entitled "the Planning System and Flood Risk Management".

The Guidelines are issued under Section 28 of the Planning and Development Act 2000. Planning Authorities and An Bord Pleanála are therefore required to implement these Guidelines in carrying out their functions under the Planning Acts.

The aim of the Guidelines is to ensure that flood risk is neither created nor increased by inappropriate development.

The Guidelines require the planning system to avoid development in areas at risk of flooding, unless the development can be justified on wider sustainability grounds and the risk can be reduced or managed to an acceptable level.

The Guidelines require the adoption of a Sequential Approach (to Flood Risk Management) of Avoidance, Reduction, Justification and Mitigation and they require the incorporation of Flood Risk Assessment into the process of making decisions on planning applications and planning appeals.

Fundamental to the Guidelines is the introduction of flood risk zoning and the classifications of different types of development having regard to their vulnerability.

The management of flood risk is now a key element of any development proposal in an area of potential flood risk and should therefore be addressed as early as possible in the site master planning stage.

2.1.2. Definition of Flood Zones

In the context of the 'Planning System and Flood Risk Management Guidelines, DOEHLG, 2009' three flood zones are designated in the consideration of flood risk to a site. The three flood zones are described in Table 2-1 below.

Table 2-1 - Flood Zone Description

Flood Zone	Description
Flood 'Zone A'	where the probability of flooding from watercourses is the highest (greater than 1% or 1 in 100 year for watercourse flooding or 0.5% or 1 in 200 for coastal flooding).
Flood 'Zone B'	where the probability of flooding from watercourses is moderate (between 0.1% or 1 in 1000 year and 1% or 1 in 100 year for watercourse flooding, and
Flood 'Zone C'	where the probability of flooding from watercourses and the sea is low or negligible (less than 0.1% or 1 in 1000 year for both watercourse and coastal flooding). Flood Zone 'C' covers all areas which are not in Zones 'A' or 'B'.

2.1.3. Definition of Vulnerability Classes

Table 2-2 summarises the Vulnerability Classes defined in the Guidelines and provides a sample of the most common type of development applicable to each.

Table 2-2 - Definition of Vulnerability Classes

Vulnerability	Type of Development
Highly Vulnerable Development	Includes Garda, ambulance and fire stations, hospitals, schools, residential dwellings, residential institutions, essential infrastructure, such as primary transport and utilities distribution and SEVESO and IPPC sites, etc
Less Vulnerable Development	Includes retail, leisure, warehousing, commercial, industrial and non-residential institutions, etc.
Water Compatible Development	Includes Flood Control Infrastructure, docks, marinas, wharves, navigation facilities, water based recreation facilities, amenity open spaces and outdoor sport and recreation facilities

2.1.4. Types of Vulnerability Classes appropriate to each zone

Table 2-3 illustrates the types of development that would be appropriate to each flood zone and those that would be required to meet the Justification Test.

Table 2-3 - Matrix - Development Vulnerability and Flood Zone

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

2.2. Meath County Development Plan 2013-2019

The Meath County Development Plan 2013-2019 sets out policies and objectives for the sustainable development of the County. The following extracts summarise the relevant areas contained within the plan which focus on Flood Risk Management.

Section 7.15 of the plan presents the policies created to mitigate flooding:

- *WS POL 29 To have regard to the "Planning System and Flood Risk Management – Guidelines for Planning Authorities" (DoEHLG/OPW, 2009) through the use of the sequential approach and application of the Justification Tests for Development Management and Development Plans, during the period of this Plan.*
- *WS POL 30 To have regard to the findings and recommendations of the current Strategic Flood Risk Assessment prepared as part of the County Development Plan review.*
- *WS POL 31 To ensure that all developments have regard to the surface water management policies in the Greater Dublin Strategic Drainage Study (GDSDS). Compliance with the recommendations contained in Technical Guidance Document, Volume 2, Chapter 4 of the Greater Dublin Strategic Drainage Study shall be required in all instances.*

- *WS POL 32 To ensure that a flood risk assessment is carried out for any development proposal, where flood risk may be an issue in accordance with the "Planning*
- *System and Flood Risk Management – Guidelines for Planning Authorities" (DoECLG/OPW, 2009). This assessment shall be appropriate to the scale and nature of risk to the potential development.*
- *WS POL 33 To consult with the Office of Public Works in relation to proposed developments in the vicinity of drainage channels and rivers for which the OPW are responsible, and the Council will, retain a strip of 10 metres on either side of such channel where required, to facilitate access thereto.*
- *WS POL 34 To consult, where necessary, with Inland Fisheries Ireland, the National Parks and Wildlife Service and other relevant agencies in the construction of flood alleviation measures in County Meath.*
- *WS POL 35 To ensure that flood risk management is incorporated into the preparation of Local Area Plans and Town Development Plans in accordance with 'The Planning System and Flood Risk Management - Guidelines for Planning Authorities (2009)'*
- *WS POL 36 To have regard to the recommendations of the Fingal East Meath Flood Risk Assessment and Management Study, the Eastern, North West and Neagh Bann Catchment Flood Risk Assessment and Management Study when finalised and approved*

Objectives

Section 7.15 of the development plan also outlines the following objectives in relation to Flood Risk Management.

- *WS OBJ 11 To undertake a review of the 'Strategic Flood Risk Assessment for County Meath' following the publication of the flood mapping which is being produced as part of the Catchment Flood Risk Assessment and Management (CFRAM) Studies.*
- *WS OBJ 12 To design flood relief measures to ensure appropriate protection for alluvial woodland (i.e. a qualifying interest) along the Boyne.*
- *WS OBJ 13 To design flood relief measures to protect the conservation objectives of Natura 2000 sites and to avoid indirect impacts of conflict with other qualifying interests or Natura 2000 sites.*
- *WS OBJ 14 To promote positive flood relief measures that can enhance habitats in the Boyne floodplain such as swales, constructed wetland basins etc.*
- *WS OBJ 15 To seek to ensure that construction works are designed so as not to result in surface water runoff into cSAC or SPAs either directly or indirectly via a watercourse.*

It is the intention that the application of these policies and objectives will mitigate flooding as much as is reasonably practicable.

3. Site Description

3.1. General

The site is located between the Grange and Clontail junctions of the existing N52 single carriageway road. The proposed development land is located primarily on existing greenfield land as shown below in Figure 3-1 (development route denoted by red line).

Figure 3-1 - Site Overview

The scheme location resides between the towns of Kells and Ardee. To the north is the existing N52 road and greenfield agricultural land; to the east is greenfield agricultural land; to the south is greenfield agricultural land the existing N52 and to the west is the R162 regional road and greenfield agricultural land.

Further details of the overall site location can be seen in **Appendix A.**

3.2. Existing Topography

The existing topographical levels along the route of the proposed road scheme range from 81.99mOD to 37.07mOD. The existing ground profile is moderately to steeply sloping with falls generally in an easterly direction.

Further details of the topographical survey can be seen in **Appendix B.**

3.3. Local Hydrology & Existing Drainage

There are five key hydrological features within the scheme area:

- The Headstown Stream which drains in a northerly/north-westerly direction to the Stephenstown Stream, prior to discharging to the River Dee;
- The Carnacop Stream which also flows in a north-westerly direction towards the River Dee;

- The Killary Water River, which flows in a northerly direction before discharging to the River Dee. These are indicated in Figure 3-2 (development route denoted by red line).

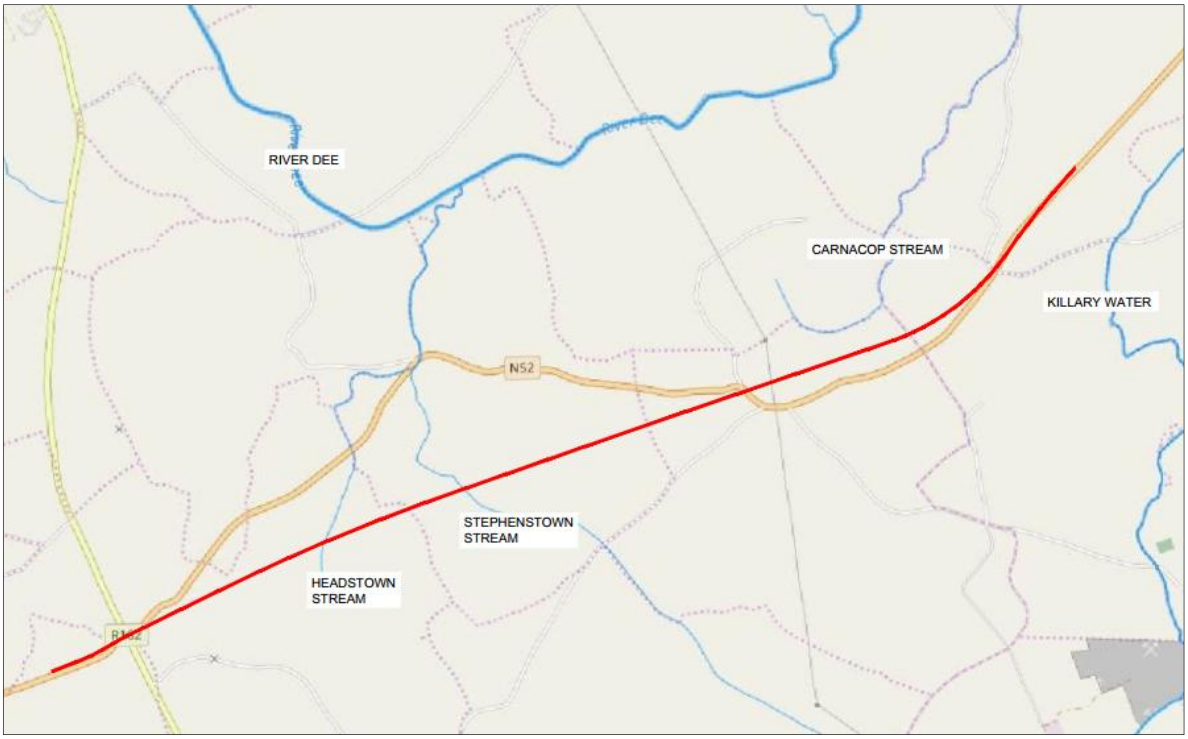


Figure 3-2 - Local River Network

3.4. Geology

A review of the Geological Survey of Ireland (GSI) online maps indicates that the western half of the site is underlain by Navan Beds defined as Dark limestone, mudstone, sandstone and the eastern half by Clontail Formation defined as Calcareous red-mica greywacke.

3.5. Proposed Scheme

Meath County Council (MCC) proposes to realign a section of the existing N52 route between an appropriate tie-in point in the Townland of Grange in Co. Meath to the west and extend to an appropriate tie-in point in the Townland of Clontail in Co. Meath to the east. The scheme will involve the realignment of circa 5.3km of the existing N52 and will incorporate an upgrade of the N52 / R162 Junction (i.e. Grange Cross). The overall aim of the scheme will be to remove a significantly sub-standard section (approximately 4.5km in total) of the existing N52 route.

The N52 Grange to Clontail Scheme has gone through a route selection process and a Preferred Route Corridor has been identified.

The proposed road scheme is to consist of a 7m wide carriageway comprising two 3.5m wide lanes, a 2.5m shared cyclepath/footpath, verges and hard shoulders. The proposed road route crosses the Headstown and Stephenstown Streams, as well as two local unnamed stream/ditches. The proposed road levels are higher than the existing topography at the watercourse crossing locations and these watercourses will be culverted as part of this scheme.

This report identifies and assessed any flood risk to the development site, and demonstrates where appropriate, how the development will not increase flood risk to the site or the surrounding areas.

The proposed drainage layout can be seen in **Appendix C.**

4. Initial Flood Risk Assessment

In accordance with the planning guidelines, a *Stage 1 Flood Risk Identification* is required to be undertaken to identify if there are any flooding or surface water management issued related to the proposed scheme site.

This flood study for the site is undertaken in three principle stages, these being 'Step 1 – Screening Assessment', Step 2 – Scoping Assessment' and 'Step 3 – Assessing Flood Risk'.

4.1. Possible Flooding Mechanisms

Table 4-1 below summarises the possible flooding mechanisms considered for the site.

Table 4-1 - Possible Flooding Mechanisms

Source/Pathway	Significant?	Comment/Reason
Tidal/Coastal	No	The proposed site is not at a coastal location.
Fluvial	Possible	The Headstown Stream, Stephenstown Stream, Carnacop Stream, Killary Water and Dee River are located in the vicinity of the proposed site.
Pluvial (urban drainage)	No	The existing site is a greenfield site, and there is no significant drainage infrastructure in the immediate vicinity of the site.
Pluvial (overland flow)	Possible	The surrounding land falls in a north-easterly direction, towards the watercourses.
Blockage	No	There are no existing hydraulic structures in the direct vicinity of the proposed site.
Groundwater	No	There are no significant springs or groundwater discharges recorded in the immediate vicinity of the site.

The primary flood risks to the site can be attributed to fluvial flooding and pluvial (overland flow) sources.

5. Screening Assessment

The purpose of this screening assessment is to establish the level of flooding risk that may exist for a particular site and to collate and assess existing current or historical information and data which may indicate the level or extent of any flood risk.

The following information was collated as part of the screening assessment carried out for the site.

5.1. OPW/EPA/Local Authority Hydrometric Data

The Office of Public Works (OPW), Environmental Protection Agency (EPA) and Local Authority hydrometric data were investigated, and one existing hydrometric station was identified. The hydrometric station identified (No.06025 Burley) is located on the River Dee adjacent to the boarder of County Meath ad County Louth, approximately 12km downstream of the proposed development site as shown in Figure 5-1 below (development route denoted by red line).

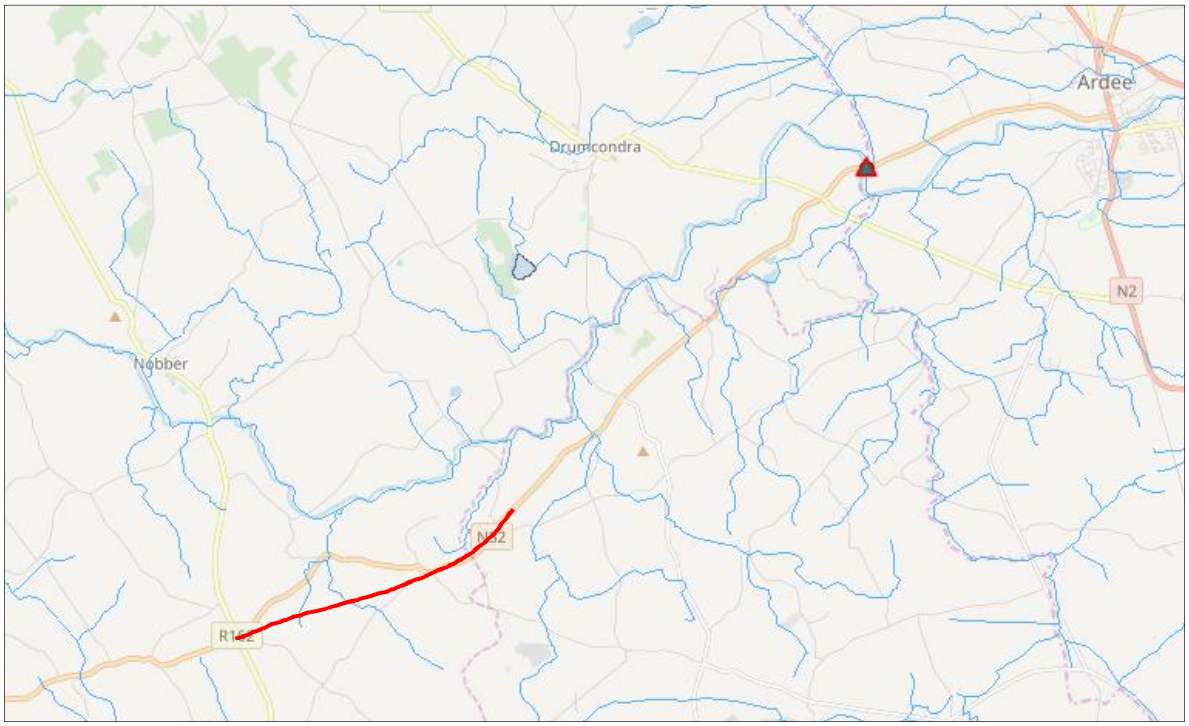


Figure 5-1 - Hydrometric Data (EPA HydroNet)

This hydrometric station has an upstream catchment size of 175.97km^2 and is maintained by the OPW. The station records water levels and measurements for river flow, however, the data from this station cannot be used to assess possible fluvial flood risk at the proposed development site due to distance and differences in ground levels.

5.2. OPW Draft PFRA Mapping

Draft Preliminary Flood Risk Assessment (PFRA) Maps have been produced for the whole country by the OPW. Figure 5-2 below, extracted from OPW PFRA Map number 2019/MAP/222/A illustrates predictive flood zones in the vicinity of the site (development route denoted by red line).

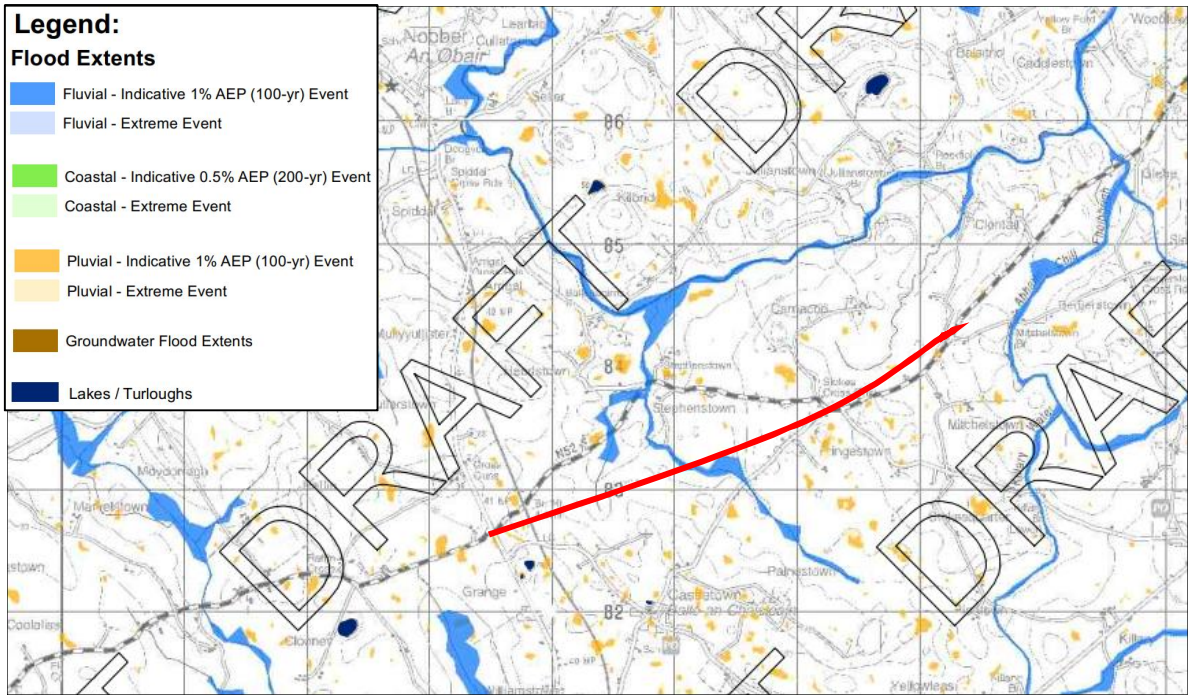


Figure 5-2 - OPW PFRA Map

This indicates that a section of the proposed development site may be in the 1 in 100-year fluvial floodplain of the Stephenstown Stream and in small areas of the pluvial floodplain. It should be noted that the predicted extent of the flooding shown on these maps was developed using low resolution digital terrain model (DTM) and the illustrated flood extents are intended to be indicative only.

5.3. OPW Flood Map Viewer

The OPW recently launched an interactive map viewer (http://www.floodinfo.ie/map/floodmaps/) which displays the predicted flood extents for both rivers and coastal areas over various return periods. The viewer was consulted in relation to the River Dee and upstream tributaries in the vicinity of the development site. Upon review of the map it is evident that the upstream tributaries, the Headstown and Stephenstown Streams and the upstream extents of the River Dee have not been included in the study areas as shown below (development route denoted by red line).

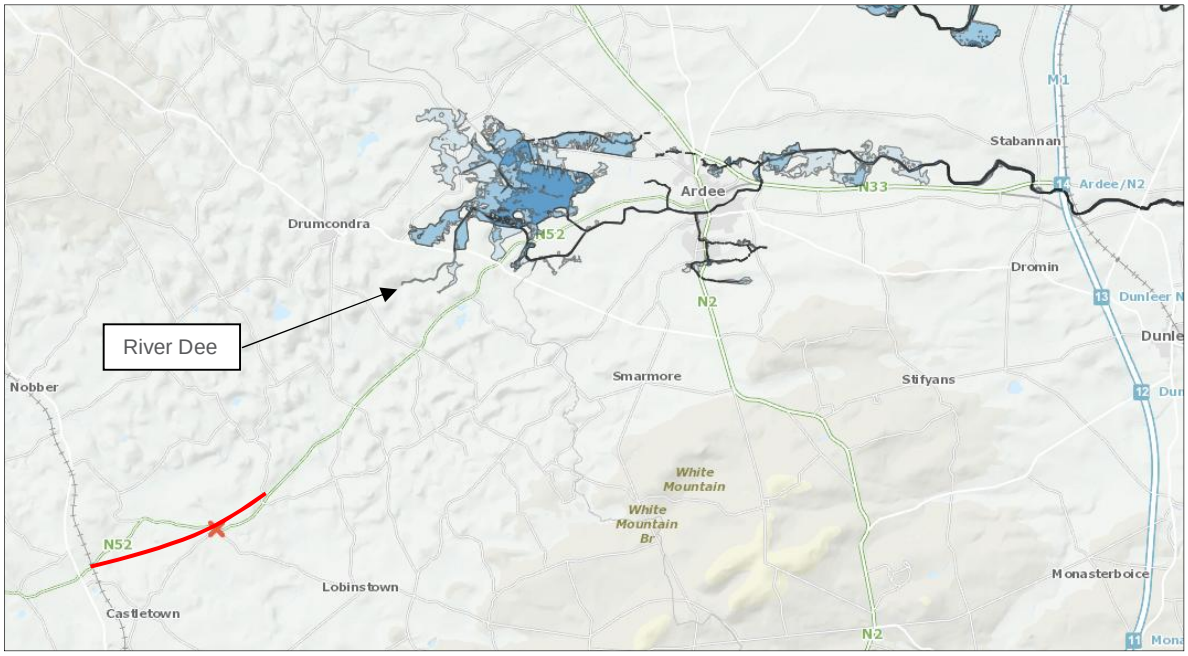


Figure 5-3 - OPW Flood Map Viewer

5.4. Ordnance Survey Historic Mapping

Available historic mapping for the area was consulted as this can provide evidence of historical flooding incidences or occurrences. The maps consulted were the pre-1900's historic 6-inch colour and 25-inch maps. The flood maps layer was investigated to identify any potential flood plains within the environs of the site.

Historic Maps for the site environs is illustrated in Figure 5-4 and Figure 5-5 below.

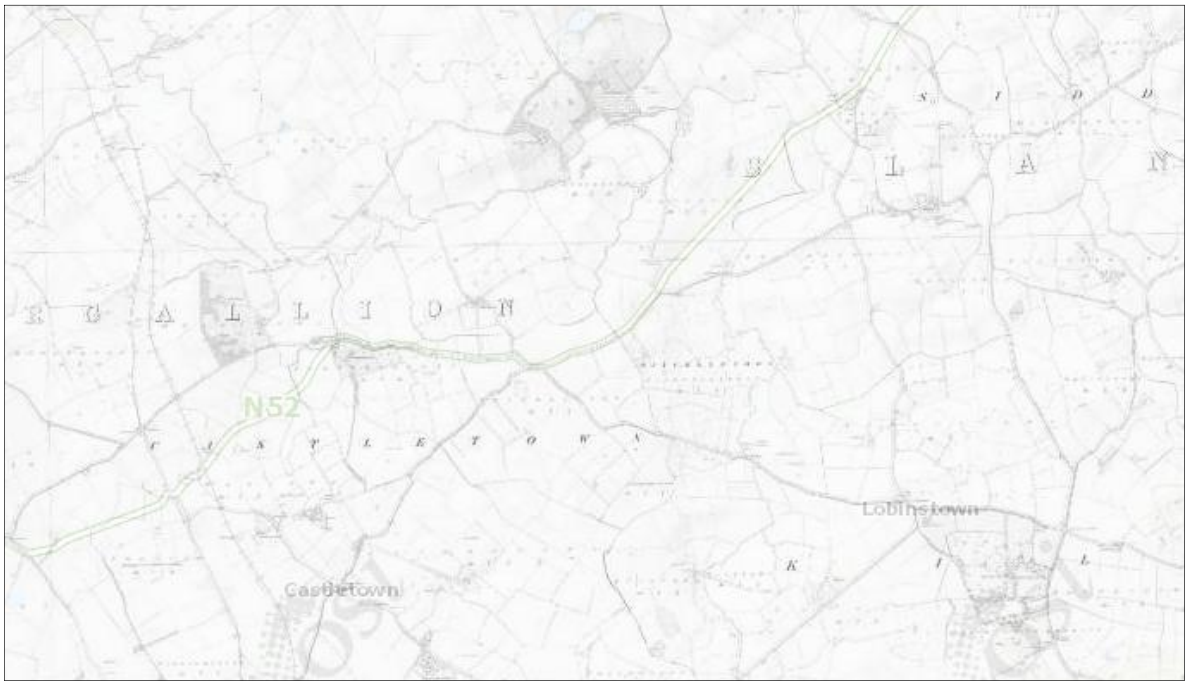


Figure 5-4 - OSI Historic 25 Inch Map

Figure 5-5 - OSI Historic 6 Inch Map

With reference to the pre-1900's historic maps and the flood maps layer, no indication of historical or anecdotal instances of flooding were observed within the environs of the site.

5.5. Geological Survey of Ireland Mapping

The soils maps of Geological Survey of Ireland (GSI) were consulted to determine the presence of alluvium deposits in the vicinity of the site. Alluvium deposits can be an indicator of areas which have flooded in the recent geological past.

Figure 5-6 - GSI Quaternary Sediments Map

Figure 5-6 above shows the GSI Quaternary Sediments mapping for the proposed development route, which indicate an area of alluvium deposits at the Stephenstown Stream where the proposed road is located (denoted by red line).

5.6. Meath County Council SFRA

A Strategic Flood Risk Assessment (SFRA) carried out by JBA Consulting in May 2012 as part of a Variation to the Meath County Development Plan 2007-2013. The SFRA focuses on flood risk in County Meath, including historical flood events, flood sources and impacts.

Following review of the SFRA, there is no evidence of any historical or current flood risk to the development site or surrounding lands.

5.7. Conclusion of Screening Assessment

The purpose of the screening assessment is to establish whether a flood-risk issue exists or may exist in the future. If there is a potential flood risk issue then this procedure should move to “Step 2 – Scoping Assessment” or if no potential flood risk is identified from the screening assessment, then the overall assessment can end at Step 1.

Based on the findings of the screening assessment, this flood study is required to proceed to “Step 2 – Scoping Assessment” due to the presence of a fluvial floodplain within the development route and the potential for pluvial flood risk from overland flow.

6. Scoping Assessment

The purpose of the scoping assessment is to identify possible flood risks and to implement the necessary level of detail and also to assess these possible risks, and to ensure they can be adequately addressed in this study. The scoping assessment should also identify whether sufficient quantitative information is already available to complete this study.

The potential flood risks identified at the initial flood risk assessment stage are listed below:

- Fluvial;
- Pluvial (Overland flow);

The PFRA maps indicate that the proposed development site may be at risk of fluvial flooding from the Stephenstown Stream during a 1 in 100-year flood event.

There does not appear to be any evidence to indicate if the proposed development site is at risk of flooding from overland flow. The small areas of pluvial floodplain in the surrounding areas of the site will not be adversely affected by the development as the levels of the new road are proposed approximately 1-6m higher than the existing topography.

In consideration of the above scoping assessment, the primary flood risk can be attributed to fluvial flooding from the Stephenstown Stream. This will be assessed in the following chapters.

The PFRA map extracts can be seen in **Appendix C.**

7. Assessing Flood Risk

7.1. River Flow Analysis

The FSU Programme is an online programme managed by the OPW, to provide improved methods of extreme rainfall and flood estimation at both gauged and ungauged locations in the Republic of Ireland. It is a substantial update of a prior programme of study called the Flood Studies Report 1975 (FSR), which was undertaken in the early 1970s by organisations in Ireland and the United Kingdom (UK) to provide methodologies for flood estimation.

The Greenfield Runoff Rate Estimation tool, provided by HR Wallingford through UK SuDS, was then used to provide estimated runoff rates based on basic site characteristic information gathered from the FSU Programme. The tool was used to assess the flows for the Headstown Stream, Stephenstown Stream and two unnamed streams where the proposed road crossings are located. The two unnamed streams have been calculated using estimated catchment areas based on data from the FSU programme. The 1 in 100-year (Q100) flow was calculated for each catchment and is listed in Table 7-1 below, including the Q100 flows with a climate change allowance of 20%. As well as the 20% allowance for climate change, a standard factorial error of 1.651 has been added to each of the flows. A further factor of 1.6 was applied to the flow of the Headstown Stream and Stephenstown Stream as they are drained channels, part of the Glyde and Dee Arterial Drainage Scheme.

Table 7-1 - Q100 Flow Rates

Stream	Return Period	Flow (m^3/s)	Flow + CC + Factors (m^3/s)
Unnamed Stream 1	Q100	0.40	0.78
Headstown Stream	Q100	0.77	2.44
Stephenstown Stream	Q100	1.91	6.06
Unnamed Stream 2	Q100	0.16	0.31

Further details of the assessed flows and estimated catchment areas can be seen in **Appendix D.**

7.2. Flood Level Analysis

A Flood Level Analysis was carried out to determine whether the proposed development route at the four crossing points are within the 1 in 100-year flood plain (inclusive of climate change). Culverts are proposed where the new road crosses the watercourses. The size of the culverts will be determined through assessing the existing flood levels in the watercourses at each crossing location.

7.2.1. Open Channel Capacity

Manning's Equation shown below was used for this Flood Risk Analysis to determine the 1 in 100-year water levels at the four watercourse crossing locations:

$$Q(m^3/s) = \frac{A\,R^{2/3}S^{1/2}}{n}$$

The calculations carried out were based on cross sections of the Headstown, Stephenstown and two unnamed streams at the proposed road crossings with the 1 in 100-year flow determined through the FSU Programme.

The 1 in 100-year water levels calculated at the proposed culvert locations are listed below in Table 7-2.

Table 7-2 - Flood Risk Analysis Results at Proposed Watercourse Crossings

Watercourse	Critical Levels	Level (mOD)
Unnamed Stream 1	1 in 100-year Water Level	66.802
	Proposed Road Centreline Level	73.200
	Proposed Road Formation Level	72.475
Headstown Stream	1 in 100-year Water Level	48.908
	Proposed Road Centreline Level	58.102
	Proposed Road Formation Level	57.377
Stephenstown Stream	1 in 100-year Water Level	51.233
	Proposed Road Centreline Level	53.125
	Proposed Road Formation Level	52.400
Unnamed Stream 2	1 in 100-year Water Level	51.872
	Proposed Road Centreline Level	61.200
	Proposed Road Formation Level	60.475

The results show that the finished and formation levels (based on a 725mm pavement construction depth) of the proposed road are higher than the 1 in 100-year flood level at all four watercourse crossing locations. A minimum of 300mm freeboard from the 1 in 100-year flood level is also provided.

Further details on the depth used for the calculations are included in **Appendix E**.

7.3. Sizing of Proposed Culverts

The proposed culverts will be a minimum of 900mm in diameter or height for ease of access and maintenance in accordance with OPW Section 50 requirements.

The culverts have been sized using the Colebrook White equation which calculates the pipe capacity based on a pipe's length, diameter, gradient, effective roughness and kinematic velocity. The results can be seen below in Table 7-3.

Table 7-3 – Culvert Sizing for Each Watercourse

Information	Unnamed Stream 1	Headstown Stream	Stephenstown Stream	Unnamed Stream 2
U/S River Bed Level (m)	66.400	48.600	50.100	52.010
D/S River Bed Level (m)	66.150	46.970	49.920	50.470
Culvert Length (m)	60	75	30	75
Required Flow Rate (m^3/s) (Q100 + 20% Climate Change)	0.78	2.44	6.06	0.31
Maximum Pipe Capacity (m^3/s)	1.37	3.14	6.25	3.05
Pipe Diameter (mm)	900*	1350	1650	900*

**600mm culvert diameter sized for flow, however minimum 900mm minimum culvert diameter required.*

From the above, it can be concluded that the required culverts are sufficiently sized at each location to cater for the calculated Q100 flow rates (including 20% for Climate Change).

Further details of the above calculations can be seen in **Appendix F.**

8. Application of Flood Risk Management Guidelines

8.1. Classification of proposed development

The proposed development is classified as a 'highly vulnerable development' as per the vulnerability classification in the planning guidelines in Figure 8-1.

Vulnerability class	Land uses and types of development which include*:
Highly vulnerable development (including essential infrastructure)	Garda, ambulance and fire stations and command centres required to be operational during flooding; Hospitals; Emergency access and egress points; Schools; Dwelling houses, student halls of residence and hostels; Residential institutions such as residential care homes, children's homes and social services homes; Caravans and mobile home parks; Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility; and Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites, etc.) in the event of flooding.
Less vulnerable development	Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions; Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans; Land and buildings used for agriculture and forestry; Waste treatment (except landfill and hazardous waste); Mineral working and processing; and Local transport infrastructure.
Water-compatible development	Flood control infrastructure; Docks, marinas and wharves; Navigation facilities; Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location; Water-based recreation and tourism (excluding sleeping accommodation); Lifeguard and coastguard stations; Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms; and Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan).
*Uses not listed here should be considered on their own merits	

Figure 8-1 - Vulnerability Classification

8.2. Sequential Approach

Figure 8-2 illustrates the sequential approach to be adopted under the 'Planning System and Flood Risk Management' Guidelines. The site of the proposed development is classified as Flood Zone A. Following the sequential approach, a Justification Test for the proposed development is required.

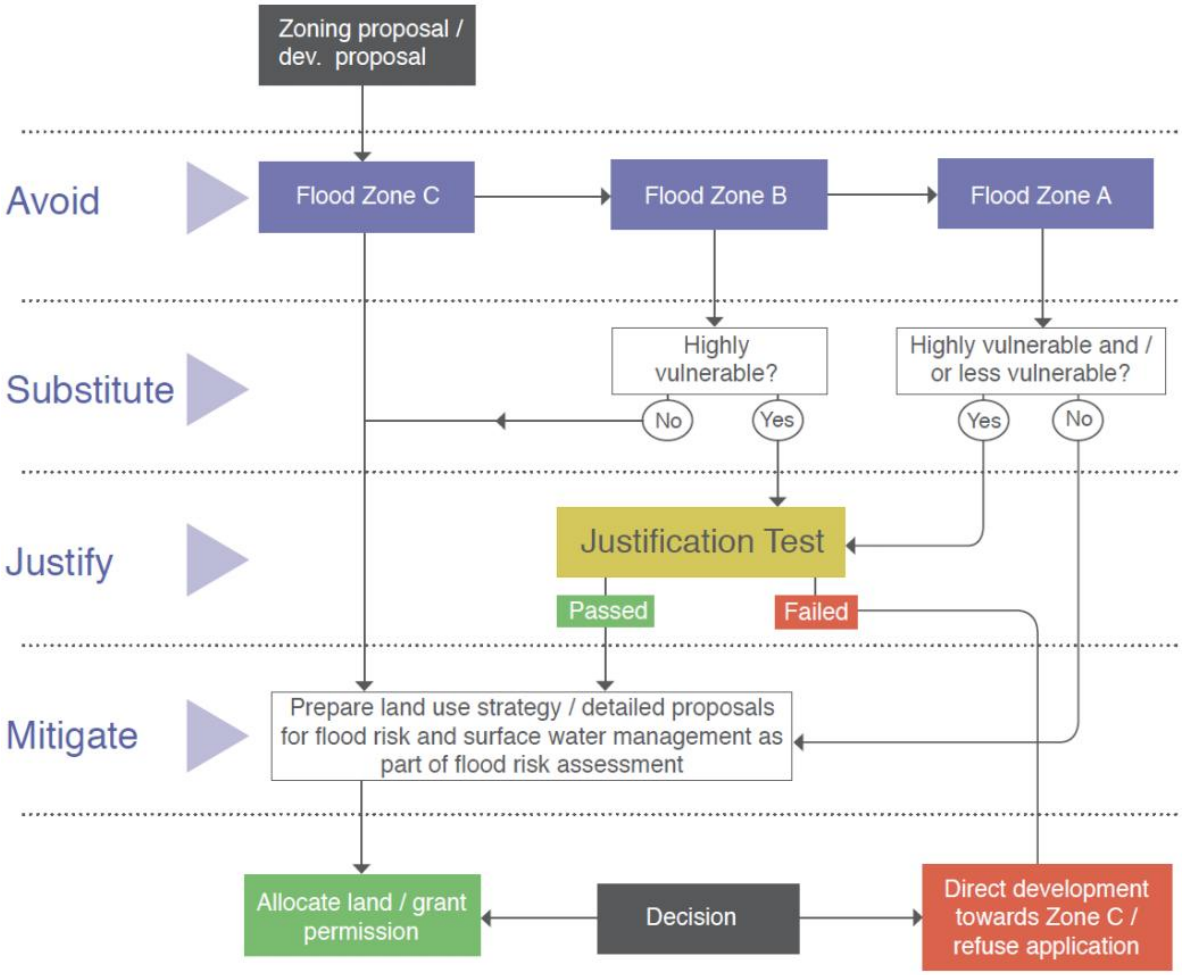


Figure 8-2 - Sequential approach mechanism in the planning process

8.3. Justification Test

It is the intention to satisfy all of the criteria of the Justification Test as described in Chapter 5 of the OPW Flood Risk Management Guidelines.

8.3.1. Criteria 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

As stated in Chapter 6 of the Meath County Development Plan, it is an objective of Meath County Council:

(TRAN OBJ 17) To support, where appropriate, major road improvements, bypasses of local towns and villages and proposed national road schemes by reserving the corridors of any such proposed routes free of developments, which would interfere with the provision of such proposals. Such road schemes include:

- *N52 Fringestown Re-alignment of approximately 3km of the existing N52*

This clearly indicates that the subject land has been designated for this particular use in the Meath County Development Plan.

8.3.2. Criteria 2 – Part 1

The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk.

As stated previously, the proposed road formation levels reside above the 1 in 100-year flood levels of all four watercourse crossings, with a provision of a minimum 300mm freeboard. Culverts have been sized sufficiently at the four watercourse crossing locations to ensure the existing flows are catered for with an allowance for climate change can be conveyed.

8.3.3. Criteria 2 – Part 2

The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible.

The land use downstream of the site has been identified as agricultural, therefore the receptor vulnerability is classified as low. There does not appear to be any evidence to indicate if the proposed development site is at risk of flooding from overland flow. The levels of the new road are proposed approximately 1-6m higher than the existing topography and therefore the small areas in the surrounding areas of the site will not be adversely affected by the development.

8.3.4. Criteria 2 – Part 3

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.

The Meath County Development Plan states that

The N52 is a particularly important strategic route, linking the two gateways of Dundalk and Mullingar, Athlone-Tullamore. County Meath is very reliant on its road infrastructure for intra and inter county movement and access. The existing N2, N51 and N52 (National Primary Roads and National Secondary Roads) are subject to ongoing improvements in terms of overlays for pavement strengthening, junction improvements, traffic calming, low cost safety measures, etc.

Therefore, it is of specific interest to Meath County Council to upgrade and maintain the N52 to facilitate the development of the surrounding areas in order to ensure the mitigation of residual risks. The culverts have been sized sufficiently at the four watercourse crossing locations to ensure the flows can be conveyed. It is deemed that the development has been managed to an acceptable level.

8.3.5. Criteria 2 – Part 4

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 Meath County Development Plan states that

The existing N2, N51 and N52 (National Primary Roads and National Secondary Roads) are subject to ongoing improvements in terms of overlays for pavement strengthening, junction improvements, traffic calming, low cost safety measures, etc.

The proposed road scheme consists of a 7m wide carriageway, a 2.5m shared cyclepath/footpath, verges and hard shoulders. The proposed road levels are higher than the existing topography at the watercourse crossing locations and these watercourses will be culverted as part of this scheme. The design has indicated the compatibility of the wider planning objectives by incorporating various transport features that comply with the regulations indicated by Transport Infrastructure Ireland.

It is deemed that all criteria of the Justification Test have been addressed and satisfied, and therefore a Stage 2 Flood Risk Assessment is not required.

9. Conclusions and Recommendations

The development proposals involve the realignment of circa 5.3km of the existing N52 road with the overall aim to remove a significantly sub-standard section (approximately 4.5km in total) of the existing N52 route.

The proposed road crosses four significant watercourses, the Headstown, Stephenstown and two unnamed streams as well as other smaller local field ditches.

There is no evidence of historic flooding within the immediate vicinity of the development route, however, the PFRA flood maps indicate that the proposed road may be within the 1 in 100-year fluvial floodplain of the Stephenstown Stream.

This FRA has demonstrated that the proposed road formation levels reside above the 1 in 100-year flood levels of all four watercourse crossings, with a provision of a minimum 300mm freeboard.

Culverts have been sized sufficiently at the four watercourse crossing locations to ensure the existing flows with an allowance for climate change can be conveyed.

The land use downstream of the site has been identified as agricultural, therefore the receptor vulnerability is classified as low.

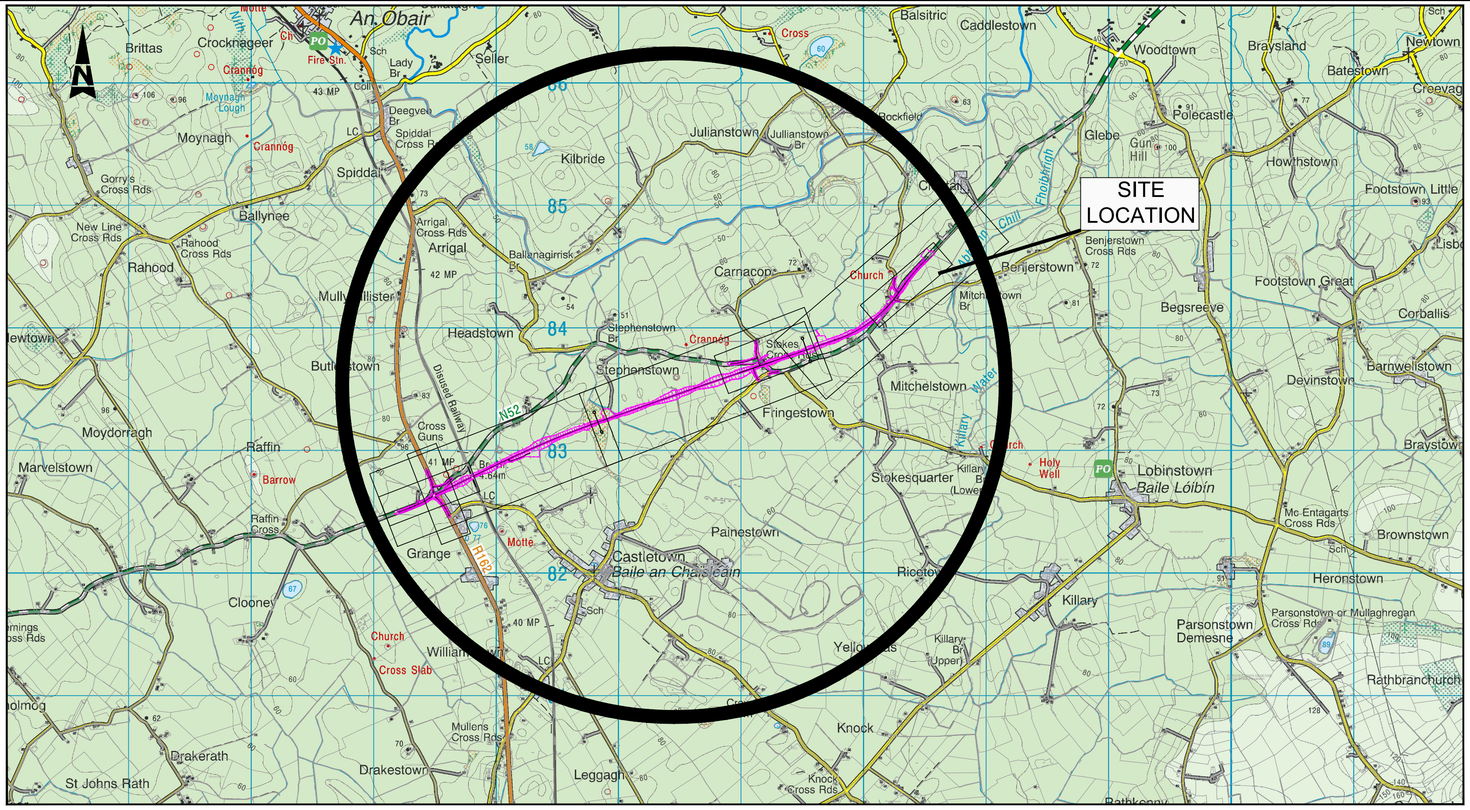
The proposed road development route located in Flood Zone A. Therefore, a Justification Test is required. The proposed development has been designated for this particular use as written in the Meath County Development Plan. It is deemed that all criteria of the Justification Test have been addressed and satisfied, and therefore a Stage 2 Flood Risk Assessment is not required.

The following recommendations are to be taken into consideration during the design and construction of the proposed development:

- The proposed discharge for the storm-water drainage to the watercourses does not exceed the existing greenfield runoff rates unless otherwise agreed Meath County Council;
- The proposed discharge for the storm-water drainage to the watercourse should be designed in accordance with best practice to include natural treatment of surface water prior to discharge to watercourses;
- The Contractor will be required to prepare an emergency plan for managing flood risk during construction, which may include monitoring of weather conditions through consultation with Meath County Council. The Contractor is to ensure measures are in place to reduce any potential inundation due to flooding during the works.

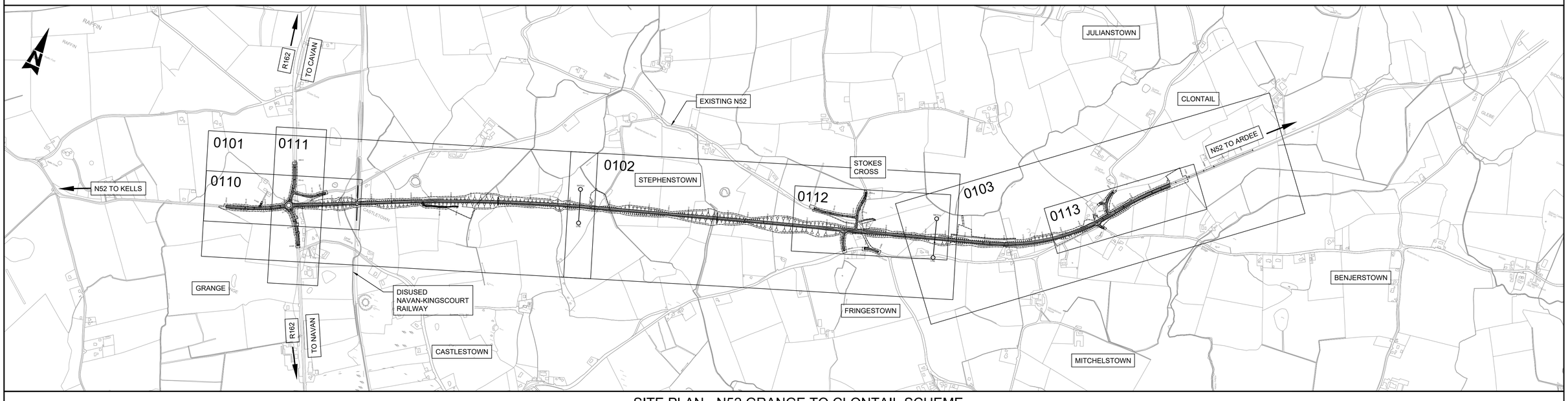
Appendices

Appendix A. Site Location



SITE MAP - N52 GRANGE TO CLONTAIL SCHEME

Scale at A1 1:25,000
Scale at A3 1:50,000



SITE PLAN - N52 GRANGE TO CLONTAIL SCHEME

Scale at A1 1:10,000
Scale at A3 1:20,000

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comhairle chontae na mí
meath county council

An Roinn Iompair Turasóireachta agus Spóirt
Department of Transport, Tourism and Sport

Rev	Description	By	Date	Chk'd	Auth
B	FOR PLANNING	DB	26.02.20	ST	UOH
A	FOR PLANNING	DB	03.07.19	ST	UOH
-	FOR PLANNING	AK	17.05.19	ST	UOH

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1st Floor Technology House, Parkmore Technology Park, Galway
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Fax (+353) 091 779 830

Client: MEATH COUNTY COUNCIL

Project: N52 GRANGE TO CLONTAIL SCHEME

Purpose: FOR PLANNING

Title: PART 8 SITE LOCATION PLAN

Original Scale	Design/Drawn	Checked	Authorised
AS SHOWN	AK	ST	UOH
	Date 17.05.19	Date 17.05.19	Date 17.05.19

Status: P

Drawing Number: 5158291 / HTR / DR / 0001

Rev: B

A1 DO NOT SCALE

Date: Feb 26, 2020 - 11:19am Plotted by: Dórien

File: 5158291_HTR_DR_0001.dwg

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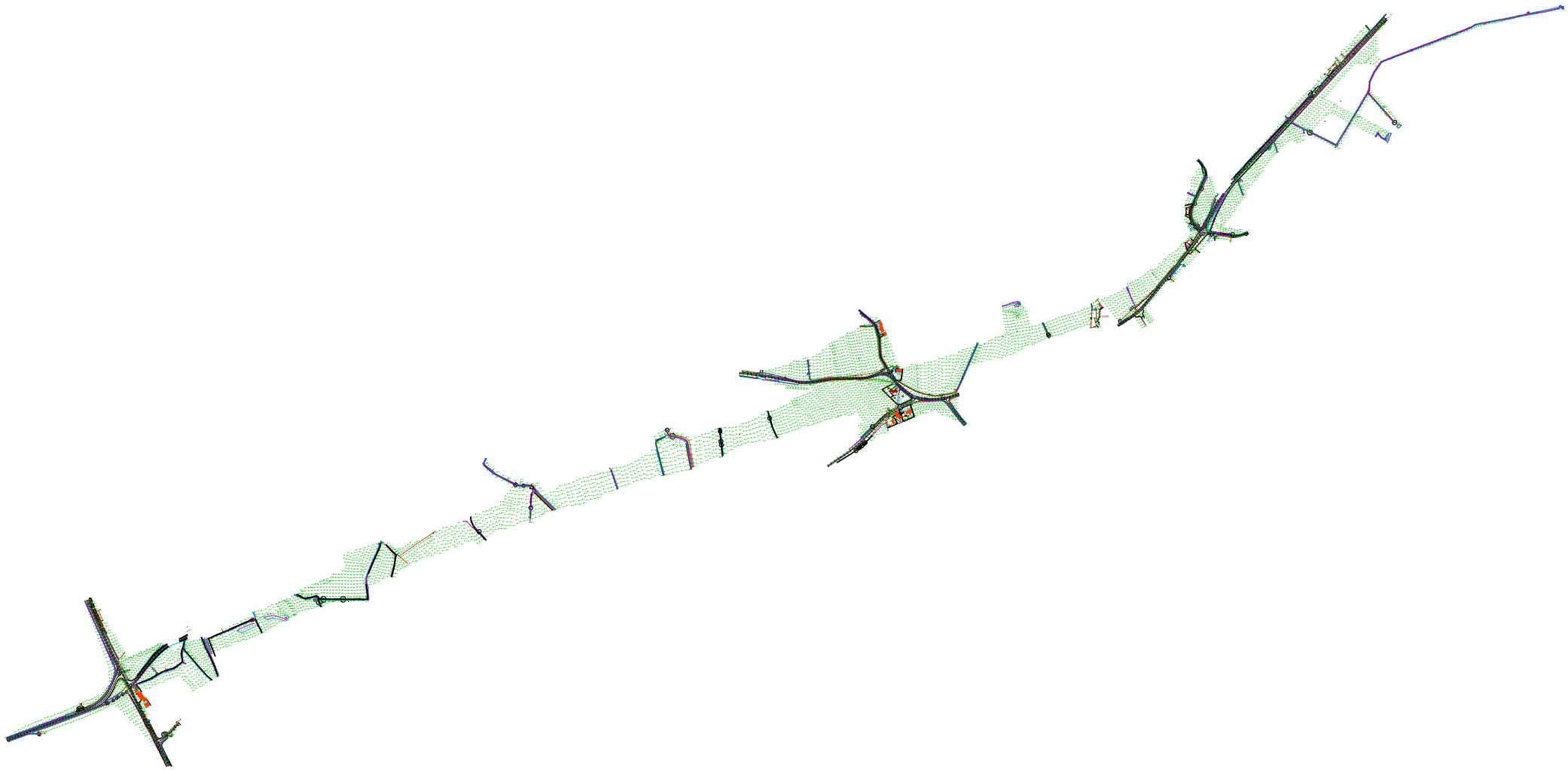
Appendix B. Topographical Survey



X:\Projects\9930\docs\Logos-Brochures\D3D_colour2-Sig.jpg

D3D Geomatics,

Unit 1 Airport Hub,

Furry Business Park, Santry,

Dublin 9, Rep of Ireland

Tel: +353-1-8427676

email: Ken@d3d.ie

Legend

- Bottom of Bank
- Building Line
- Carraigeway Edge
- Edge of Trees
- ESB Lines
- Fenceline
- Hard Shoulder
- Hedgeline
- Kerb Line
- Road Edge
- Road Centre Line
- Solid White Line
- Top of Bank
- Track
- Wall Line

Date	Rev. No.	Description	Drawn by	Checked by	Approved by
01/03/19	04				

Client

Meath County Council
Paul Phelan
Buvinda House
Dublin Road
Navan
Co Meath

NOTES:

1. ITM Co-ordinates.
2. All levels relative to Malin Head Datum.
3. Contour interval 0.5 metres.
4. Although every effort has been made to survey all features, some may be missing due to obstructions.
5. Every effort has been made to survey features at 10m intervals and retain their integrity.

Project Title:

N52,Grange to Clontail

Drawing Title:

2482_Topographical Survey_2D_ITM

Approved by Keith O'Neill	Y
Checked by K. O'Neill	Y
Drawn by: K. O'Neill	Y

Scale: 1:8000

Date: 01 03 2019

Appendix C. PFRA Map Extracts

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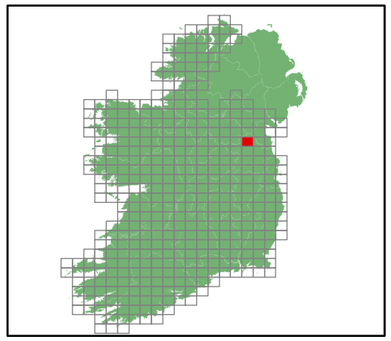
Osi permit number EN-002-1011

KILMAINHAMWOOD

DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT

0.5 0.25 0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 Kilometers

Location Plan :



Legend:

Flood Extents

- Fluvial - Indicative 1% AEP (100-yr) Event
- Fluvial - Extreme Event
- Coastal - Indicative 0.5% AEP (200-yr) Event
- Coastal - Extreme Event
- Pluvial - Indicative 1% AEP (100-yr) Event
- Pluvial - Extreme Event
- Groundwater Flood Extents
- Lakes / Turloughs

PFRA Outcomes

- Probable Area for Further Assesment
- Possible Area for Further Assesment

Important User Note:

The flood extents shown on these maps are based on broad-scale simple analysis and may not be accurate for a specific location. Information on the purpose, development and limitations of these maps is available in the relevant reports (see www.cfram.ie). Users should seek professional advice if they intend to rely on the maps in any way.

If you believe that the maps are inaccurate in some way please forward full details by contacting the OPW (refer to PFRA Information leaflets or 'Have Your Say' on www.cfram.ie).

Office of Public Works
Jonathon Swift Street
Trim
Co Meath
Ireland

Project :
PRELIMINARY FLOOD RISK ASSESMENT (PFRA)

Map :
PFRA Indicative extents and outcomes
- Draft for Consultation

Figure By :	PJW	Date :	July2011
Checked By :	MA	Date :	July 2011

Figure No. : 2019 / MAP / 305 / A

Revision 0

Drawing Scale : 1:50,000

Plot Scale : 1:1 @ A3

Appendix D. River Flow Analysis

N52 – Unnamed Stream 1

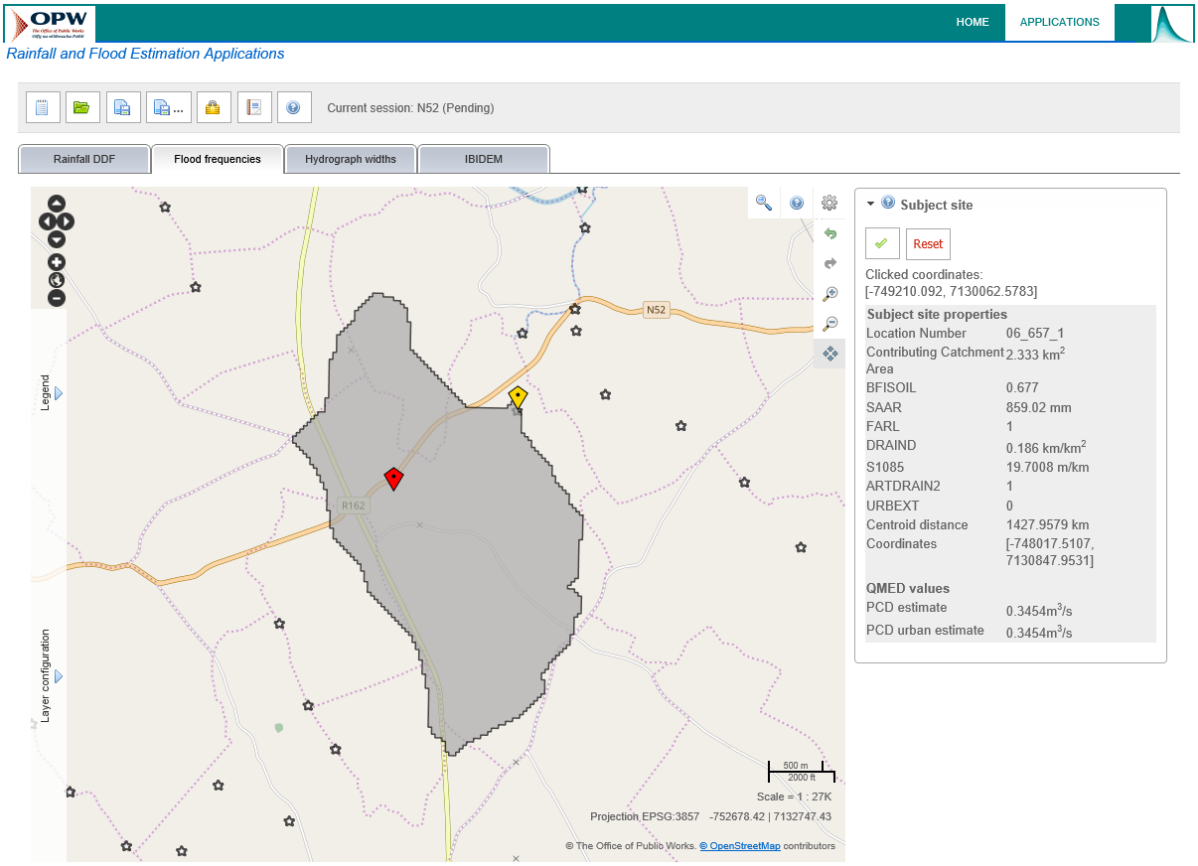


Figure 1 - OPW Catchment Area and Desciptors

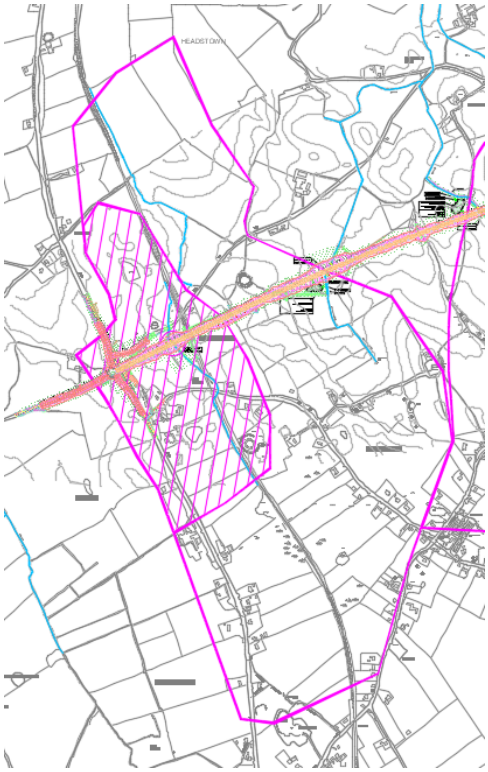


Figure 2 - Interpolated Contributing Catchment (hatched area)

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Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	
Site name:	Culvert 1
Site location:	N52

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site coordinates

Latitude:	53.78796° N
Longitude:	6.7298° W

Reference:	
Date:	2019-06-06 09:28

Methodology	IH124

Site characteristics

Total site area (ha)	56

Methodology

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
SOIL type	3	3
HOST class	---	---
SPR/SPRHOST	0.37	0.37

Hydrological characteristics

	Default	Edited
SAAR (mm)	965	859.02
Hydrological region	12	12
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 30 year	2.13	2.13
Growth curve factor: 100 year	2.61	1.96

Notes:

(1) Is Q_{BAR} < 2.0 l/s/ha?

(2) Are flow rates < 5.0 l/s?

(3) Is SPR/SPRHOST ≤ 0.3?

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	231.32	201.88
1 in 1 year (l/s)	196.62	171.6
1 in 30 years (l/s)	492.7	430
1 in 100 years (l/s)	603.73	395.68

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Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	
Site name:	Culvert 1
Site location:	N52

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site coordinates

Latitude:	53.78796° N
Longitude:	6.7298° W

Reference:	
Date:	2019-06-06 09:28

Methodology	FEH Statistical

Site characteristics

Total site area (ha)	56

Methodology

Qmed estimation method	Calculate from BFI and SAAR
BFI and SPR estimation method	Specify BFI manually
HOST class	N/A
BFI / BFIHOST	0.677
Qmed (l/s)	NaN
Qbar / Qmed Conversion Factor	1.05

Hydrological characteristics

	Default	Edited
SAAR (mm)	965	859.02
Hydrological region	12	12
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 30 year	2.13	2.13
Growth curve factor: 100 year	2.61	1.96

Notes:

(1) Is Q_{BAR} < 2.0 l/s/ha?

(2) Are flow rates < 5.0 l/s?

(3) Is SPR/SPRHOST ≤ 0.3?

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	NaN	147.06
1 in 1 year (l/s)	NaN	125
1 in 30 years (l/s)	NaN	313.25
1 in 100 years (l/s)	NaN	288.25

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UNNAMED STREAM 1

Culvert Location

Coordinate x	683667	ITM
Coordinate y	782770	ITM
Coordinate x	-749214	EPSG:3857
Coordinate y	7130064	EPSG:3857

Catchment Descriptors (from FSU portal)

Area	0.56	km2
SAAR	859.02	mm
SOIL	0.677	

Q100 Calculations

To calculate Q100, QBAR is multiplied by the FSR growth factor of 1.96.

Q100 (IH124)	0.40	m3/s
Q100 (FEH)	0.29	m3/s

As per OPW guidelines, a factorial standard error of 65% needs to be applied to QBAR

QBAR (IH124) with 65% factorial standard error	0.65	m3/s
QBAR (FSSR 6) with 65% factorial standard error	0.48	m3/s

Climate Change

An allowance of 20% increase in peak flow has been assumed for climate change.

Q100 + Climate Change (IH124)	0.78	m3/s
Q100 + Climate Change (FEH)	0.57	m3/s

N52 – Headstown Stream

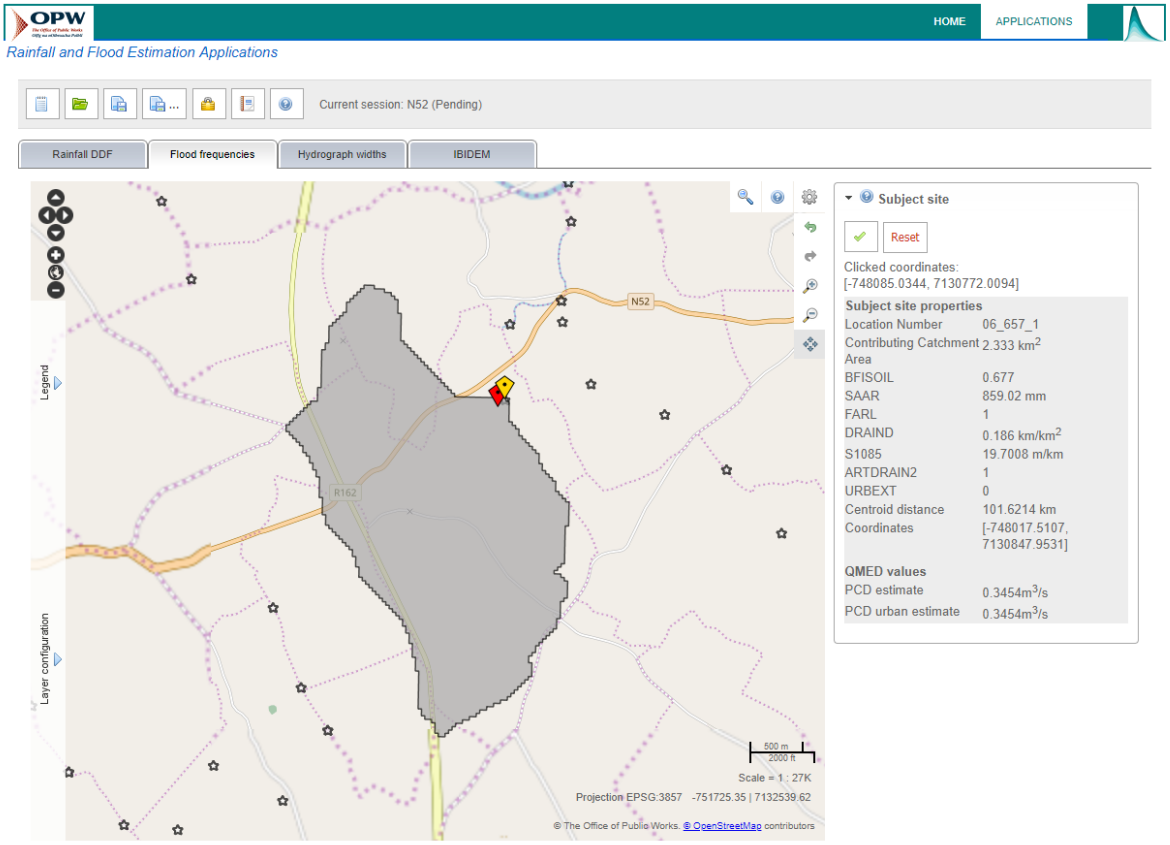

Figure 3 - OPW Catchment Area and Desciptors

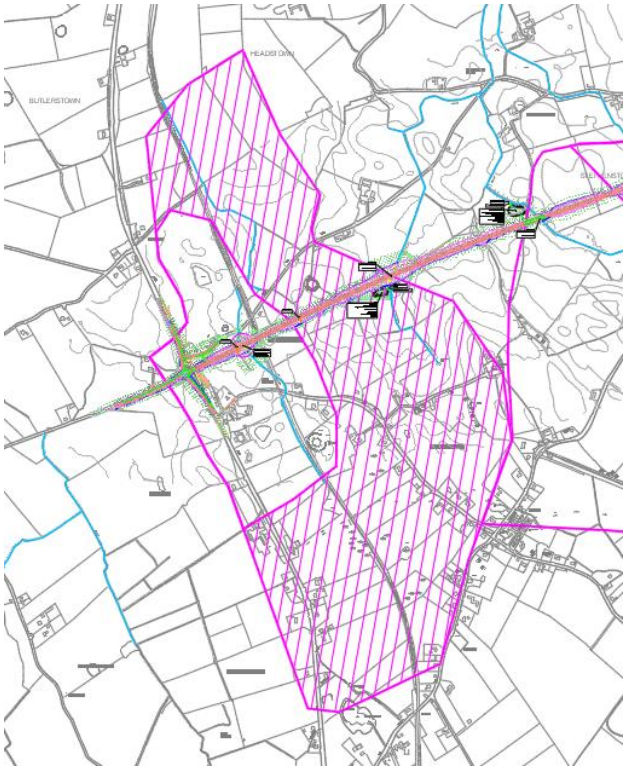

Figure 4 - Interpolated Contributing Catchment (hatched area)

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Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	
Site name:	Culvert 2
Site location:	N52

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site coordinates

Latitude:	53.79237° N
Longitude:	6.71987° W

Reference:	
Date:	2019-06-06 09:35

Methodology	IH124

Site characteristics

Total site area (ha)	177.3

Methodology

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
SOIL type	2	2
HOST class	---	---
SPR/SPRHOST	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm)	968	859.02
Hydrological region	12	12
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 30 year	2.13	2.13
Growth curve factor: 100 year	2.61	1.96

Notes:

(1) Is Q_{BAR} < 2.0 l/s/ha?

(2) Are flow rates < 5.0 l/s?

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite may be a requirement for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	410.77	357.2
1 in 1 year (l/s)	349.16	303.62
1 in 30 years (l/s)	874.95	760.84
1 in 100 years (l/s)	1072.12	700.11

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Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	
Site name:	Culvert 2
Site location:	N52

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site coordinates

Latitude:	53.79237° N
Longitude:	6.71987° W

Reference:	
Date:	2019-06-06 09:35

Methodology	FEH Statistical

Site characteristics

Total site area (ha)	177.3

Methodology

Qmed estimation method	Calculate from BFI and SAAR
BFI and SPR estimation method	Specify BFI manually
HOST class	N/A
BFI / BFIHOST	0.677
Qmed (l/s)	NaN
Qbar / Qmed Conversion Factor	1.05

Hydrological characteristics

	Default	Edited
SAAR (mm)	968	859.02
Hydrological region	12	12
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 30 year	2.13	2.13
Growth curve factor: 100 year	2.61	1.96

Notes:

(1) Is Q_{BAR} < 2.0 l/s/ha?

(2) Are flow rates < 5.0 l/s?

(3) Is SPR/SPRHOST ≤ 0.3?

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	NaN	392.15
1 in 1 year (l/s)	NaN	333.33
1 in 30 years (l/s)	NaN	835.27
1 in 100 years (l/s)	NaN	768.61

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HEADSTOWN STREAM

Culvert Location

Coordinate x	684290	ITM
Coordinate y	783060	ITM
Coordinate x	-748153	EPSG:3857
Coordinate y	7130535	EPSG:3857

Catchment Descriptors (from FSU portal)

Area	1.773	km2
SAAR	859.02	mm
SOIL	0.677	

Q100 Calculations

To calculate Q100, QBAR is multiplied by the FSR growth factor of 1.96.

Q100 (IH124)	0.70	m3/s
Q100 (FEH)	0.77	m3/s

As per OPW guidelines, a factorial standard error of 65% needs to be applied to QBAR

QBAR (IH124) with 65% factorial standard error	1.16	m3/s
QBAR (FSSR 6) with 65% factorial standard error	1.27	m3/s

Climate Change

An allowance of 20% increase in peak flow has been assumed for climate change.

Q100 + Climate Change (IH124)	1.39	m3/s
Q100 + Climate Change (FEH)	1.52	m3/s

As per OPW guidelines, a factor of 60% needs to a Drained Channel

Q100 + Climate Change (IH124) + 60%	2.22	m3/s
Q100 + Climate Change (FEH) + 60%	2.44	m3/s

N52 – Stephenstown Stream

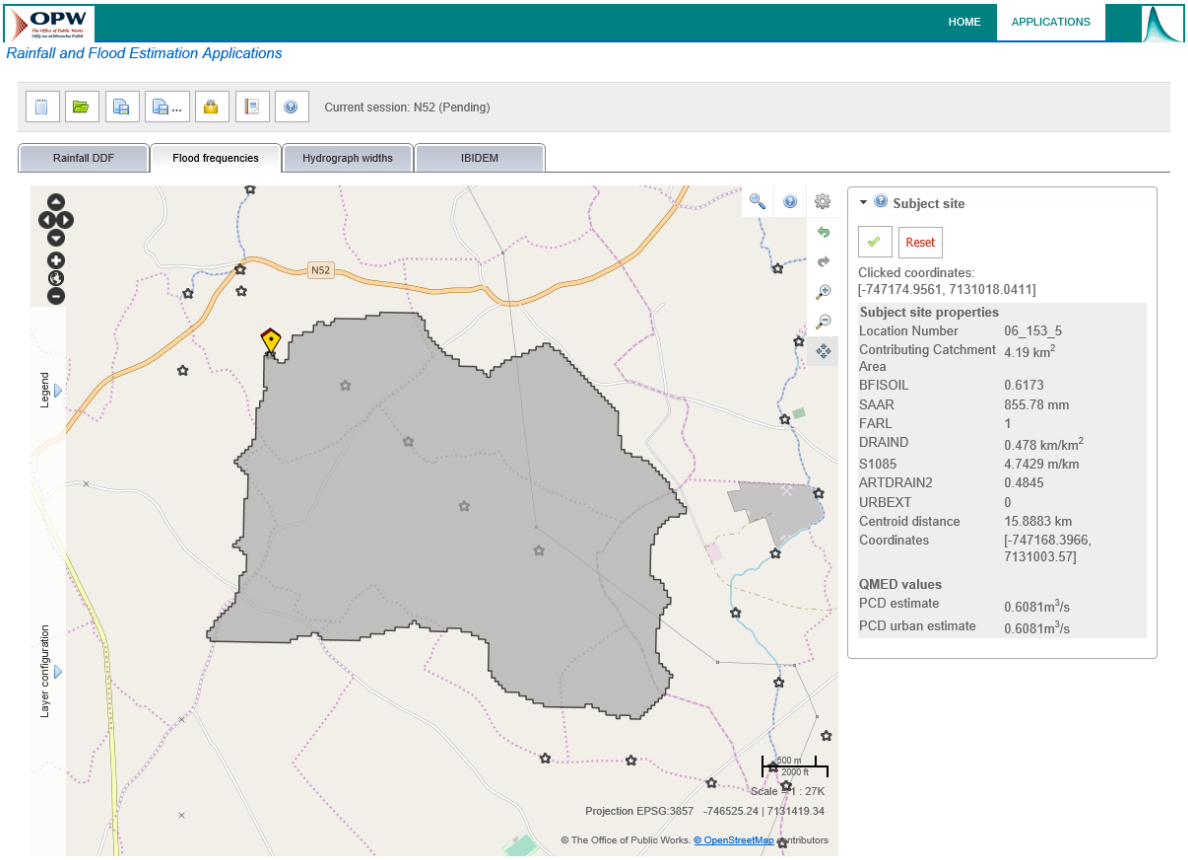

Figure 5 - OPW Catchment Area and Desciptors

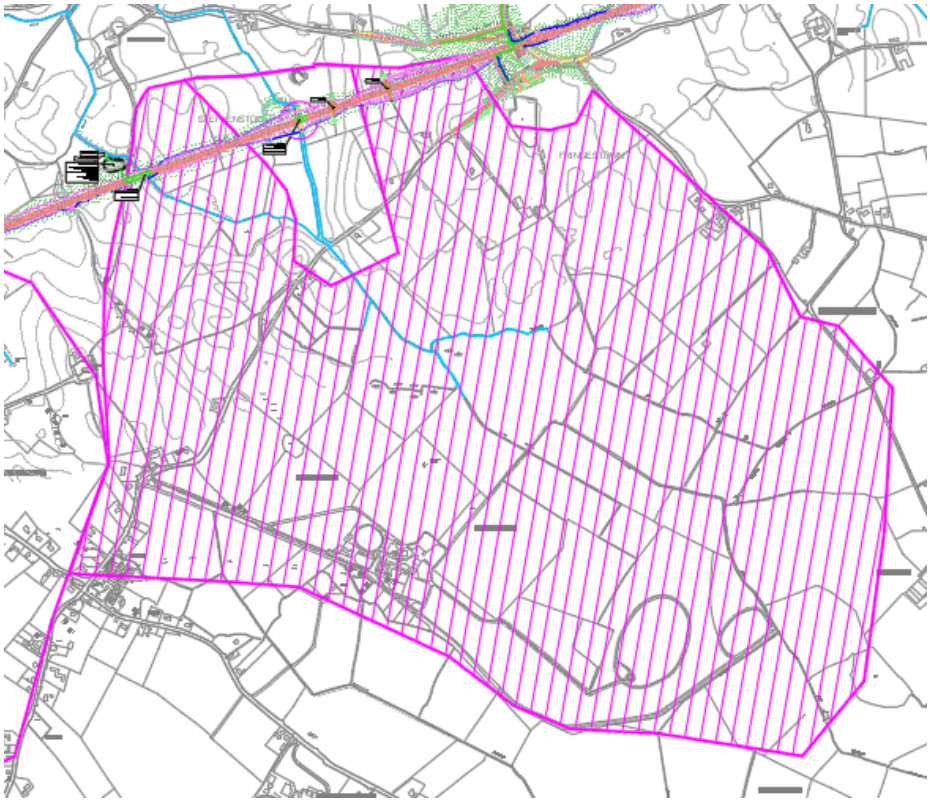

Figure 6 - Interpolated Contributing Catchment (hatched area)

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Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	
Site name:	Culvert 3
Site location:	N52

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site coordinates

Latitude:	53.79304° N
Longitude:	6.71215° W

Reference:	
Date:	2019-06-06 09:42

Methodology	IH124

Site characteristics

Total site area (ha)	395

Methodology

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
SOIL type	2	2
HOST class	---	---
SPR/SPRHOST	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm)	967	855.78
Hydrological region	12	12
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 30 year	2.13	2.13
Growth curve factor: 100 year	2.61	1.96

Notes:

(1) Is Q_{BAR} < 2.0 l/s/ha?

Normally limiting discharge rates which are less than 2.0 l/s/ha are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite may be a requirement for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	836.95	725.46
1 in 1 year (l/s)	711.4	616.64
1 in 30 years (l/s)	1782.69	1545.22
1 in 100 years (l/s)	2184.43	1421.9

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Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	
Site name:	Culvert 3
Site location:	N52

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site coordinates

Latitude:	53.79304° N
Longitude:	6.71215° W

Reference:	
Date:	2019-06-06 09:42

Methodology	FEH Statistical

Site characteristics

Total site area (ha)	395

Methodology

Qmed estimation method	Calculate from BFI and SAAR
BFI and SPR estimation method	Specify BFI manually
HOST class	N/A
BFI / BFIHOST	0.6173
Qmed (l/s)	NaN
Qbar / Qmed Conversion Factor	1.05

Hydrological characteristics

	Default	Edited
SAAR (mm)	967	855.78
Hydrological region	12	12
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 30 year	2.13	2.13
Growth curve factor: 100 year	2.61	1.96

Notes:

(1) Is Q_{BAR} < 2.0 l/s/ha?

(2) Are flow rates < 5.0 l/s?

(3) Is SPR/SPRHOST ≤ 0.3?

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	NaN	975.54
1 in 1 year (l/s)	NaN	829.21
1 in 30 years (l/s)	NaN	2077.9
1 in 100 years (l/s)	NaN	1912.06

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STEPHENSTOWN STREAM

Culvert Location

Coordinate x	684907	ITM
Coordinate y	783301	ITM
Coordinate x	-747104	EPSG:3857
Coordinate y	7130925	EPSG:3857

Catchment Descriptors (from FSU portal)

Area	3.95	km2
SAAR	855.78	mm
SOIL	0.6173	

Q100 Calculations

To calculate Q100, QBAR is multiplied by the FSR growth factor of 1.96.

Q100 (IH124)	1.42	m3/s
Q100 (FEH)	1.91	m3/s

As per OPW guidelines, a factorial standard error of 65% needs to be applied to QBAR

QBAR (IH124) with 65% factorial standard error	2.35	m3/s
QBAR (FSSR 6) with 65% factorial standard error	3.16	m3/s

Climate Change

An allowance of 20% increase in peak flow has been assumed for climate change.

Q100 + Climate Change (IH124)	2.82	m3/s
Q100 + Climate Change (FEH)	3.79	m3/s

As per OPW guidelines, a factor of 60% needs to a Drained Channel

Q100 + Climate Change (IH124) + 60%	4.51	m3/s
Q100 + Climate Change (FEH) + 60%	6.06	m3/s

N52 – Unnamed Stream 2

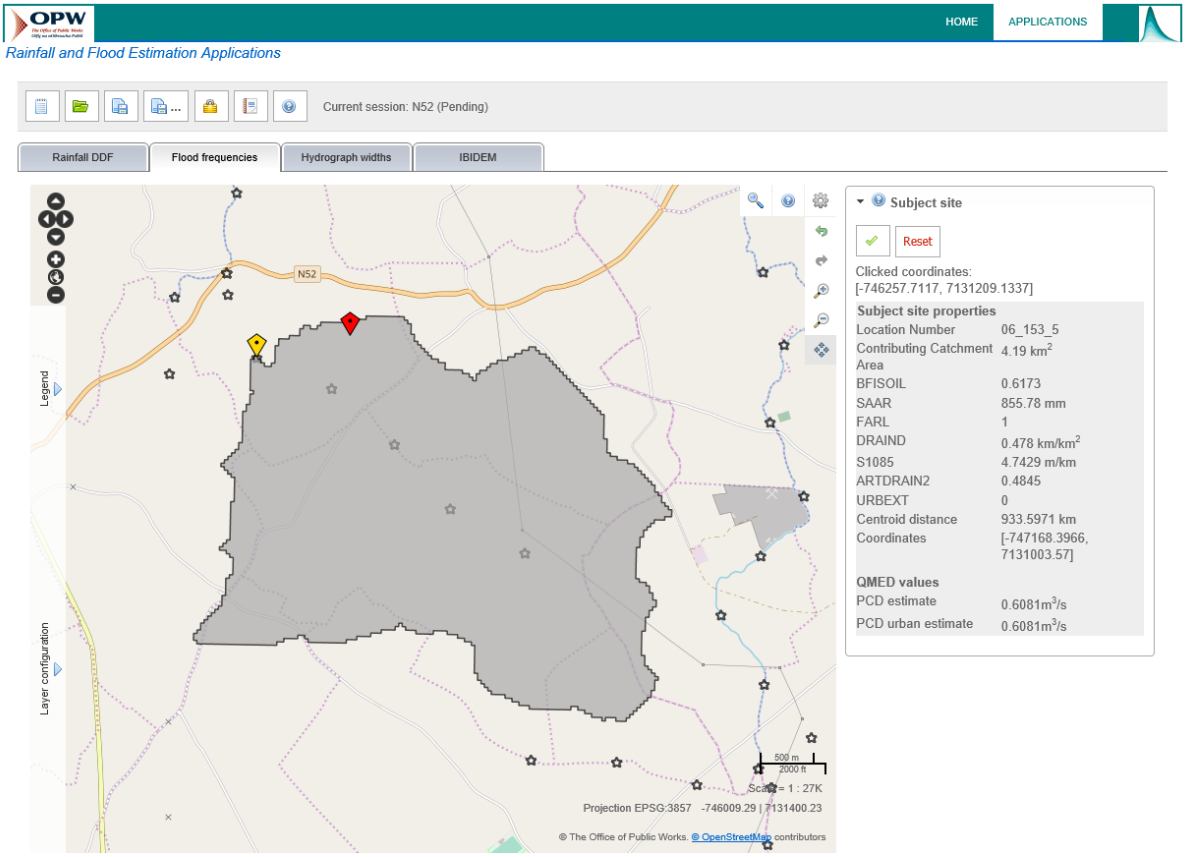

Figure 7 - OPW Catchment Area and Desciptors

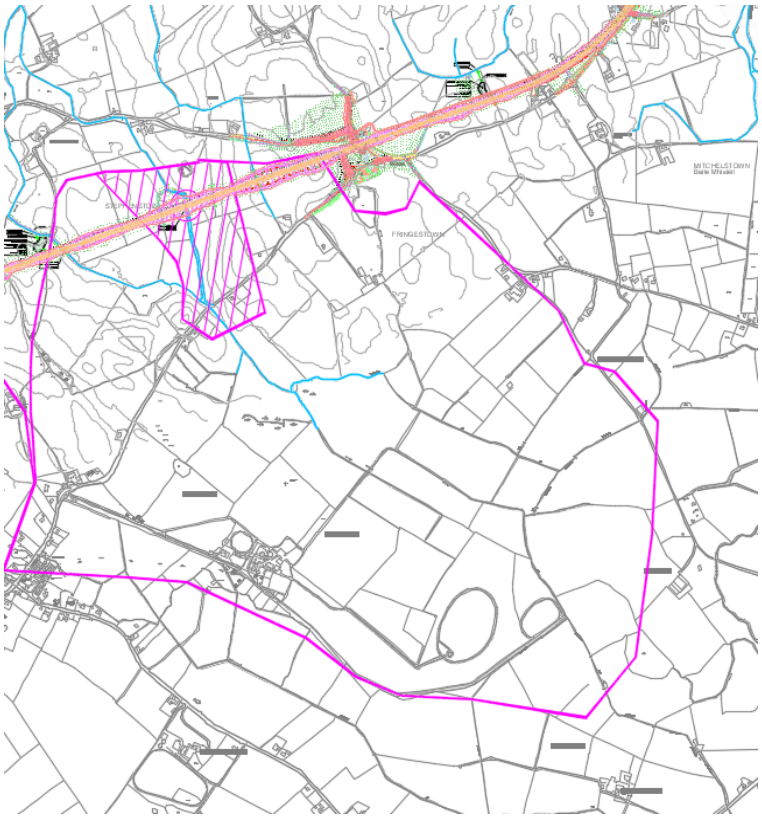

Figure 8 - Interpolated Contributing Catchment (hatched area)

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Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	
Site name:	Culvert 4
Site location:	N52

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site coordinates

Latitude:	53.79464° N
Longitude:	6.70486° W

Reference:	
Date:	2019-06-06 09:47

Methodology	IH124

Site characteristics

Total site area (ha)	24

Methodology

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
SOIL type	2	2
HOST class	---	---
SPR/SPRHOST	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm)	967	855.78
Hydrological region	12	12
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 30 year	2.13	2.13
Growth curve factor: 100 year	2.61	1.96

Notes:

(1) Is Q_{BAR} < 2.0 l/s/ha?

(2) Are flow rates < 5.0 l/s?

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite may be a requirement for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	63.83	55.33
1 in 1 year (l/s)	54.26	47.03
1 in 30 years (l/s)	135.97	117.85
1 in 100 years (l/s)	166.61	108.45

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Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	
Site name:	Culvert 4
Site location:	N52

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site coordinates

Latitude:	53.79464° N
Longitude:	6.70486° W

Reference:	
Date:	2019-06-06 09:47

Methodology	FEH Statistical

Site characteristics

Total site area (ha)	24

Methodology

Qmed estimation method	Calculate from BFI and SAAR
BFI and SPR estimation method	Specify BFI manually
HOST class	N/A
BFI / BFIHOST	0.6173
Qmed (l/s)	NaN
Qbar / Qmed Conversion Factor	1.05

Hydrological characteristics

	Default	Edited
SAAR (mm)	967	855.78
Hydrological region	12	12
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 30 year	2.13	2.13
Growth curve factor: 100 year	2.61	1.96

Notes:

(1) Is Q_{BAR} < 2.0 l/s/ha?

(2) Are flow rates < 5.0 l/s?

(3) Is SPR/SPRHOST ≤ 0.3?

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	NaN	80.65
1 in 1 year (l/s)	NaN	68.55
1 in 30 years (l/s)	NaN	171.78
1 in 100 years (l/s)	NaN	158.07

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UNNAMED STREAM 2

Culvert Location

Coordinate x	684907	ITM
Coordinate y	783301	ITM
Coordinate x	-747104	EPSG:3857
Coordinate y	7130925	EPSG:3857

Catchment Descriptors (from FSU portal)

Area	0.24	km2
SAAR	855.78	mm
SOIL	0.6173	

Q100 Calculations

To calculate Q100, QBAR is multiplied by the FSR growth factor of 1.96.

Q100 (IH124)	0.11	m3/s
Q100 (FEH)	0.16	m3/s

As per OPW guidelines, a factorial standard error of 65% needs to be applied to QBAR

QBAR (IH124) with 65% factorial standard error	0.18	m3/s
QBAR (FSSR 6) with 65% factorial standard error	0.26	m3/s

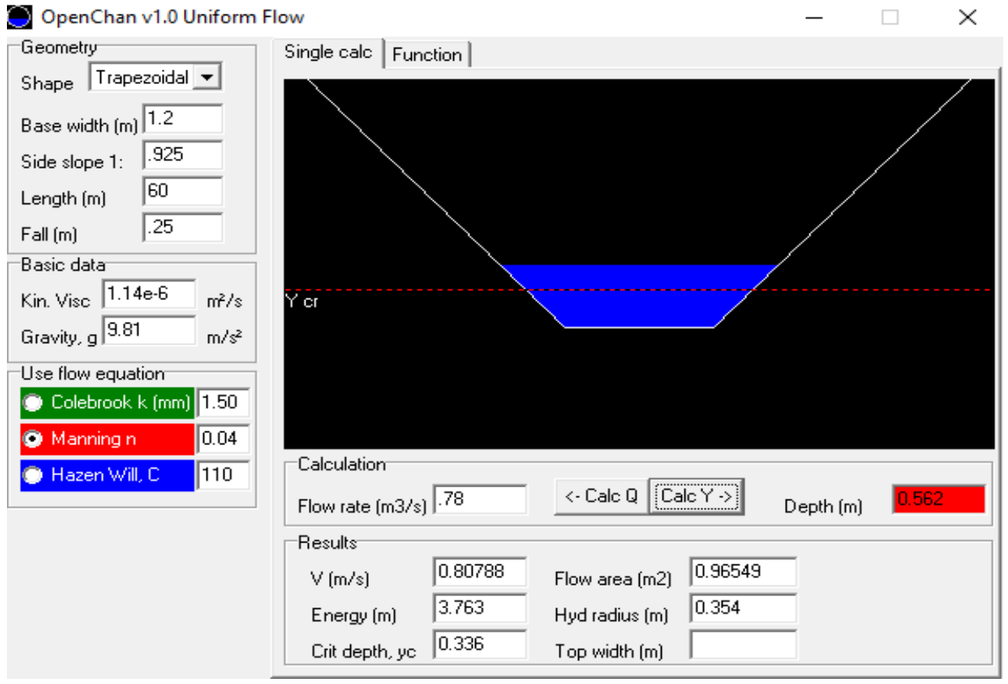
Climate Change

An allowance of 20% increase in peak flow has been assumed for climate change.

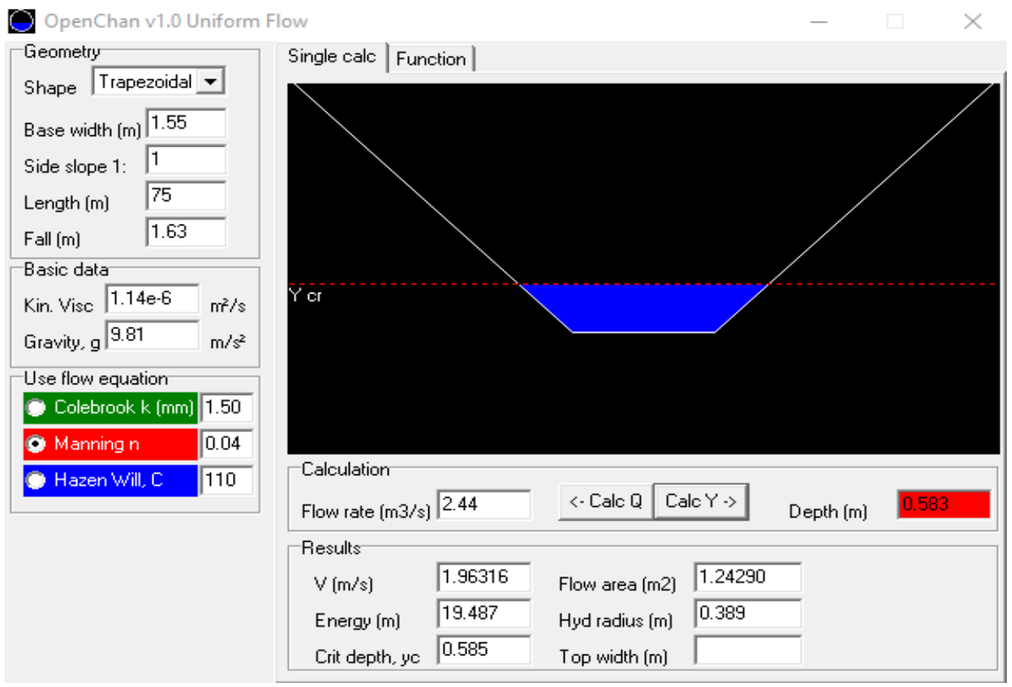
Q100 + Climate Change (IH124)	0.21	m3/s
Q100 + Climate Change (FEH)	0.31	m3/s

Appendix E. Open Channel Capacity Calculations

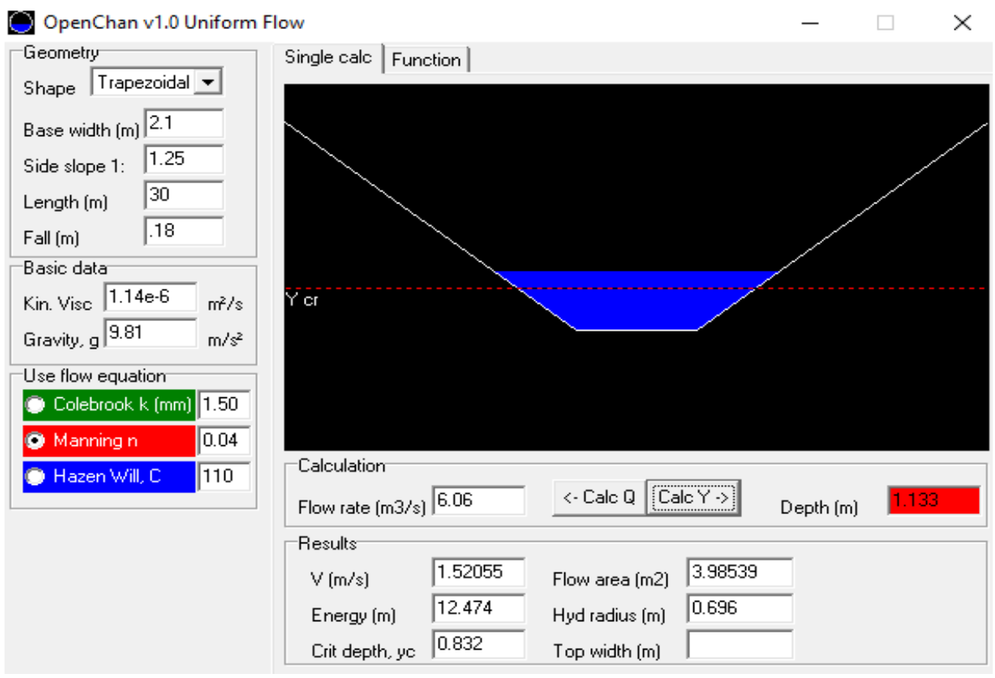
UNNAMED STREAM 1



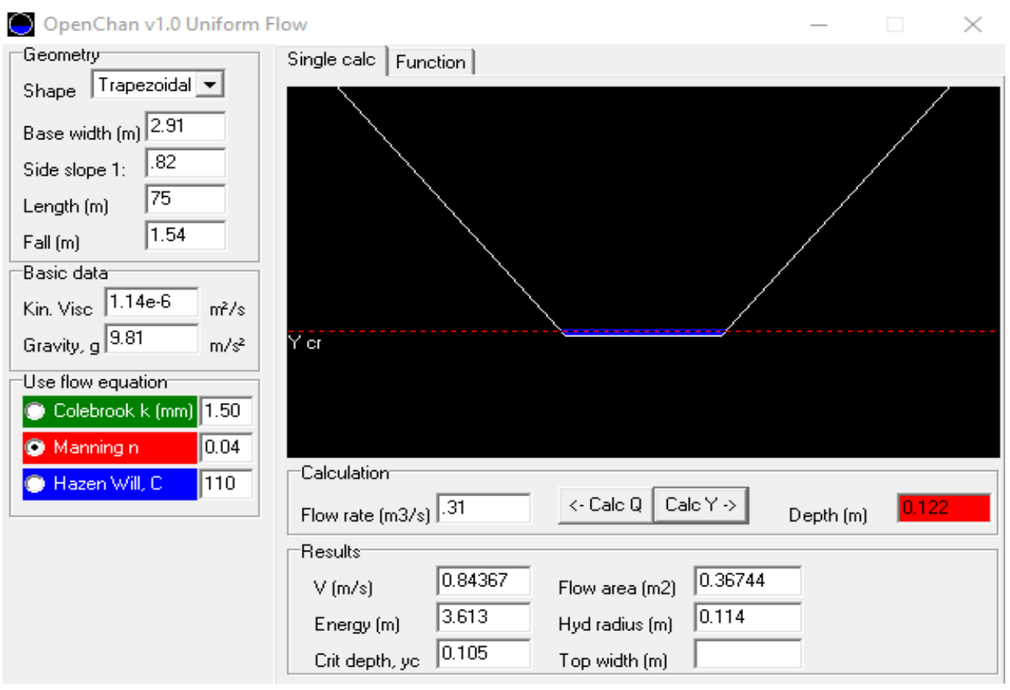
HEADSTOWN STREAM



STEPHENSTOWN STREAM



UNNAMED STREAM 2



Appendix F. Culvert Sizing Calculations

COLEBROOK WHITE - Unnamed Stream 1

			State Grad (y/n)	n		State Gradient 1 in x							
Roughness	0.6	mm	**U/S level**	0.0006			66.4	m		fluid kinematic viscosity	1.140E-06		
												base	
Diam(mm)	900	mm	**D/S level**	0.9			66.15	m		viscosity correction	1.00	water@15C	
Length	60	m	**Gradient**				0.0041667		1in 240				

PROPOR'N DEPTH	WETTED PERIMETER	AREA OF FLOW	HYDRAULIC MEAN DEPTH	(32mgi)^.5	Ks 14.8m	1.255v m(32..)^.5	LOG	VELOCITY (m/s)	DISCHARGE (l/s)	DEPTH (mm)	SURFACE WIDTH _(mm)__	V^2/2g	Froude No
FULL	2.8274334	0.63617251	0.2250000	0.542	0.0001802	1.172E-05	-3.716918	2.02	1,282.52	900	0	0.21	N/A
0.01	0.1803014	0.00107675	0.0059720	0.088	0.0067885	0.002711	-2.022299	0.18	0.19	9	179	0.00	0.74
0.02	0.2554147	0.00303631	0.0118878	0.125	0.0034103	0.0009653	-2.358965	0.29	0.89	18	252	0.00	0.86
0.03	0.3133494	0.00556106	0.0177472	0.152	0.0022843	0.0005292	-2.550748	0.39	2.16	27	307	0.01	0.92
0.04	0.3624443	0.00853557	0.0235500	0.175	0.0017215	0.0003462	-2.68452	0.47	4.02	36	353	0.01	0.97
0.05	0.4059241	0.011892	0.0292961	0.196	0.0013838	0.0002495	-2.786925	0.55	6.48	45	392	0.02	1.00
0.1	0.579151	0.03310897	0.0571681	0.273	0.0007091	9.153E-05	-3.096541	0.85	28.04	90	540	0.04	1.09
0.15	0.7158589	0.05983852	0.0835898	0.331	0.000485	5.177E-05	-3.270217	1.08	64.69	135	643	0.06	1.13
0.2	0.8345657	0.09057728	0.1085322	0.377	0.0003735	3.499E-05	-3.388779	1.28	115.67	180	720	0.08	1.15
0.25	0.9424778	0.12437243	0.1319632	0.415	0.0003072	2.61E-05	-3.477151	1.44	179.59	225	779	0.11	1.15
0.3	1.0433515	0.16051637	0.1538469	0.449	0.0002635	2.073E-05	-3.546306	1.59	255.38	270	825	0.13	1.15
0.35	1.1394933	0.19843419	0.1741425	0.477	0.0002328	1.722E-05	-3.602029	1.72	341.11	315	859	0.15	1.14
0.4	1.2324946	0.23762954	0.1928037	0.502	0.0002103	1.478E-05	-3.647726	1.83	435.34	360	882	0.17	1.13
0.45	1.323566	0.27765386	0.2097771	0.524	0.0001933	1.302E-05	-3.685549	1.93	535.87	405	895	0.19	1.11
0.5	1.4137167	0.31808626	0.2250000	0.542	0.0001802	1.172E-05	-3.716918	2.02	641.26	450	900	0.21	1.08
0.55	1.5038674	0.35851865	0.2383978	0.558	0.0001701	1.075E-05	-3.742795	2.09	749.30	495	895	0.22	1.05
0.6	1.5949388	0.39854297	0.2498798	0.572	0.0001622	1.002E-05	-3.763824	2.15	857.27	540	882	0.24	1.02
0.65	1.6879401	0.43773833	0.2593329	0.582	0.0001563	9.474E-06	-3.780415	2.20	963.46	585	859	0.25	0.98
0.7	1.7840819	0.47565614	0.2666112	0.590	0.0001521	9.089E-06	-3.792777	2.24	1,064.99	630	825	0.26	0.94
0.75	1.8849556	0.51180008	0.2715184	0.596	0.0001493	8.843E-06	-3.800921	2.27	1,159.23	675	779	0.26	0.89
0.8	1.9928677	0.54559523	0.2737739	0.598	0.0001481	8.734E-06	-3.804614	2.28	1,241.77	720	720	0.26	0.83
0.85	2.1115744	0.576334	0.2729404	0.597	0.0001485	8.774E-06	-3.803252	2.27	1,309.43	765	643	0.26	0.77
0.9	2.2482824	0.60306354	0.2682330	0.592	0.0001511	9.006E-06	-3.795485	2.25	1,355.69	810	540	0.26	0.68
0.95	2.4215093	0.62428052	0.2578064	0.581	0.0001573	9.558E-06	-3.777778	2.19	1,369.05	855	392	0.25	0.56
1	2.8274334	0.63617251	0.2250000	0.542	0.0001802	1.172E-05	-3.716918	2.02	1,282.52	900	0	0.21	N/A
0.95	2.4215093	0.62428052	0.2578064	0.581	0.0001573	9.558E-06	-3.777778	2.19	1,369.05	855	392	0.25	0.56

COLEBROOK WHITE - Headstown Stream

			State Grad (y/n)	n		State Gradient 1 in x								
Roughness	0.6	mm	**U/S level**	0.0006				48.6	m		fluid kinematic viscosity	1.140E-06		
													base	
Diam(mm)	900	mm	**D/S level**	0.9				46.97	m		viscosity correction	1.00	water@15C	
Length	75	m	**Gradient**					0.0217333		1in	46.01227			

PROPOR'N DEPTH	WETTED PERIMETER	AREA OF FLOW	HYDRAULIC MEAN DEPTH	(32mgi)^.5	Ks 14.8m	1.255v m(32..)^.5	LOG	VELOCITY (m/s)	DISCHARGE (l/s)	DEPTH (mm)	SURFACE WIDTH _(mm)__	V^2/2g	Froude No
FULL	2.8274334	0.63617251	0.2250000	1.239	0.0001802	5.133E-06	-3.732094	4.62	2,941.03	900	0	1.09	N/A
0.01	0.1803014	0.00107675	0.0059720	0.202	0.0067885	0.001187	-2.098241	0.42	0.46	9	179	0.01	1.74
0.02	0.2554147	0.00303631	0.0118878	0.285	0.0034103	0.0004227	-2.416468	0.69	2.09	18	252	0.02	2.00
0.03	0.3133494	0.00556106	0.0177472	0.348	0.0022843	0.0002317	-2.599281	0.90	5.03	27	307	0.04	2.14
0.04	0.3624443	0.00853557	0.0235500	0.401	0.0017215	0.0001516	-2.727451	1.09	9.33	36	353	0.06	2.24
0.05	0.4059241	0.011892	0.0292961	0.447	0.0013838	0.0001093	-2.825919	1.26	15.02	45	392	0.08	2.32
0.1	0.579151	0.03310897	0.0571681	0.624	0.0007091	4.008E-05	-3.125388	1.95	64.63	90	540	0.19	2.52
0.15	0.7158589	0.05983852	0.0835898	0.755	0.000485	2.267E-05	-3.294426	2.49	148.82	135	643	0.32	2.60
0.2	0.8345657	0.09057728	0.1085322	0.860	0.0003735	1.532E-05	-3.410211	2.93	265.75	180	720	0.44	2.64
0.25	0.9424778	0.12437243	0.1319632	0.949	0.0003072	1.143E-05	-3.496702	3.32	412.54	225	779	0.56	2.65
0.3	1.0433515	0.16051637	0.1538469	1.024	0.0002635	9.078E-06	-3.564489	3.65	586.05	270	825	0.68	2.64
0.35	1.1394933	0.19843419	0.1741425	1.090	0.0002328	7.539E-06	-3.619175	3.94	782.62	315	859	0.79	2.62
0.4	1.2324946	0.23762954	0.1928037	1.147	0.0002103	6.471E-06	-3.664062	4.20	998.52	360	882	0.90	2.58
0.45	1.323566	0.27765386	0.2097771	1.196	0.0001933	5.702E-06	-3.701241	4.43	1,229.17	405	895	1.00	2.54
0.5	1.4137167	0.31808626	0.2250000	1.239	0.0001802	5.133E-06	-3.732094	4.62	1,470.51	450	900	1.09	2.48
0.55	1.5038674	0.35851865	0.2383978	1.275	0.0001701	4.706E-06	-3.757557	4.79	1,717.66	495	895	1.17	2.42
0.6	1.5949388	0.39854297	0.2498798	1.305	0.0001622	4.386E-06	-3.778257	4.93	1,965.61	540	882	1.24	2.34
0.65	1.6879401	0.43773833	0.2593329	1.330	0.0001563	4.148E-06	-3.794594	5.05	2,209.27	585	859	1.30	2.26
0.7	1.7840819	0.47565614	0.2666112	1.348	0.0001521	3.979E-06	-3.806769	5.13	2,441.54	630	825	1.34	2.16
0.75	1.8849556	0.51180008	0.2715184	1.361	0.0001493	3.872E-06	-3.814791	5.19	2,656.75	675	779	1.37	2.05
0.8	1.9928677	0.54559523	0.2737739	1.366	0.0001481	3.824E-06	-3.818429	5.22	2,846.92	720	720	1.39	1.91
0.85	2.1115744	0.576334	0.2729404	1.364	0.0001485	3.842E-06	-3.817088	5.21	3,001.55	765	643	1.38	1.76
0.9	2.2482824	0.60306354	0.2682330	1.353	0.0001511	3.943E-06	-3.809437	5.15	3,107.59	810	540	1.35	1.56
0.95	2.4215093	0.62428052	0.2578064	1.326	0.0001573	4.185E-06	-3.791997	5.03	3,138.88	855	392	1.29	1.27
1	2.8274334	0.63617251	0.2250000	1.239	0.0001802	5.133E-06	-3.732094	4.62	2,941.03	900	0	1.09	N/A
0.95	2.4215093	0.62428052	0.2578064	1.326	0.0001573	4.185E-06	-3.791997	5.03	3,138.88	855	392	1.29	1.27

COLEBROOK WHITE - Stephenstown Stream

			State Grad (y/n)	n	State Gradient 1 in x				
Roughness	0.6	mm	**U/S level**	0.0006		50.1	m	fluid kinematic viscosity	1.140E-06
									base
Diam(mm)	1500	mm	**D/S level**	1.5		49.92	m	viscosity correction	1.00 water@15C
Length	30	m	**Gradient**			0.006	1in	166.66667	

PROPOR'N DEPTH	WETTED PERIMETER	AREA OF FLOW	HYDRAULIC MEAN DEPTH	(32mgi)^.5	Ks 14.8m	1.255v m(32..)^.5	LOG	VELOCITY (m/s)	DISCHARGE (l/s)	DEPTH (mm)	SURFACE WIDTH _(mm)__	V^2/2g	Froude No
FULL	4.712389	1.76714587	0.3750000	0.840	0.0001081	4.54E-06	-3.948275	3.32	5,863.39	1500	0	0.56	N/A
0.01	0.3005023	0.00299098	0.0099533	0.137	0.0040731	0.00105	-2.29047	0.31	0.94	15	298	0.01	1.00
0.02	0.4256912	0.00843419	0.0198129	0.193	0.0020462	0.0003739	-2.61618	0.51	4.26	30	420	0.01	1.14
0.03	0.522249	0.0154474	0.0295786	0.236	0.0013706	0.000205	-2.802565	0.66	10.21	45	512	0.02	1.21
0.04	0.6040738	0.02370991	0.0392500	0.272	0.0010329	0.0001341	-2.932944	0.80	18.90	60	588	0.03	1.27
0.05	0.6765402	0.03303332	0.0488268	0.303	0.0008303	9.664E-05	-3.032954	0.92	30.39	75	654	0.04	1.31
0.1	0.9652517	0.09196937	0.0952802	0.424	0.0004255	3.545E-05	-3.336357	1.41	129.95	150	900	0.10	1.41
0.15	1.1930982	0.1662181	0.1393164	0.512	0.000291	2.005E-05	-3.507174	1.80	298.53	225	1,071	0.16	1.46
0.2	1.3909428	0.25160356	0.1808871	0.584	0.0002241	1.355E-05	-3.62402	2.12	532.14	300	1,200	0.23	1.47
0.25	1.5707963	0.34547898	0.2199387	0.644	0.0001843	1.011E-05	-3.711226	2.39	825.00	375	1,299	0.29	1.48
0.3	1.7389192	0.4458788	0.2564115	0.695	0.0001581	8.03E-06	-3.779532	2.63	1,170.88	450	1,375	0.35	1.47
0.35	1.8991555	0.55120608	0.2902375	0.739	0.0001397	6.668E-06	-3.834611	2.84	1,562.67	525	1,431	0.41	1.46
0.4	2.0541576	0.66008206	0.3213395	0.778	0.0001262	5.724E-06	-3.879805	3.02	1,992.13	600	1,470	0.46	1.44
0.45	2.2059434	0.77126072	0.3496285	0.811	0.000116	5.043E-06	-3.917227	3.18	2,451.07	675	1,492	0.51	1.41
0.5	2.3561945	0.88357293	0.3750000	0.840	0.0001081	4.54E-06	-3.948275	3.32	2,931.69	750	1,500	0.56	1.38
0.55	2.5064456	0.99588515	0.3973296	0.865	0.000102	4.163E-06	-3.973894	3.44	3,422.86	825	1,492	0.60	1.34
0.6	2.6582314	1.1070638	0.4164663	0.886	9.734E-05	3.879E-06	-3.994719	3.54	3,915.68	900	1,470	0.64	1.30
0.65	2.8132335	1.21593979	0.4322214	0.902	9.38E-05	3.669E-06	-4.011151	3.62	4,400.49	975	1,431	0.67	1.25
0.7	2.9734698	1.32126707	0.4443519	0.915	9.124E-05	3.52E-06	-4.023397	3.68	4,862.26	1050	1,375	0.69	1.20
0.75	3.1415927	1.42166689	0.4525306	0.923	8.959E-05	3.425E-06	-4.031464	3.72	5,290.02	1125	1,299	0.71	1.14
0.8	3.3214462	1.51554231	0.4562899	0.927	8.885E-05	3.383E-06	-4.035123	3.74	5,668.13	1200	1,200	0.71	1.06
0.85	3.5192907	1.60092777	0.4549007	0.926	8.912E-05	3.398E-06	-4.033775	3.73	5,976.26	1275	1,071	0.71	0.97
0.9	3.7471373	1.67517649	0.4470550	0.917	9.068E-05	3.488E-06	-4.02608	3.69	6,188.10	1350	900	0.70	0.86
0.95	4.0358488	1.73411255	0.4296773	0.899	9.435E-05	3.702E-06	-4.008539	3.61	6,253.21	1425	654	0.66	0.71
1	4.712389	1.76714587	0.3750000	0.840	0.0001081	4.54E-06	-3.948275	3.32	5,863.39	1500	0	0.56	N/A
0.95	4.0358488	1.73411255	0.4296773	0.899	9.435E-05	3.702E-06	-4.008539	3.61	6,253.21	1425	654	0.66	0.71

COLEBROOK WHITE - Unnamed Stream 2

		State Grad (y/n)	n	State Gradient 1 in x				
Roughness	0.6 mm	**U/S level**	0.0006		52.01 m		fluid kinematic viscosity	1.140E-06
								base
Diam(mm)	900 mm	**D/S level**	0.9		50.47 m		viscosity correction	1.00 water@15C
Length	75 m	**Gradient**			0.0205333	1in	48.701299	

PROPOR'N DEPTH	WETTED PERIMETER	AREA OF FLOW	HYDRAULIC MEAN DEPTH	(32mgi)^.5	Ks 14.8m	1.255v m(32..)^.5	LOG	VELOCITY (m/s)	DISCHARGE (l/s)	DEPTH (mm)	SURFACE WIDTH _(mm)__	V^2/2g	Froude No
FULL	2.8274334	0.63617251	0.2250000	1.204	0.0001802	5.281E-06	-3.731747	4.49	2,858.32	900	0	1.03	N/A
0.01	0.1803014	0.00107675	0.0059720	0.196	0.0067885	0.0012212	-2.096383	0.41	0.44	9	179	0.01	1.69
0.02	0.2554147	0.00303631	0.0118878	0.277	0.0034103	0.0004348	-2.415091	0.67	2.03	18	252	0.02	1.94
0.03	0.3133494	0.00556106	0.0177472	0.338	0.0022843	0.0002384	-2.59813	0.88	4.89	27	307	0.04	2.09
0.04	0.3624443	0.00853557	0.0235500	0.390	0.0017215	0.000156	-2.726439	1.06	9.06	36	353	0.06	2.18
0.05	0.4059241	0.011892	0.0292961	0.434	0.0013838	0.0001124	-2.825005	1.23	14.59	45	392	0.08	2.25
0.1	0.579151	0.03310897	0.0571681	0.607	0.0007091	4.123E-05	-3.124719	1.90	62.81	90	540	0.18	2.45
0.15	0.7158589	0.05983852	0.0835898	0.734	0.000485	2.332E-05	-3.293867	2.42	144.63	135	643	0.30	2.53
0.2	0.8345657	0.09057728	0.1085322	0.836	0.0003735	1.576E-05	-3.409718	2.85	258.24	180	720	0.41	2.57
0.25	0.9424778	0.12437243	0.1319632	0.922	0.0003072	1.176E-05	-3.496253	3.22	400.98	225	779	0.53	2.58
0.3	1.0433515	0.16051637	0.1538469	0.996	0.0002635	9.34E-06	-3.564073	3.55	569.67	270	825	0.64	2.57
0.35	1.1394933	0.19843419	0.1741425	1.059	0.0002328	7.756E-06	-3.618783	3.83	760.60	315	859	0.75	2.55
0.4	1.2324946	0.23762954	0.1928037	1.115	0.0002103	6.657E-06	-3.663689	4.08	970.48	360	882	0.85	2.51
0.45	1.323566	0.27765386	0.2097771	1.163	0.0001933	5.866E-06	-3.700882	4.30	1,194.74	405	895	0.94	2.47
0.5	1.4137167	0.31808626	0.2250000	1.204	0.0001802	5.281E-06	-3.731747	4.49	1,429.16	450	900	1.03	2.41
0.55	1.5038674	0.35851865	0.2383978	1.239	0.0001701	4.842E-06	-3.75722	4.66	1,669.62	495	895	1.11	2.35
0.6	1.5949388	0.39854297	0.2498798	1.269	0.0001622	4.512E-06	-3.777928	4.79	1,910.61	540	882	1.17	2.28
0.65	1.6879401	0.43773833	0.2593329	1.293	0.0001563	4.268E-06	-3.794271	4.91	2,147.11	585	859	1.23	2.19
0.7	1.7840819	0.47565614	0.2666112	1.311	0.0001521	4.094E-06	-3.80645	4.99	2,373.05	630	825	1.27	2.10
0.75	1.8849556	0.51180008	0.2715184	1.323	0.0001493	3.984E-06	-3.814475	5.05	2,582.54	675	779	1.30	1.99
0.8	1.9928677	0.54559523	0.2737739	1.328	0.0001481	3.934E-06	-3.818114	5.07	2,766.71	720	720	1.31	1.86
0.85	2.1115744	0.576334	0.2729404	1.326	0.0001485	3.953E-06	-3.816773	5.06	2,917.40	765	643	1.31	1.71
0.9	2.2482824	0.60306354	0.2682330	1.315	0.0001511	4.057E-06	-3.809119	5.01	3,020.14	810	540	1.28	1.51
0.95	2.4215093	0.62428052	0.2578064	1.289	0.0001573	4.306E-06	-3.791673	4.89	3,050.86	855	392	1.22	1.24
1	2.8274334	0.63617251	0.2250000	1.204	0.0001802	5.281E-06	-3.731747	4.49	2,858.32	900	0	1.03	N/A
0.95	2.4215093	0.62428052	0.2578064	1.289	0.0001573	4.306E-06	-3.791673	4.89	3,050.86	855	392	1.22	1.24

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Appendix C. Ground Investigation Report

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N52 GRANGE TO CLONTAIL SCHEME

GROUND INVESTIGATION CONTRACT

FACTUAL REPORT

NO. P19026

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15/11/2019

REPORT CONTROL SHEET

Employer	Meath County Council					
Employer Representative	Atkins					
Project Name	N52 Grange to Clontail Scheme, Ground Investigation Contract					
Report Name	N52 Grange to Clontail Scheme, Ground Investigation Contract, Factual Report					
Project Number	P19026					
This Report Comprises of	RCS	TOC	Text	No. of Appendices	Drawings	Electronic data
	1	1	15	3	8	*.pdf, *.dwg

Revision	Status	Author(s)	Approved By	Issue Date
D01	Draft	S McSweeney	Gregory Hayes	15.11.2019

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APPENDIX B LABORATORY TEST RESULTS

APPENDIX C EXPLORATION LOCATION LAYOUT AND PLANS

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1 INTRODUCTION

1.1 SCOPE OF WORKS

In February, 2019, Atkins on behalf of Meath County Council, (the Employer), commissioned Priority Geotechnical, PGL, to carry out the ground investigation for the proposed N52 Grange to Clontail Preliminary Ground Investigation Contract.

The purpose of this ground investigation contract is to provide preliminary geotechnical data for the preliminary design stage of the emerging preferred route that has been identified for the scheme. The information gathered will be used to inform the preliminary design of the emerging preferred route.

The scope of works as tender comprised of:

- 14 Nr. 200 mm diameter cable percussion boreholes;
- 14 Nr. Follow on rotary boreholes;
- 36 Nr. trial pit excavations to a depth of 4.5m
- 08 Nr. groundwater standpipes and standpipe piezometers;
- *In-situ* testing including; standard penetration tests in boreholes, hand vane tests and CBR determination by DCP probes;
- All associated sampling;
- Laboratory testing;
- Associated reporting.

The detailed ground investigation fieldwork was carried out between the 26th March and the 26th August, 2019 under the supervision of PGL geologist(s); in accordance with the contract specification: Specification and Related Documents for Ground Investigation in Ireland (Engineers Ireland, 2nd ed. 2016), 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 as completed are outlined in Section 2.2, herein. The laboratory testing as completed are outlined in Section 3, herein.

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1.2 SITE LOCATION & DESCRIPTION

Meath County Council (MCC) proposes to realign a section of the existing N52 route between an appropriate tie-in point in the Townland of Grange in Co. Meath to the west and extend to an appropriate tie-in point in the Townland of Clontail in Co. Meath to the east. The scheme will entail the realignment of circa 5.3km of the existing N52 and will incorporate an upgrade of the N52 / R162 Junction (i.e. Grange Cross). The overall aim of the scheme will be to remove a significantly sub-standard section (approximately 4.5km in total) of the existing N52 route.

The extent of the site is outlined on the exploration location layout, drawing ref: P19026-SI-A, presented in **APPENDIX C** of this factual report.

1.3 GEOLOGY

The published geological maps of the local area indicate the site to be underlain by solid geology consisting of three geological formations, namely the Cruicetown Group (CRT, argillaceous bioclastic Limestone), the Navan Beds (NAV, dark Limestone, Mudstone and Sandstone) and the Clontail Formation (CL, Calcareous red-mica Greywacke).

Superficial deposits of Glacial till derived from Limestones, Gravels derived Limestones and Alluvium deposits are present across the site. Pockets of bedrock was mapped along the route sporadically. The national groundwater vulnerability mapping indicated the area is of high to extreme vulnerability. Historic well ID: 2627NEW026 described bedrock at 3.0m.

1.4 REPORTING

This geotechnical data, ground investigation factual report (ref: P19026-Rp-D01) presents the factual records of the fieldwork with respect to the detailed ground investigation contract for the proposed N52 Grange to Clontail Scheme.

This report should be read in conjunction with its appendices and the associated electronic data files.

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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. PGL have provided for the interpretation of the data collected. Additional works and further observations may form part of a more detailed investigation. This report may be subject to change where further information becomes available.

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 the Employer (Meath County Council) and their Representative as outlined, 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.

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2 FIELDWORKS

2.1 GENERAL

The fieldwork was carried out in general accordance with BS EN1997-2: 2007, Eurocode 7 Geotechnical Design, Part 2, Ground investigation and testing and BS 5930 (2015) Code of Practice for Site Investigation and Part 9 of BS 1377 (1990), Method of Tests for Soil for Civil Engineering Purposes. Details of the equipment and plant used are presented below.

Operation	Equipment	Nominal diameter, mm	Flush	Comments
Cable Percussion Boring	Dando 2000	200mm	N/A	Standard Penetration Test, Nspt values, bulk disturbed sampling. Visual observation of ground conditions
Rotary Boreholes	Soilmec PSM, 7t	Symmetrex 131, 150mm open hole/ 76mm double barrel core	Compressed air-mist	Nspt values, Core recovery, Standpipe/ piezometer installation
Trial Pits	14t tracked machine	Plan area L x W	N/A	Logging of ground and groundwater characteristics and bulk disturbed sample recovery.

The exploratory locations were selected by Atkins and set out by PGL subject to work space restrictions and available space. The 'as constructed' exploratory locations were subsequently surveyed using Trimble V8 GPS equipment to the Ordnance Survey, Irish Transverse Mercator (ITM) system of co-ordinates and elevations to Malin Head datum. The locations are shown on the Exploration Location Layout and Plans (dwg: P19026-SI-A, and P19026-SI-01) are presented in **APPENDIX C** of this factual report.

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2.2 EXPLORATORY HOLES

The exploratory holes as completed during the ground investigation are listed in the following table(s):

SUMMARY OF EXPLORATORY HOLES

Type	Quantity	Depth Range (m bgl)	Remarks
Cable Percussion Boreholes	12 Nr.	0.60 – 4.60	BH01, BH02, BH03, BH04, BH04A, BH07, BH08, BH10, BH11, BH12, BH13 and BH14.
Rotary Boreholes	12 Nr.	8.9 – 12.2	RC01, RC02, RC03, RC04, RC07, RC08, RC09, RC10, RC11, RC12, RC13 and RC14.
Trial Pits	33 Nr.	1.00 – 3.7	TP01A, TP02, TP02A, TP03, TP04, TP05, TP06 TP07, TP08, TP13, TP14, TP15, TP16, TP17, TP18, TP19, TP20, TP21,TP22, TP23, TP24 TP25, TP26, TP27, TP28, TP29, TP30, TP31 TP32, TP33, TP34, TP35 and TP36.

Boreholes terminated after one (1) hour chiselling without progress.

Location	Depth Top (m bgl)	Depth Base (m bgl)	Duration	Tool
BH01	3.7	3.7	01:00	Chisel.
BH02	3.8	3.97	00:30	Chisel.
BH02	4.6	4.6	01:00	Chisel.
BH03	3.3	3.3	01:00	Chisel.
BH04A	1.4	1.4	01:00	Chisel.
BH07	2.6	2.75	00:30	Chisel.
BH07	3.6	3.6	01:00	Chisel.
BH08	1.3	1.46	00:30	Chisel.
BH08	2.4	2.57	00:30	Chisel.
BH08	3.4	3.4	01:00	Chisel.
BH10	1.3	1.45	00:30	Chisel.
BH10	3.2	3.42	00:30	Chisel.
BH10	3.5	3.5	01:00	Chisel.
BH11	2.4	2.58	00:30	Chisel.
BH11	4.5	4.5	01:00	Chisel.
BH12	1.4	1.4	01:00	Chisel.
BH13	2.5	2.5	01:00	Chisel.
BH14	1.8	1.9	01:00	Chisel.

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Location	Stability
TP01A	Very poor.
TP02	Moderate.
TP02A	Poor to very poor.
TP03	Moderate.
TP04	Moderate
TP05	Poor
TP06	Moderate
TP07	Moderate
TP08	Moderate
TP13	Very poor
TP14	Moderate
TP15	Very poor
TP16	Poor
TP17	Moderate
TP18	Moderate
TP19	Moderate
TP20	Moderate
TP21	Moderate
TP22	Moderate
TP23	Moderate
TP24	Moderate.
TP25	Moderate
TP26	Moderate
TP27	Moderate
TP28	Moderate.
TP29	Moderate.
TP30	Moderate.
TP31	Moderate.
TP32	Moderate
TP33	Moderate
TP34	Moderate
TP35	Moderate
TP36	Moderate.

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The exploration and photographic records are presented in **APPENDIX A** of this factual report and should be read in conjunction with the key sheets included. The records provide descriptions, in accordance with BS 5930 (2015) and Eurocode 7, Identification and classification of soils, Part 1, Identification and description (BS EN ISO 14688-1: 2002), of the materials encountered, in situ testing and details of the samples taken, together with any observations made during the detailed ground investigation.

2.3 SAMPLING

A total of one hundred and one (101) bulk disturbed samples (B) eighty four (84) small disturbed samples (D), two undisturbed samples (U) and 56.7 lin.m of rotary core (C) were taken in accordance with Geotechnical Investigation and Sampling – Sampling Methods and Groundwater Measurements (EN ISO 22475-1:2006).

Four (4) environmental samples (ENV) were taken between 0.5m bgl and 0.8m bgl at trial pit 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.

2.4 GROUNDWATER MONITORING

Groundwater was recorded when encountered during boring and trial pit excavations over a period of 20 minutes, noting any changes that may occur. Groundwater levels were also monitored at start and end of drilling shifts.

It should be noted that the normal rate of boring may not permit the recording of equilibrium groundwater levels for any one groundwater water strike where casing may exclude low volume flows as the borehole progresses. Groundwater conditions observed in the borings or pits are those appertaining to the period of the investigation. Groundwater levels may be subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions, tidal variations etc. The groundwater regime should be assessed from standpipe well installations, where available. Standpipe wells were installed under instruction. Otherwise the exploratory boreholes were backfilled with arisings and bentonite grout.

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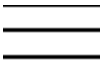
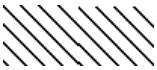
SUMMARY OF BACKFILL DETAILS

GRAVEL Backfill to installation/ borehole

ARISINGS Backfill

 uPVC slotted pipe

 BENTONITE Backfill to installation/ borehole

2.5 IN SITU TESTING

Ninety four (94) number standard penetration tests, N_{SPT} values, were carried out in the cable percussion (35Nr.) and rotary (59Nr.) boreholes using the 60^{o} solid cone (CPT) in place of the standard split barrel sampler. Standard Penetration Tests, N values, were carried out in the in accordance with Geotechnical Investigation and Testing, Part 3 Standard penetration test, BS EN ISO 22476-3:2005+A1:2011. The data was presented on the relevant logs in **APPENDIX A** and presented graphically within this report.

A total of eighty seven (87) in situ hand vane tests were carried out to assess shear strength (kPa) in trial pit excavations. The data was presented on the relevant logs in **APPENDIX A**, herein.

Sixteen (16) *in situ* dynamic probes (UK DCP) were undertaken using the Transport Research laboratory, TRL probe, 60^{o} cone, 8kg drop weight over 575mm with the mm per blows (penetration rate, pen rate) recorded to refusal at trial pit and slit trench locations. Care should be used assessing the dynamic probe data as it provided only for the rate of penetration through the soils and should be reviewed with trial pit records. The dynamic probing was carried out in general accordance with Geotechnical Investigation and Testing, Part 2, Dynamic probing, BS EN ISO 22476-2:2005 and TRL document: “Measuring Road Pavement Strength and Designing Low Volume Sealed Roads using the Dynamic Cone Penetrometer” Samuel and Done, 2006 ref: UPR/IE/76/06 Project Record No R7783. The pen rate was converted to an unadjusted California bearing ratio, CBR value using both Kleyn (1982) for pen rate >2mm/blow and the TRL (Jones and Rolt, 1991) equations. The dynamic probe logs were presented along with the corresponding exploratory records in **APPENDIX A**.

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SUMMARY OF IN-SITU TESTING

Type	Quantity	Remarks
Standard Penetration Test, N value- Cable percussion	35Nr.	N values ranging from N= 7 to N=50, including (refusal >50)
Standard Penetration Test, N value - Rotary	59Nr.	N values ranging from N=8 to N=50, including (refusal >50)
Hand Vane tests	87Nr.	See **APPENDIX A**
DCP TRL Probes	16Nr.	See **APPENDIX A**

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3 LABORATORY TESTING

All samples were transported to Priority Geotechnical's laboratory in Midleton, Co. Cork examined, logged and prepared for scheduled testing. Laboratory testing was scheduled by Atkins. Testing was carried out by PGL and GSTL (UK) on behalf of 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 testing was carried out by Chemtest UK Ltd. on behalf of PGL. The laboratory test results were presented in **APPENDIX B** of 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.*

A summary of tests undertaken were detailed as follows.

SUMMARY OF LABORATORY TESTING UNDERTAKEN

Type	Nr.	Remarks
Natural Moisture Content	109	Range 1% to 58%
Atterberg Limit	47	Liquid Limit 22% to 87% Plastic Limit 13% to 54% (Incl. NP Non-plastic soils) Plasticity Index 13 to 54
Particle Size Distribution	42	33Nr. hydrometer analysis were undertaken on fine soils
Organic content	03	3.3% to 4.3%
Dry Density/Moisture Content Relationship	07	BH08 0.5m, TP19 1.5m, TP20 0.8m, TP24 0.5m, TP25 1.5m and TP35 1.5m. Optimum moisture content 9.2% to 17.7% Maximum dry density 15.41Mgm^{-3} to 25.22 Mgm^{-3}
Moisture Condition Value, MCV	07	BH13 1.5m, TP14 0.5m, TP19 1.5m, TP20 0.8m, TP22 0.5m, TP25 0.5m, TP32 0.2m. MCV0.0 to MCV6.9
MCV/ Moisture Content Relationship	01	TP18 1.5m.
Point Load Index	07	1.5MPa to 4.9MPa
Unconfined Compressive Strength	03	32.57MPa to 125.37MPa
Environmental results Suite I	04	See **APPENDIX B**
Environmental results Suite E	02	See **APPENDIX B**

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4 GROUND AND GROUNDWATER CONDITIONS

The full details of the ground conditions encountered are provided for on the exploratory records accompanying this report, **APPENDIX A**. 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.

Groundwater was noted in exploratory locations at depths between 1.2m bgl and 6.00m bgl. Groundwater shift data was recorded during cable tool and rotary boreholes. It should be appreciated that seasonal fluctuations in groundwater levels may occur.

Seven (7) number 50mm HDPE diameter standpipe installations were constructed to allow for groundwater monitoring. Details of the ground water and groundwater standpipes are presented graphically on the relevant exploratory logs within **APPENDIX A** of this factual report and in table format below.

SUMMARY OF GROUNDWATER STRIKES

Exploratory Hole	Groundwater level, m bgl	Comments	Groundwater Installation
			Y/N
BH01	-	None encountered.	N
BH02	-	None encountered.	N
BH03	-	None encountered.	N
BH04	-	None encountered.	N
BH04A	-	None encountered.	N
BH07	-	None encountered.	N
BH08	-	None encountered.	N
BH10	3.0	See shift data.	N
BH11	1.2	See shift data.	N
BH12	-	None encountered.	N
BH13	-	None encountered.	N
BH14	-	None encountered.	N
RC01	3.5	See shift data.	N
RC02	6.0	See shift data.	Y
RC03	3.0	See shift data.	N
RC04	3.0	See shift data.	Y

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Exploratory Hole	Groundwater level, m bgl	Comments	Groundwater Installation
			Y/N
RC07	3.0	See shift data.	Y
RC08	2.5	See shift data.	N
RC09	5.7	See shift data.	Y
RC09	6.0	See shift data.	
RC10	3.0	See shift data.	Y
RC11	2.5	See shift data.	N
RC12	3.5	See shift data.	Y
RC13	-	None encountered.	N
RC14	4.0	See shift data.	Y
TP01A	1.3	Fast flow rate.	N
TP02	-	None encountered.	N
TP02A	1.3	Fast flow rate.	N
TP02A	1.6	Fast flow rate.	N
TP03	-	None encountered.	N
TP04	2.4	Trickling flow rate.	N
TP05	2.0	Trickling flow rate.	N
TP06	-	None encountered	N
TP07	-	None encountered	N
TP08	-	None encountered	N
TP13	2.1	Steady flow rate.	N
TP14	-	None encountered	N
TP15	2.0	Slow flow rate.	N
TP16	1.9	Steady flow rate.	N
TP16	2.1	Steady flow rate.	N
TP17	-	None encountered	N
TP18	-	None encountered	N
TP19	2.3	Trickle of water	N
TP20	-	None encountered	N
TP21	-	None encountered	N
TP22	-	None encountered	N
TP23	1.8	Trickle flow rate.	N
TP24	-	None encountered	N
TP25	-	None encountered	N
TP26	-	None encountered	N
TP27	1.8	Steady flow rate.	N
TP28	-	None encountered.	N
TP29	-	None encountered.	N
TP30	-	None encountered.	N

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Exploratory Hole	Groundwater level, m bgl	Comments	Groundwater Installation
			Y/N
TP31	-	None encountered.	N
TP32	-	None encountered	N
TP33	-	None encountered	N
TP34	-	None encountered	N
TP35	-	None encountered	N
TP36	2.4	Trickle flow rate.	N

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5 SUMMARY

1. Fourteen (14) cable percussion boreholes, fourteen (14) rotary boreholes and thirty three (33) trial pit excavations were carried out during the period of works. The exploratory logs are presented in **APPENDIX A** of this factual report.

2. The ground conditions encountered are presented on the exploratory holes logs in **APPENDIX A** of this factual report.

3. Groundwater is summarised in section 4 of this factual report. Groundwater strikes and drilling shift data relating to groundwater is detailed on the exploratory logs in **APPENDIX A**.

4. A total of eighty seven (87) *in-situ* hand vane tests were carried out to assess shear strength (kPa) in trial pit excavations. The data was presented on the relevant logs in **APPENDIX A**, herein.

5. Ninety four (94) number standard penetration tests, N_{SPT} values, were carried out in the cable percussion (35Nr.) and rotary (59Nr.) boreholes. The data was presented on the relevant logs in **APPENDIX A** and presented graphically within this report.

6. Seven (7) number 50mm HDPE diameter standpipe installations were constructed to allow for groundwater monitoring. The standpipe details are presented graphically on the relevant borehole logs in **APPENDIX A**.

7. Sixteen (16) *in situ* dynamic probes (UK DCP) were undertaken using the Transport Research laboratory, TRL probe. The dynamic probe logs were presented along with the corresponding exploratory records in **APPENDIX A**.

8. Laboratory testing was undertaken to determine the classification and engineering characteristics of the soil and rock encountered during the ground investigation. The data is presented in **APPENDIX B**.

9. The locations are shown on the Exploration Location Layout and Plans (dwg: P19026-SI-A, and P19026-SI-01 to P19026-SI-07) are presented in **APPENDIX C** of this factual report.

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APPENDIX A

EXPLORATORY HOLE AND PHOTOGRAPHIC RECORDS

Type	Remarks
Cable Percussion Boreholes	BH01, BH02, BH03, BH04, BH04A, BH07, BH08, BH10, BH11, BH12, BH13 and BH14.
Rotary Boreholes	RC01, RC02, RC03, RC04, RC07, RC08, RC09, RC10, RC11, RC12, RC13 and RC14.
Trial Pits	TP01A, TP02, TP02A, TP03, TP04, TP05, TP06 TP07, TP08, TP13, TP14, TP15, TP16, TP17, TP18, TP19, TP20, TP21,TP22, TP23, TP24 TP25, TP26, TP27, TP28, TP29, TP30, TP31 TP32, TP33, TP34, TP35 and TP36.

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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^o 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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Drilled By:	Borehole No.
JC	**BH01**
Logged By:	Sheet 1 of 1
OD	

Project Name:	N52 Grange to Clontail	**Project No.** P19026	**Co-ords:**	683639E - 782759N	**Hole Type** CP
Location:	Co. Meath		**Level:**	68.41m OD	**Scale** 1:50
Client:	Meath County Council		**Date:**	31/05/2019 - 31/05/2019	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
					0.30	68.11		(TOPSOIL)
		0.50 - 1.00	B					Soft, brown, slightly sandy slightly gravelly SILT with some roots. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded.
		1.20	SPT (C)	N=7 (5,4/2,1,2,2)				
		1.50 - 1.95	U		1.40	67.01		Stiff, grey, slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded with cobble content.
		1.50 - 2.00	B					
		2.20	SPT (C)	N=28 (3,4/5,7,8,8)				
		2.50 - 3.00	B					
		3.00	SPT (C)	N=34 (4,6/5,7,10,12)				
		3.70	SPT (C)	50 (25 for 0mm/50 for 0mm)	3.70	64.71		End of Borehole at 3.700m

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)
3.70	200	200

Equipment: Dando 2000.

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
3.70	3.70	01:00	Chisel.

Remarks:

Borehole terminated at 3.70m bgl due to obstruction.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	31/05/2019 08:00	0.00	Start of shift.
Dry.	31/05/2019 18:00	3.70	End of borehole.

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Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 683639E - 782759N		**Hole Type** Rotary open hole
Location: Co. Meath		**Level:** 68.41m OD		**Scale** 1:50
Client: Meath County Council		**Dates:** 19/08/2019	19/08/2019	

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description
										Cable tool rig borehole depth. Refer to BH01 for detailed overburden description..
		1.00	D							
		2.00	D							
		3.00	D							
	▼									
							3.70	64.71		Open hole boring. Driller described: slightly sandy gravelly CLAY.
		5.00 - 5.50 N=19 (3,5/5,5,3,6) (C)	B				5.00	63.41		Open hole boring. Grey, slightly gravelly sandy SILT. Sand is fine to coarse. Gravel is fine to coarse.
							5.50	62.91		Open hole boring. Driller described: slightly sandy gravelly CLAY.
		6.00 - 6.30 N=23 (4,6/6,5,6,6) (C)	B				6.00 6.30	62.41 62.11		Open hole boring. Grey, slightly gravelly sandy SILT. Sand is fine to coarse. Gravel is fine to coarse and angular. Open hole boring. Driller described: slightly clayey sandy GRAVEL.
		N=27 (6,6/8,6,6,7) (C)								

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
3.50				See shift data.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
12.00	131	131

Equipment:	Soilmech PSM.
Method:	Compressed air mist.

Remarks:

Borehole terminated at 12.00m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	19/08/2019 08:00	0.00	Start of shift.
3.0	19/08/2019 18:00	12.00	End of borehole.

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Project Name:	N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 683639E - 782759N	**Hole Type** Rotary open hole
Location:	Co. Meath		**Level:** 68.41m OD	**Scale** 1:50
Client:	Meath County Council		**Dates:** 19/08/2019	19/08/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description
		N=42 (8,8/9,11,11,11) (C)								Open hole boring. Driller described: slightly clayey sandy GRAVEL.
		39 (6,8/39 for 135mm) (C)								
		N=43 (9,10/9,11,11,12) (C)					12.00	56.41		End of Borehole at 12.000m

10 11 12 13 14 15 16 17 18

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
3.50				See shift data.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
12.00	131	131

Equipment:	Soilmech PSM.
Method:	Compressed air mist.

Remarks:

Borehole terminated at 12.00m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	19/08/2019 08:00	0.00	Start of shift.
3.0	19/08/2019 18:00	12.00	End of borehole.

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Drilled By:	Borehole No.
JC	**BH02**
Logged By:	Sheet 1 of 1
OD	

Project Name:	N52 Grange to Clontail	**Project No.** P19026	**Co-ords:**	683673E - 782780N	**Hole Type** CP
Location:	Co. Meath		**Level:**	67.30m OD	**Scale** 1:50
Client:	Meath County Council		**Date:**	30/05/2019 - 30/05/2019	

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		0.30	67.00		(TOPSOIL)
		1.20	SPT (C)	N=25 (3,3/4,6,7,8)				Medium dense, brown grey, clayey very sandy GRAVEL with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 200mm dia, sub-angular to sub-rounded.
		1.50 - 2.00	B					
		2.00	SPT (C)	N=20 (4,3/5,4,5,6)				
		2.50 - 3.00	B					
		3.00	SPT (C)	N=16 (4,4/3,5,4,4)				
		4.00	SPT (C)	N=28 (12,10/9,5,6,8)				
		4.60	SPT (C)	50 (25 for 0mm/50 for 0mm)	4.60	62.70		End of Borehole at 4.600m

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)
4.60	200	200

Equipment: Dando 2000.

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
3.80	3.97	00:30	Chisel.
4.60	4.60	01:00	Chisel.

Remarks:

Borehole terminated at 4.60m bgl due to refusal.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	30/05/2019 08:00	0.00	Start of shift.
Dry.	30/05/2019 18:00	4.60	End of borehole.

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Drilled By:	Borehole No.
GW	**RC02**
Logged By:	Sheet 1 of 2
OD	

Project Name:	N52 Grange to Clontail	**Project No.** P19026	**Co-ords:**	683673E - 782780N	**Hole Type** Rotary open hole
Location:	Co. Meath		**Level:**	67.30m OD	**Scale** 1:50
Client:	Meath County Council		**Dates:**	16/08/2019	16/08/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description
										Cable tool rig borehole depth. Refer to BH02.
							4.60	62.70		Open hole boring. Driller described: Medium dense, sandy Gravel.
	▼	N=21 (5,5/4,5,6,6) (C)								
		N=17 (3,5/3,4,4,6) (C)					7.50	59.80		Open hole boring. Driller described: Medium dense, slightly silty sandy Gravel.

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
6.00				See shift data.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
12.00	131	131

Equipment:	Soilmech PSM.
Method:	Compressed air mist.

Remarks:

Borehole terminated at 12.00m bgl. Piezo standpipe (19mm dia) installed from GL to 6.00. Piezo tip response zone from 5.70m to 6.00m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	16/08/2019 08:00	0.00	Start of shift.
6.0	16/08/2019 18:00	12.00	End of borehole.

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Project Name:	N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 683673E - 782780N	**Hole Type** Rotary open hole
Location:	Co. Meath		**Level:** 67.30m OD	**Scale** 1:50
Client:	Meath County Council		**Dates:** 16/08/2019	16/08/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description
		N=49 (8,10/11,11,14,13) (C)								Open hole boring. Driller described: Medium dense, slightly silty sandy Gravel.
		N=28 (5,5/6,6,7,9) (C)								
		N=29 (4,5/5,7,8,9) (C)					12.00	55.30		End of Borehole at 12.000m

10 11 12 13 14 15 16 17 18

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
6.00				See shift data.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
12.00	131	131

Equipment:	Soilmech PSM.
Method:	Compressed air mist.

Remarks:

Borehole terminated at 12.00m bgl. Piezo standpipe (19mm dia) installed from GL to 6.00. Piezo tip response zone from 5.70m to 6.00m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	16/08/2019 08:00	0.00	Start of shift.
6.0	16/08/2019 18:00	12.00	End of borehole.

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Drilled By:	Borehole No.
JC	**BH03**
Logged By:	Sheet 1 of 1
OD	

Project Name:	N52 Grange to Clontail	**Project No.** P19026	**Co-ords:**	683693E - 782780N	**Hole Type** CP
Location:	Co. Meath		**Level:**	68.51m OD	**Scale** 1:50
Client:	Meath County Council		**Date:**	30/05/2019 - 30/05/2019	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
		0.50 - 1.00	B					(MADE GROUND) Clayey sandy GRAVEL.
		1.20	SPT (C)	N=24 (6,7/8,5,5,6)	1.20	67.31		
		1.50 - 2.00	B					Medium dense, brown grey, clayey sandy GRAVELY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 150mm dia, sub-angular to sub-rounded.
		2.00	SPT (C)	N=26 (4,7/8,7,5,6)				
		2.50 - 3.00	B					
		3.00	SPT (C)	55 (4,10/55 for 225mm)				
					3.30	65.21		End of Borehole at 3.300m

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)
3.30	200	200

Equipment: Dando 2000.

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
3.30	3.30	01:00	Chisel.

Remarks:

Borehole terminated at 3.30m bgl due to obstruction.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	30/05/2019 08:00	0.00	Start of shift.
Dry.	30/05/2019 18:00	3.30	End of borehole.

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Project Name:	N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 683693E - 782780N	**Hole Type** Rotary open hole
Location:	Co. Meath		**Level:** 68.51m OD	**Scale** 1:50
Client:	Meath County Council		**Dates:** 12/08/2019	12/08/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description
										Open hole boring. Refer to BH03 for detailed overburden description.
	▼						3.30	65.21		
		N=14 (4,4/3,2,4,5) (C)								Open hole boring. Driller described: Medium dense, black, sandy GRAVEL.
		N=26 (3,5/5,6,7,8) (C)								
		N=24 (6,6/5,6,6,7) (C)					9.00	59.51		

1 2 3 4 5 6 7 8 9

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
3.00				See shift data.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
12.00	131	131

Equipment:	Soilemch PSM.
Method:	Compressed air mist.

Remarks:

Borehole terminated at 12.00m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	15/08/2019 08:00	0.00	Start of shift.
3.00	15/08/2019 18:00	12.00	End of borehole.

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Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 683693E - 782780N		**Hole Type** Rotary open hole
Location: Co. Meath		**Level:** 68.51m OD		**Scale** 1:50
Client: Meath County Council		**Dates:** 12/08/2019	12/08/2019	

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description
		N=23 (3,4/5,6,6,6) (C)								Open hole boring. Driller described: dense, slightly silty sandy GRAVEL.
		N=22 (5,5/4,5,6,7) (C)								
		N=26 (6,7/7,6,6,7) (C)					12.00	56.51		End of Borehole at 12.000m

10 11 12 13 14 15 16 17 18

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
3.00				See shift data.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
12.00	131	131

Equipment: Soilemch PSM.

Method: Compressed air mist.

Remarks:

Borehole terminated at 12.00m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	15/08/2019 08:00	0.00	Start of shift.
3.00	15/08/2019 18:00	12.00	End of borehole.

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Drilled By:	Borehole No.
JC	**BH04**
Logged By:	Sheet 1 of 1
N/A	

Project Name:	N52 Grange to Clontail	**Project No.** P19026	**Co-ords:**	684097E - 782960N	**Hole Type** CP
Location:	Co. Meath		**Level:**	59.85m OD	**Scale** 1:50
Client:	Meath County Council		**Date:**	29/05/2019 - 29/05/2019	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
					0.20	59.65		(TOPSOIL)
								Inspection pit. CLAY with cobble content.
					0.60	59.25		Inspection pit. Boulder.
					0.60	59.25		End of Borehole at 0.600m

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)
0.60		

Equipment: Dando 2000.

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks:

Borehole terminated on clients instruction due to obstruction on boulder.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	29/05/2019 08:00	0.00	Start of shift.
Dry.	29/05/2019 18:00	0.60	End of borehole.

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Drilled By:	Borehole No.
JC	**BH04A**
Logged By:	Sheet 1 of 1
OD	

Project Name:	N52 Grange to Clontail	**Project No.** P19026	**Co-ords:**	684096E - 782960N	**Hole Type** CP
Location:	Co. Meath		**Level:**	59.85m OD	**Scale** 1:50
Client:	Meath County Council		**Date:**	29/05/2019 - 29/05/2019	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
					0.20	59.65		(TOPSOIL)
		0.50 - 1.00	B					Brown, slightly sandy gravelly CLAY with some and coble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded.
		1.20	SPT (C)	50 (5,10/50 for 160mm)				
					1.40	58.45		End of Borehole at 1.400m

Groundwater:

Struck (m bgl)	Rose to	After (mins)	Sealed	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
1.40	200	200

Equipment: Dando 2000.

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
1.40	1.40	01:00	Chisel.

Remarks:

Borehole terminated at 1.40m bgl due to obstruction.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	29/05/2019 08:00	0.00	Start of shift.
Dry.	29/05/2019 18:00	1.40	End of borehole.

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Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 684097E - 782960N		**Hole Type** Rotary cored
Location: Co. Meath		**Level:** 59.85m OD		**Scale** 1:50
Client: Meath County Council		**Dates:** 26/08/2019	26/08/2019	

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 rig borehole depth. Refer to BH04.
		1.00	D							
							1.40	58.45		Open hole boring. Driller described: Medium dense, slightly clayey sandy GRAVEL
	▼	N=25 (6,8/5,5,7,8) (C)								
		~~N=47~~ (3,3/5,6,16,20) (C)					4.50	55.35		Core run attempted. Poor recovery. Driller described: angular sandy clayey GRAVEL. *4.50m - 6.00m: Not intact with clay infill*
		4.50 - 6.00	10mm 90mm 60mm	47	7	0				
		~~0 (44 for 85mm/0~~ for 0mm) (C)					6.00	53.85		Open hole boring. Driller described: Slightly sandy gravelly CLAY.
		~~0 (75 for 0mm/0~~ for 0mm) (C)					6.50	53.35		Lithology: Strong, green, fine to medium SANDSTONE.
		6.50 - 7.70	20mm 200mm 110mm	100	83	0	14/m			Weathering: Brown/orange discoloration of fracture surfaces. Fractures: Main set dips 30 to 45 degrees, with close spacing and planar rough fracture surface texture. 2nd set dips 80 to 90 degrees, with close to medium spacing and planar rough fracture surface texture.
		7.70 - 8.40	20mm 160mm 80mm	100	43	0				
		8.40 - 9.40	20mm	100	10	0				Detail: Quartz veining throughout. *6.80m - 7.00m: Not intact* *8.40m - 9.40m: Not intact*

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
3.00				See shift data.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
11.90	76	131

Equipment:	Soilmech PSM.
Method:	Compressed air mist.

Remarks:

Borehole terminated at 11.90m bgl Piezo standpipe (19mm dia) installed from GL to 3.30m bgl. Response zone from 3.00m to 3.30m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	26/08/2019 08:00	0.00	Start of shift.
3.0	26/08/2019 18:00	11.90	End of borehole.

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Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 684097E - 782960N	**Hole Type** Rotary cored
Location: Co. Meath		**Level:** 59.85m OD	**Scale** 1:50
Client: Meath County Council		**Dates:** 26/08/2019	26/08/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / FI (/m)	Level (mOD)	Legend	Stratum Description
			120mm 80mm							Lithology: Strong, green, fine to medium SANDSTONE. Weathering: Brown/orange discoloration of fracture surfaces. Fractures: Main set dips 30 to 45 degrees, with close spacing and planar rough fracture surface texture. 2nd set dips 80 to 90 degrees, with close to medium spacing and planar rough fracture surface texture. Detail: Quartz veining throughout.
		9.40 - 10.40	40mm 200mm 100mm	100	53	10	12/m			
		10.40 - 11.20	20mm 150mm 100mm	100	100	0	11/m			
		11.20 - 11.90	20mm 320mm 190mm	100	100	64	7/m			
							11.90	47.95		End of Borehole at 11.900m

10 11 12 13 14 15 16 17 18

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
3.00				See shift data.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
11.90	76	131

Equipment: Soilmech PSM.

Method: Compressed air mist.

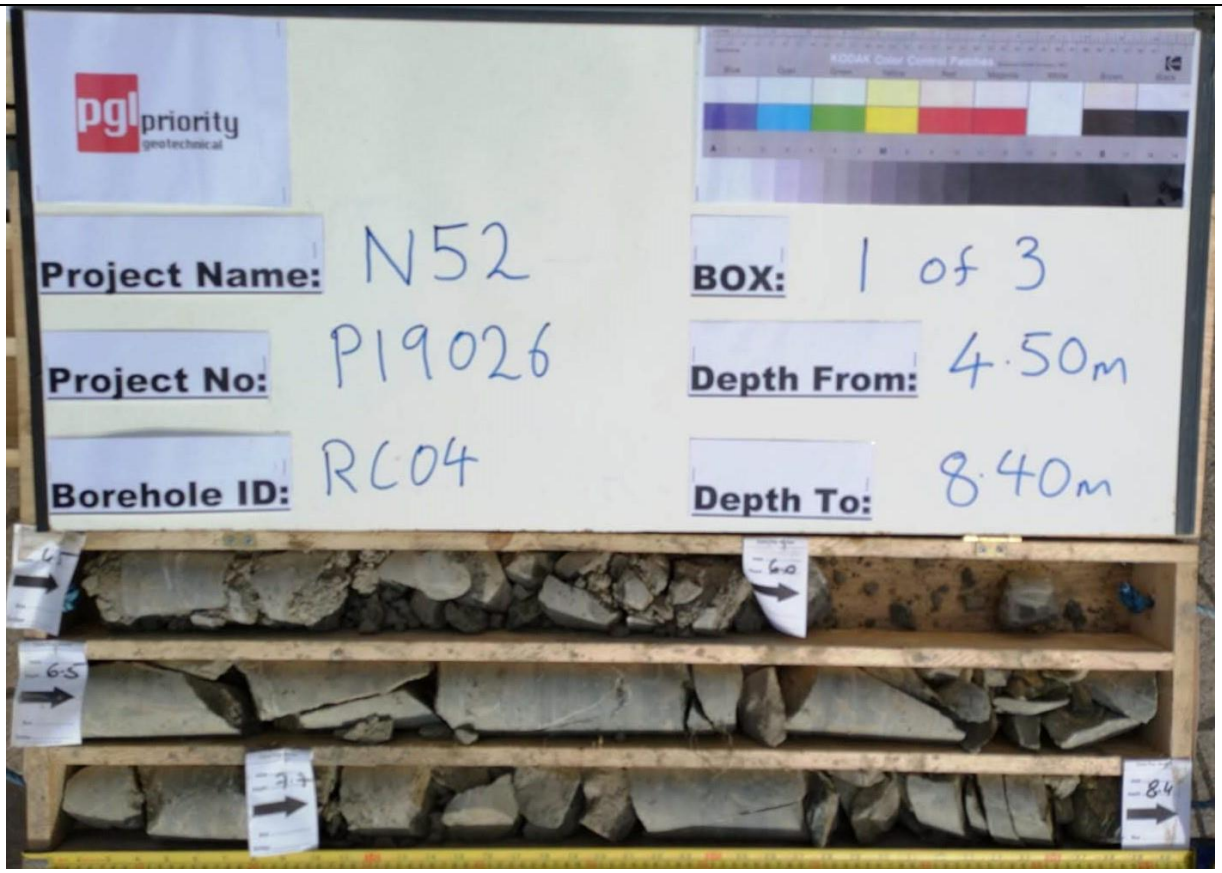
Remarks:

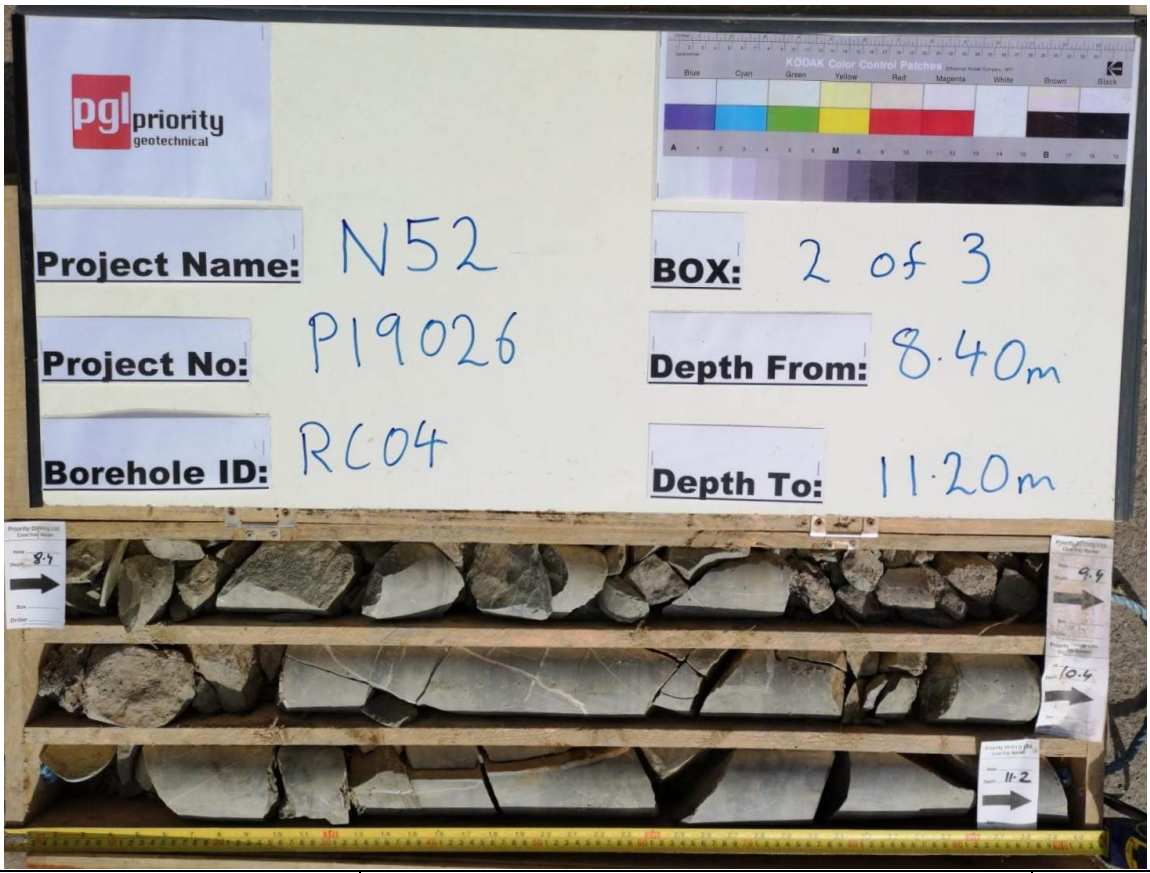
Borehole terminated at 11.90m bgl Piezo standpipe (19mm dia) installed from GL to 3.30m bgl. Response zone from 3.00m to 3.30m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	26/08/2019 08:00	0.00	Start of shift.
3.0	26/08/2019 18:00	11.90	End of borehole.

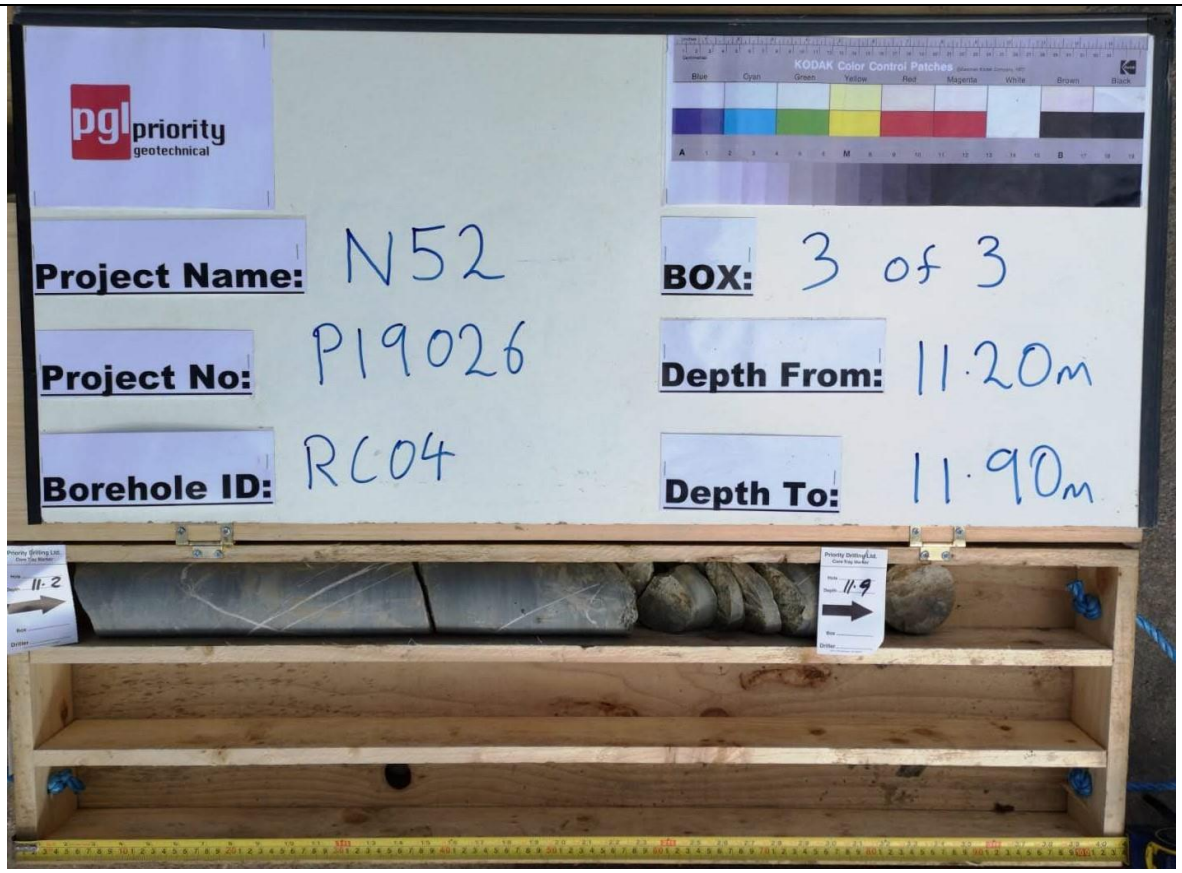
Photographic Record





Number:	**RC04**	**Project** N52 Grange to Clontail Scheme **Project No** P19026 **Engineer** Atkins	

Photographic Record



Number:	**RC04**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Drilled By:	Borehole No.
JC	**BH07**
Logged By:	Sheet 1 of 1
OD	

Project Name:	N52 Grange to Clontail	**Project No.** P19026	**Co-ords:**	684693E - 783232N	**Hole Type** CP
Location:	Co. Meath		**Level:**	51.37m OD	**Scale** 1:50
Client:	Meath County Council		**Date:**	28/05/2019 - 28/05/2019	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
					0.30	51.07		(TOPSOIL)
		0.50 - 1.00	B					Brown, slightly sandy gravelly SILT with roots and low cobble content. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 150mm dia, sub-angular.
		1.20 - 1.65 1.20	U SPT (C)	N=11 (2,3/3,2,3,3)	1.20	50.17		Firm to stiff, brown slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 100mm dia, sub-rounded.
		1.50 - 2.00	B					
		2.50 - 3.00	B					
		3.00	SPT (C)	N=34 (4,5/5,8,10,11)				
		3.60	SPT (C)	50 (25 for 0mm/50 for 0mm)	3.60	47.77		End of Borehole at 3.600m

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)
3.60	200	200

Equipment: Dando 2000.

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
2.60	2.75	00:30	Chisel.
3.60	3.60	01:00	Chisel.

Remarks:

Borehole terminated at 3.60m bgl due to refusal.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	28/05/2019 08:00	0.00	Start of shift.
Dry.	28/05/2019 18:00	3.60	End of borehole.

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Drilled By:	Borehole No.
GW	**RC07**
Logged By:	Sheet 1 of 2
SR	

Project Name:	N52 Grange to Clontail	**Project No.** P19026	**Co-ords:**	684693E - 783232N	**Hole Type** Rotary cored
Location:	Co. Meath		**Level:**	51.37m OD	**Scale** 1:50
Client:	Meath County Council		**Dates:**	23/08/2019	23/08/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description
		1.00	D							Cable tool rig borehole depth. Refer to BH07 for detailed overburden description.
	▼	2.50	D							
		3.60 - 4.50		17	0	0	3.60	47.77		Open hole boring. Brown, slightly sandy gravelly SILT.
		~~N=38~~ (6,8/8,9,10,11) (C)					4.50	46.87		Open hole boring. Driller described: angular Gravel or very weathered rock.
							5.20	46.17		Open hole boring. Driller described: Rock. Assumed Sandstone lithology.
		~~50 (25 for 0mm/50 for 0mm)~~ (C)					5.50	45.87		Lithology: Strong, light grey, slightly calcareous SANDSTONE.
		5.50 - 7.00	22mm 310mm 240mm	95	95	63	8/m			Weathering: Slightly weathered with light staining/discoloration on some fracture surfaces.
		7.00 - 8.40	10mm 270mm 160mm	96	96	49	9/m			Fractures: Moderately fractured, though completely solid and intact. Main set dips 10 to 20 degrees, with very close to medium spacing and undulate rough fracture surface texture. 2nd set dips 45 to 60 degrees, with close to wide spacing and undulate rough fracture surface texture.
		8.40 - 9.40	5mm	100	100	35	9/m			Detail: Minor veining throughout.

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
3.00				See shift data.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
9.40	76	131

Equipment:	Soilmech PSM.
Method:	Compressed air mist.

Remarks:

Borehole terminated at 9.40m bgl. Standpipe (50mm dia) installed from GL to 9.40m bgl. Response zone from 1.00m to 9.40m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	23/08/2019 08:00	0.00	Start of shift.
	23/08/2019 18:00	9.40	End of borehole.

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Project Name:	N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 684693E - 783232N	**Hole Type** Rotary cored
Location:	Co. Meath		**Level:** 51.37m OD	**Scale** 1:50
Client:	Meath County Council		**Dates:** 23/08/2019	23/08/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description
			290mm 110mm				9.40	41.97		Lithology: Strong, light grey, slightly calcareous SANDSTONE. Weathering: Slightly weathered with light staining/discoloration on some fracture surfaces. Fractures: Moderately fractured, though completely solid and intact. Main set dips 10 to 20 degrees, with very close to medium spacing and undulate rough fracture surface texture. 2nd set dips 45 to 60 degrees, with close to wide spacing and undulate rough fracture surface texture. Detail: Minor veining throughout. End of Borehole at 9.400m

10 11 12 13 14 15 16 17 18

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
3.00				See shift data.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
9.40	76	131

Equipment:	Soilmech PSM.
Method:	Compressed air mist.

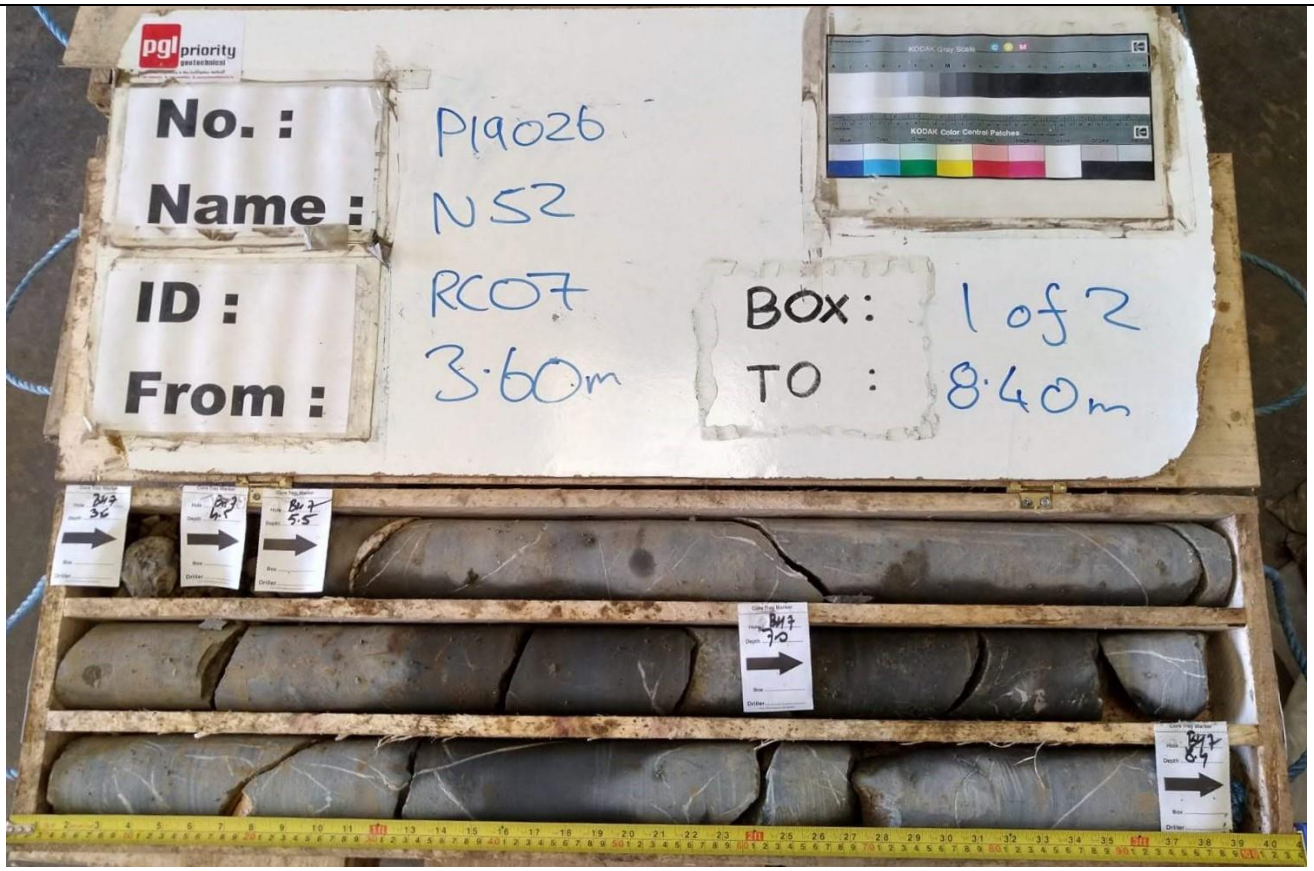
Remarks:

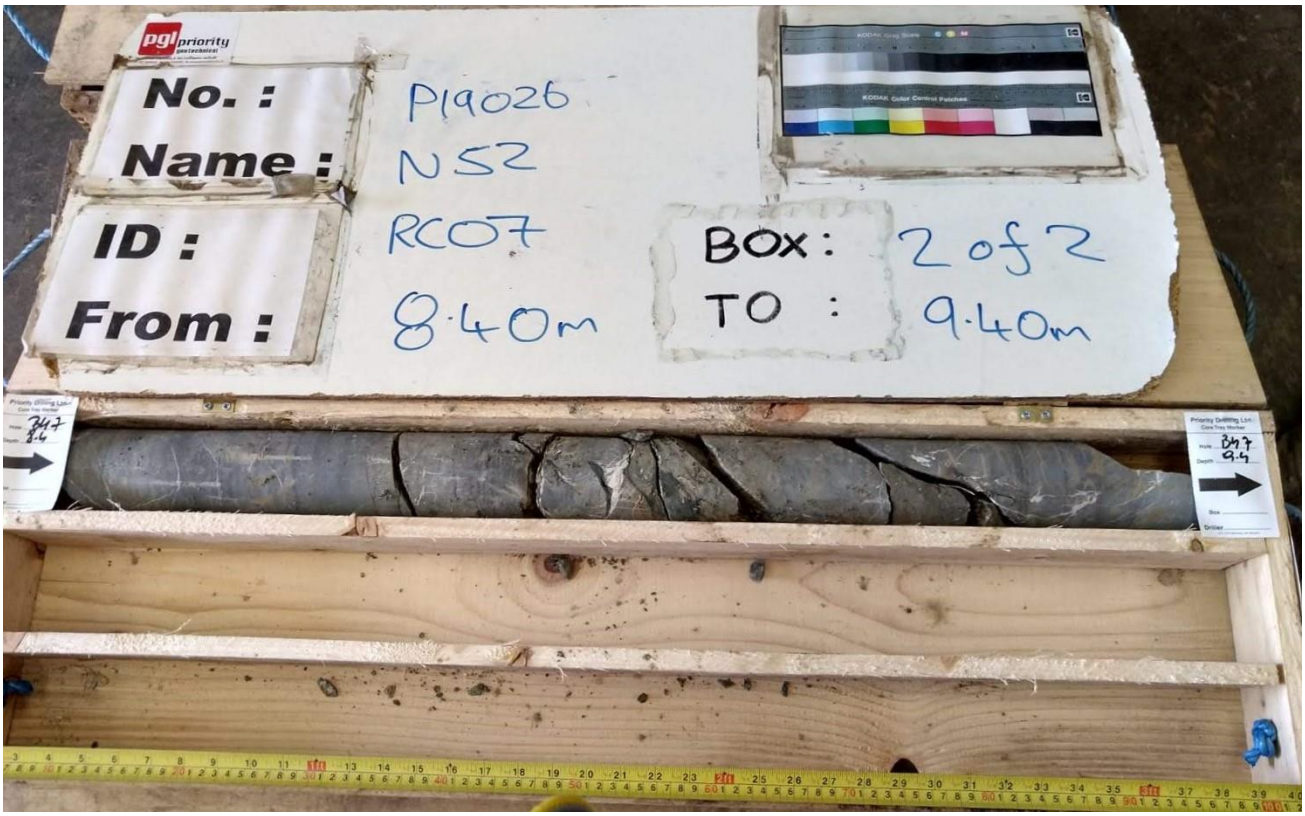
Borehole terminated at 9.40m bgl. Standpipe (50mm dia) installed from GL to 9.40m bgl. Response zone from 1.00m to 9.40m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	23/08/2019 08:00	0.00	Start of shift.
	23/08/2019 18:00	9.40	End of borehole.

Photographic Record





Number:	**RC07**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

Photographic Record

Number:	**RC07**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Drilled By:	Borehole No.
JC	**BH08**
Logged By:	Sheet 1 of 1
OD	

Project Name:	N52 Grange to Clontail	**Project No.** P19026	**Co-ords:**	684901E - 783353N	**Hole Type** CP
Location:	Co. Meath		**Level:**	51.10m OD	**Scale** 1:50
Client:	Meath County Council		**Date:**	29/05/2019 - 29/05/2019	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
					0.30	50.80		(TOPSOIL)
		0.50 - 1.00	B					Stiff, light brown grey, slightly sandy slightly 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 120mm dia, sub-angular to sub-rounded.
		1.20	SPT (C)	N=44 (8,10/12,13,9,10)				
		1.50 - 2.00	B					
		2.00	SPT (C)	N=49 (4,8/9,12,15,13)				
		2.50 - 3.00	B					
		3.00	SPT (C)	N=55 (8,9/10,10,10,25)				
		3.40	SPT (C)	50 (25 for 0mm/50 for 0mm)	3.40	47.70		End of Borehole at 3.400m

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)
3.40	200	200

Equipment: Dando 2000.

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
1.30	1.46	00:30	Chisel.
2.40	2.57	00:30	Chisel.
3.40	3.40	01:00	Chisel.

Remarks:

Borehole terminated at 3.40m bgl due to refusal.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	29/05/2019 08:00	0.00	Start of shift.
Dry.	29/05/2019 18:00	3.40	End of borehole.

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Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 684901E - 783353N		**Hole Type** Rotary cored
Location: Co. Meath		**Level:** 51.10m OD		**Scale** 1:50
Client: Meath County Council		**Dates:** 22/08/2019	22/08/2019	

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description
		1.00	D							Cable tool rig borehole depth. Refer to BH08 for detailed overburden description.
	▼	2.50	D							
							3.40	47.70		Open hole boring. Driller described: sandy Gravel.
		0 (75 for 0mm/0 for 0mm) 4.50(C)5.00		100	60	0	4.30	46.80		Core run attempted. Brown, sandy gravelly SILT with cobble content. Cobble is Limestone lithology.
		0 (75 for 0mm/0 for 0mm) (C) 5.00 - 6.50		20	0	0	5.00	46.10		Core run attempted. Dark grey, slightly silty GRAVEL. Gravel is fine to coarse and angular to sub-angular.
		0 (75 for 0mm/0 for 0mm) (C) 6.50 - 8.00		17	0	0	6.50	44.60		Core run attempted. Grey, slightly gravelly COBBLES. Gravel is coarse and angular to sub-angular. Cobbles are 63mm to 80mm dia. angular to sub-angular and of Siltstone lithology.
		0 (75 for 0mm/0 for 0mm) (C) 8.00 - 9.00		40	5	0				
							9.00	42.10		

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
2.50				See shift data.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
12.00	76	131

Equipment: Soilmech PSM.

Method: Compressed air mist.

Remarks:

Borehole terminated at 12.00m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	22/08/2019 08:00	0.00	Start of shift.
2.5	22/08/2019 18:00	12.00	End of borehole.

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Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 684901E - 783353N	**Hole Type** Rotary cored
Location: Co. Meath		**Level:** 51.10m OD	**Scale** 1:50
Client: Meath County Council		**Dates:** 22/08/2019	22/08/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / FI (/m)	Level (mOD)	Legend	Stratum Description
		0 (75 for 0mm/0 for 0mm) (C) 9.00 - 10.40	30mm 180mm 100mm	43	29	18	5/m			Lithology: Strong, grey, SILTSTONE. Weathering: Moderate to distinctly weathered with heavy clay smear on some fracture surfaces. Fractures: Moderately fractured. 1st set dips 5 to 15 degrees, with very close to close spacing and undulate rough fracture surface texture. 2nd set dips 60 degrees, with wide spacing and undulate rough fracture surface texture.
		~~0 (75 for 0mm/0~~ for 0mm) (C) 10.40 - 12.00		44	3	0	10.40	40.70		Weathered SILTSTONE. Recovered as: Grey, slightly gravelly COBBLES. Gravel is medium to coarse and angular to sub-angular. Cobbles are 63mm to 120mm dia. angular to sub-angular..
							12.00	39.10		End of Borehole at 12.000m

10 11 12 13 14 15 16 17 18

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
2.50				See shift data.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
12.00	76	131

Equipment: Soilmech PSM.

Method: Compressed air mist.

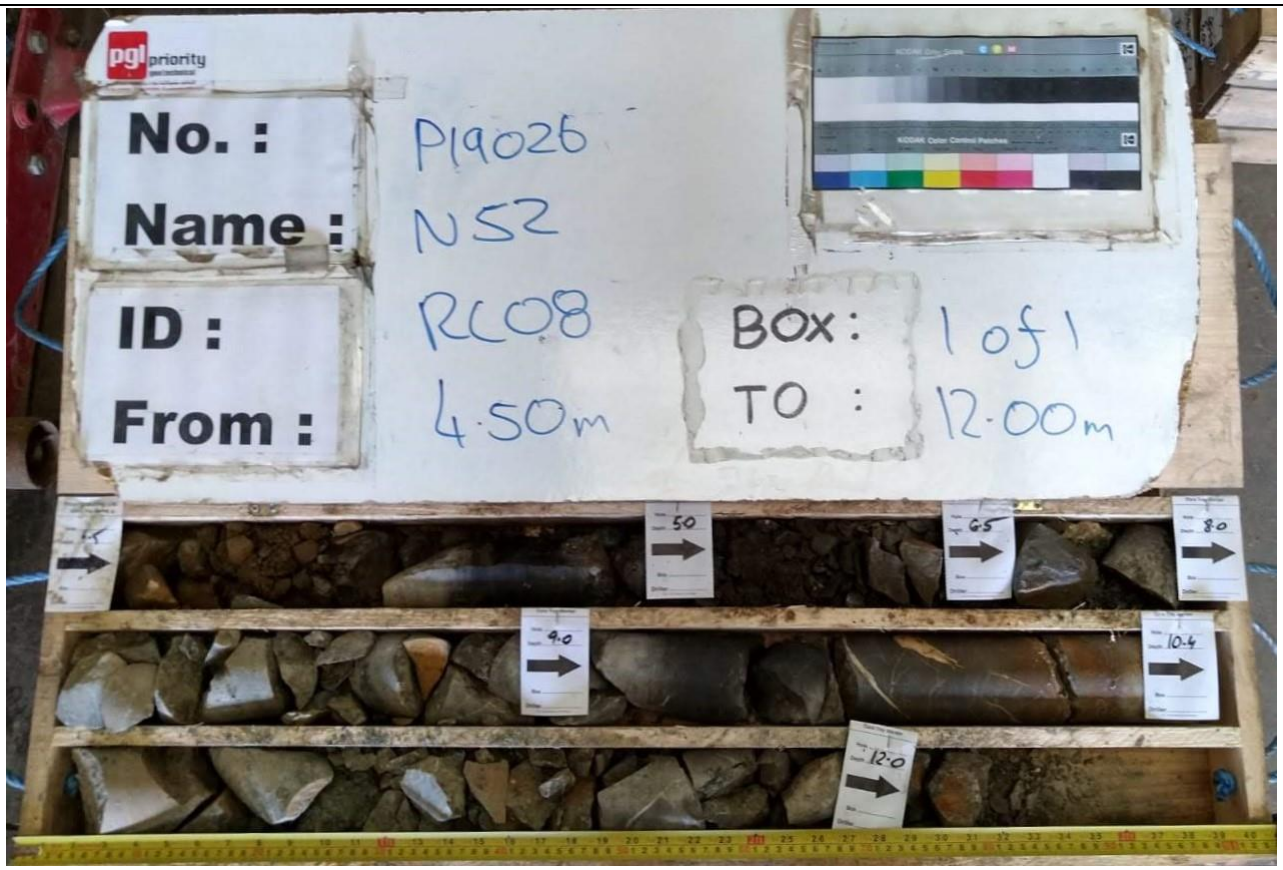
Remarks:

Borehole terminated at 12.00m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	22/08/2019 08:00	0.00	Start of shift.
2.5	22/08/2019 18:00	12.00	End of borehole.

Photographic Record



Number:	**RC08**	**Project** **Project No** **Engineer**	N52 Grange to Clontail Scheme P19026 Atkins	

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Drilled By:	Borehole No.
GW	**RC09**
Logged By:	Sheet 1 of 2
SR	

Project Name:	N52 Grange to Clontail	**Project No.** P19026	**Co-ords:**	685020E - 783359N	**Hole Type** Rotary cored
Location:	Co. Meath		**Level:**	57.87m OD	**Scale** 1:50
Client:	Meath County Council		**Dates:**	21/08/2019	21/08/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description
							0.90	56.97		Open hole boring. Driller described: sandy Clay.
		0 (42 for 75mm/0 for 0mm) (S)					3.00	54.87		Brown grey, slightly sandy gravelly SILT with cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded and of Limestone lithology. Cobbles are 63mm to 150mm dia, sub-angular and of Limestone lithology.
		3.00 - 4.60		17	0	0	4.60	53.27		Core run attempted. Poor recovery. Recovered as: Brown, slightly sandy gravelly SILT with cobble content.
	▼ ▼						6.50	51.37		Brown grey, slightly sandy gravelly SILT with cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded and of Limestone lithology. Cobbles are 63mm to 150mm dia, sub-angular and of Limestone lithology.
		6.50 - 8.00		23	0	0				Core run attempted. Poor recovery: Recovered as: Brown grey, slightly sandy gravelly SILT with cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded and of Limestone lithology. Cobbles are 63mm to 150mm dia, sub-angular and of Limestone lithology.
		8.00 - 9.50		10	10	7				

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
5.70				
6.00				

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
11.00	76	131

Equipment:	Soilmech PSM.
Method:	Compressed air mist.

Remarks:

Borehole terminated at 11.00m bgl. Standpipe (50mm dia) installed from GL to 11.00m bgl. Response zone from 1.00m to 11.00m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	21/08/2019 08:00	0.00	Start of shift.
	21/08/2019 18:00	11.00	End of borehole.

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Project Name:	N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 685020E - 783359N	**Hole Type** Rotary cored
Location:	Co. Meath		**Level:** 57.87m OD	**Scale** 1:50
Client:	Meath County Council		**Dates:** 21/08/2019	21/08/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description
		9.50 - 11.00		27	0	0	11.00	46.87		Core run attempted. Poor recovery: Recovered as: Brown grey, slightly sandy gravelly SILT with cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded and of Limestone lithology. Cobbles are 63mm to 150mm dia, sub-angular and of Limestone lithology.
										End of Borehole at 11.000m

10 11 12 13 14 15 16 17 18

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
5.70				
6.00				

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
11.00	76	131

Equipment:	Soilmech PSM.
Method:	Compressed air mist.

Remarks:

Borehole terminated at 11.00m bgl. Standpipe (50mm dia) installed from GL to 11.00m bgl. Response zone from 1.00m to 11.00m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	21/08/2019 08:00	0.00	Start of shift.
	21/08/2019 18:00	11.00	End of borehole.

Photographic Record

Number:	**RC09**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Drilled By:	Borehole No.
JC	**BH10**
Logged By:	Sheet 1 of 1
OD	

Project Name:	N52 Grange to Clontail	**Project No.** P19026	**Co-ords:**	685390E - 783474N	**Hole Type** CP
Location:	Co. Meath		**Level:**	52.63m OD	**Scale** 1:50
Client:	Meath County Council		**Date:**	28/05/2019 - 28/05/2019	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
					0.30	52.33		(TOPSOIL)
		0.50 - 1.00	B					Brown grey, slightly gravelly sandy SILT with some plant material.
		1.20	SPT (C)	N=40 (8,10/12,10,9,9)	1.20	51.43		
		1.50 - 2.00	B					Firm to stiff, brown grey black, slightly gravelly sandy SILT with medium to high cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 100mm dia, sub-angular to sub-rounded.
		2.00	SPT (C)	N=13 (2,3/3,4,3,3)				
	▼	2.50 - 3.00	B					
	▽	3.00	SPT (C)	N=39 (4,5/7,8,10,14)				
		3.50	SPT (C)	50 (25 for 0mm/50 for 0mm)				End of Borehole at 3.500m
					4.00	48.63		

1 2 3 4 5 6 7 8 9

Groundwater:

Struck (m bgl)	Rose to	After (mins)	Sealed	Comment
3.00	2.70	20		See shift data.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
3.50	200	200

Equipment: Dando 2000.

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
1.30	1.45	00:30	Chisel.
3.20	3.42	00:30	Chisel.
3.50	3.50	01:00	Chisel.

Remarks:

Borehole terminated at 3.50m bgl due to refusal.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	28/05/2019 08:00	0.00	Start of shift.
1.80	28/05/2019 18:00	3.50	End of borehole.

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Drilled By:	Borehole No.
GW	**RC10**
Logged By:	Sheet 1 of 2
SR	

Project Name:	N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 685390E - 783474N	**Hole Type** Rotary cored
Location:	Co. Meath		**Level:** 52.63m OD	**Scale** 1:50
Client:	Meath County Council		**Dates:** 20/08/2019	20/08/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / FI (/m)	Level (mOD)	Legend	Stratum Description
		1.00	D							Cable tool rig borehole depth. Refer to BH10 for detailed overburden description.
		2.00	D							
		4.00 - 5.00		20	0	0	4.00	48.63		Core run attempted: Recovered as: Slightly sandy gravelly CLAY with some boulder content. Boulders are of strong, grey, Limestone lithology with light to moderate clay smear on fracture surfaces.
		~~46 (6,6/46 for 190mm)~~ (C)								
		5.00 - 6.50		47	30	26	2/m			
		~~N=54~~ (7,8/13,16,10,15) (C)								
		6.50 - 8.00		13	0	0				
		~~0 (75 for 130mm/0 for 0mm)~~ (C)								

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
3.00				See shift data.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
10.00	131	131

Equipment:	Soilmech PSM.
Method:	Compressed air mist.

Remarks:

Borehole terminated at 10.00m bgl. Piezo standpipe (19mm dia) installed from GL to 3.30m bgl. Response zone from 3.00m to 3.30m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	20/08/2019 08:00	0.00	Start of shift.
3.0	20/08/2019 18:00	10.00	End of borehole.

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Project Name:	N52 Grange to Clontail	**Project No.** P19026	**Co-ords:**	685390E - 783474N	**Hole Type** Rotary cored
Location:	Co. Meath		**Level:**	52.63m OD	**Scale** 1:50
Client:	Meath County Council		**Dates:**	20/08/2019	20/08/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description
		N=61 (6,8/13,15,15,18) (C) 25 (9,20/25 for 0mm) (C)					10.00	42.63		Core run attempted: Recovered as: Slightly sandy gravelly CLAY with some boulder content. Boulders are of strong, grey, Limestone lithology with light to moderate clay smear on fracture surfaces. End of Borehole at 10.000m

10 11 12 13 14 15 16 17 18

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
3.00				See shift data.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
10.00	131	131

Equipment:	Soilmech PSM.
Method:	Compressed air mist.

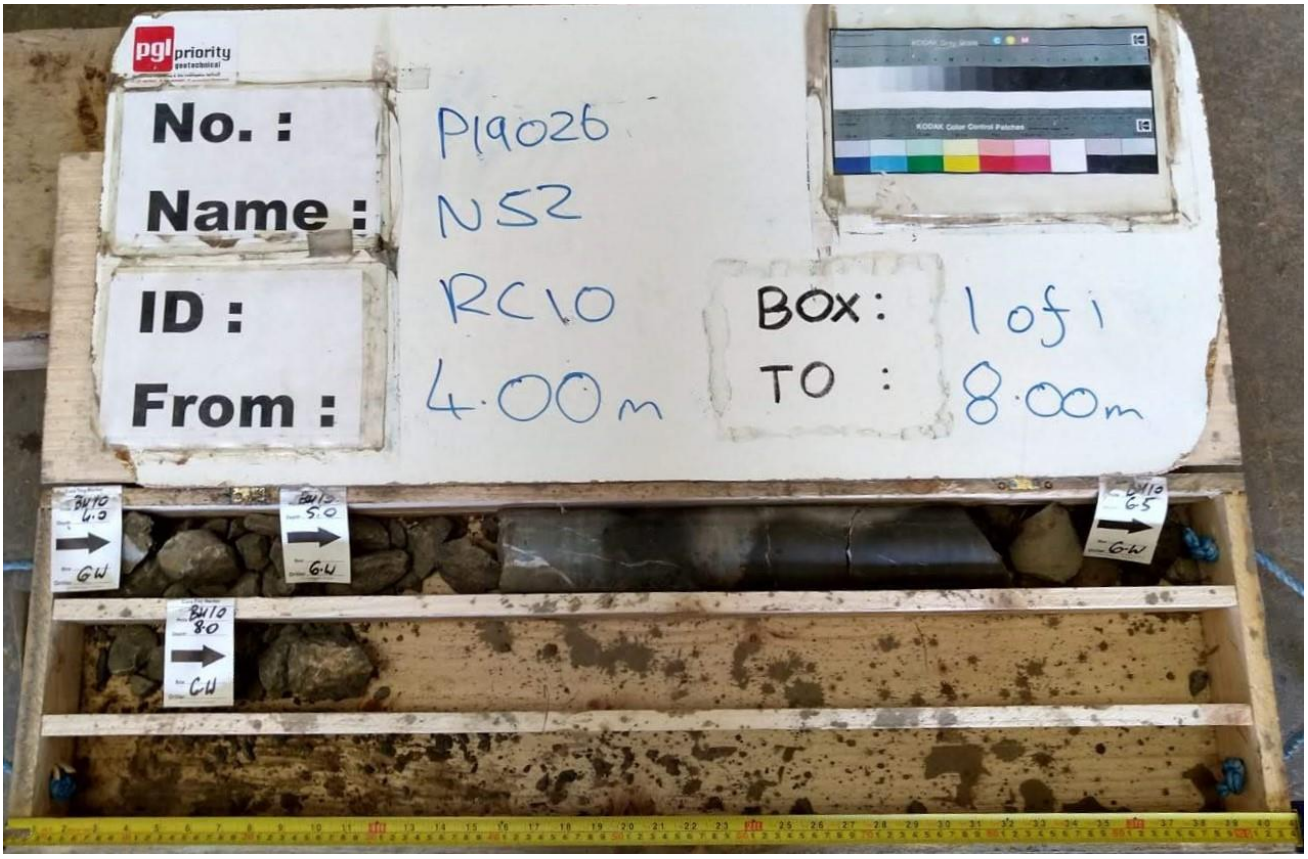
Remarks:

Borehole terminated at 10.00m bgl. Piezo standpipe (19mm dia) installed from GL to 3.30m bgl. Response zone from 3.00m to 3.30m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	20/08/2019 08:00	0.00	Start of shift.
3.0	20/08/2019 18:00	10.00	End of borehole.

Photographic Record



Number:	**RC10**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Drilled By:	Borehole No.
JC	**BH11**
Logged By:	Sheet 1 of 1
OD	

Project Name:	N52 Grange to Clontail	**Project No.** P19026	**Co-ords:**	685378E - 783503N	**Hole Type** CP
Location:	Co. Meath		**Level:**	50.76m OD	**Scale** 1:50
Client:	Meath County Council		**Date:**	30/05/2019 - 30/05/2019	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
					0.30	50.46		(TOPSOIL)
		0.50 - 1.00	B					Slightly gravelly sandy CLAY.
		1.20	SPT (C)	N=21 (5,4/7,6,4,4)	1.20	49.56		Slightly silty slightly sandy GRAVEL and COBBLES.
		1.50 - 2.00	B					
		2.00	SPT (C)	N=39 (6,7/8,7,10,14)				
		2.50 - 3.00	B					
		3.00	SPT (C)	N=35 (5,6/8,9,8,10)				
		3.50 - 4.00	B					
		4.00	SPT (C)	N=57 (7,9/10,12,15,20)				
		4.50	SPT (C)	50 (25 for 0mm/50 for 0mm)	4.50	46.26		End of Borehole at 4.500m

1 2 3 4 5 6 7 8 9

Groundwater:

Struck (m bgl)	Rose to	After (mins)	Sealed	Comment
1.20	0.60	20		See shift data.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
4.50	200	200

Equipment: Dando 2000.

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
2.40	2.58	00:30	Chisel.
4.50	4.50	01:00	Chisel.

Remarks:

Borehole terminated at 4.50m bgl due to refusal.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	30/05/2019 08:00	0.00	Start of shift.
1.00	30/05/2019 18:00	4.50	End of borehole.

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Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 685378E - 783503N		**Hole Type** Rotary cored
Location: Co. Meath		**Level:** 50.76m OD		**Scale** 1:50
Client: Meath County Council		**Dates:** 20/08/2019	21/08/2019	

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description
										Cable tool rig borehole depth. Refer to BH11 for detailed overburden description.
		1.00	D							
	▼									
							4.50	46.26		
										Open hole boring. Driller described: Sandy GRAVEL.
		~~N=39~~ (6,8/8,9,11,11) (C) 6.00 - 7.50		20	0	0	6.00	44.76		Open hole boring. Driller described: slightly sandy gravelly CLAY.
		~~50 (25 for 10mm/50 for 10mm)~~ (C) 7.50 - 9.00		40	16	7	1/m			

1 2 3 4 5 6 7 8 9

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
2.50				

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
10.00	76	131

Equipment:	Soilmech PSM.
Method:	Compressed air mist.

Remarks:

Borehole terminated at 10.00m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	20/08/2019 08:00	0.00	Start of shift.
2.5	20/08/2019 18:00	9.00	End of shift.
	21/08/2019 08:00	9.00	Start of shift.
	21/08/2019 18:00	10.00	End of borehole.

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Drilled By:	Borehole No.
GW	**RC11**
Logged By:	Sheet 2 of 2
SR	

Project Name:	N52 Grange to Clontail	**Project No.** P19026	**Co-ords:**	685378E - 783503N	**Hole Type** Rotary cored
Location:	Co. Meath		**Level:**	50.76m OD	**Scale** 1:50
Client:	Meath County Council		**Dates:**	20/08/2019	21/08/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description
		N=52 (13,10/10,12,15,15) (C)								Open hole boring. Driller described: slightly sandy gravelly CLAY.
		25 (6,16/25 for 70mm) (C)					10.00	40.76		End of Borehole at 10.000m

10 11 12 13 14 15 16 17 18

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
2.50				

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
10.00	76	131

Equipment:	Soilmech PSM.
Method:	Compressed air mist.

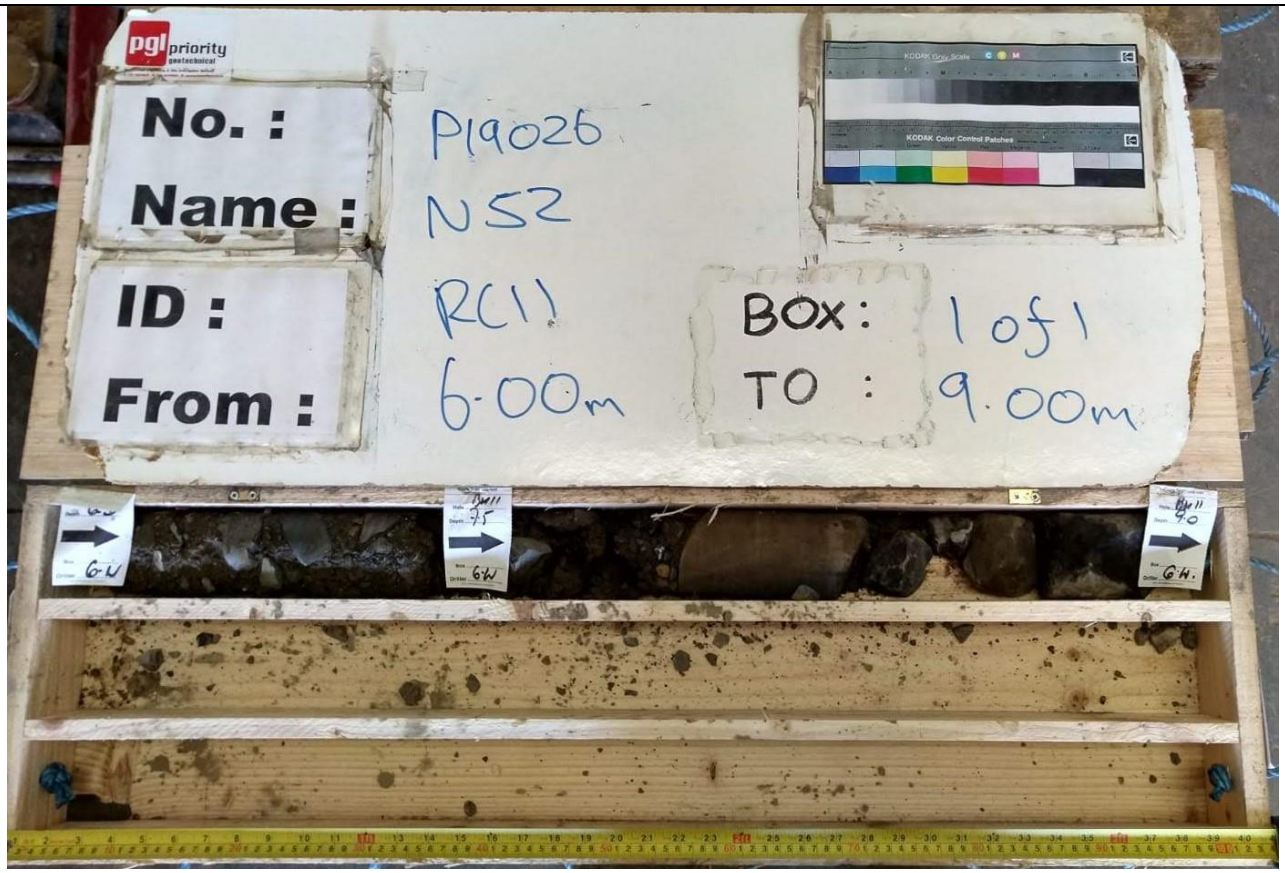
Remarks:

Borehole terminated at 10.00m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	20/08/2019 08:00	0.00	Start of shift.
2.5	20/08/2019 18:00	9.00	End of shift.
	21/08/2019 08:00	9.00	Start of shift.
	21/08/2019 18:00	10.00	End of borehole.

Photographic Record



Number:	**RC11**	**Project** **Project No** **Engineer**	N52 Grange to Clontail Scheme P19026 Atkins	

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Drilled By:	Borehole No.
JC	**BH12**
Logged By:	Sheet 1 of 1
OD	

Project Name:	N52 Grange to Clontail	**Project No.** P19026	**Co-ords:**	685785E - 783585N	**Hole Type** CP
Location:	Co. Meath		**Level:**	75.68m OD	**Scale** 1:50
Client:	Meath County Council		**Date:**	27/05/2019 - 27/05/2019	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
		0.50 - 1.00	B		0.30	75.38		(TOPSOIL)
								Light brown, slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 100mm dia, sub-rounded.
		1.20	SPT (C)	53 (4,5/53 for 180mm)	1.40	74.28		End of Borehole at 1.400m

Groundwater:

Struck (m bgl)	Rose to	After (mins)	Sealed	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
1.40	200	200

Equipment: Dando 2000.

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
1.40	1.40	01:00	Chisel.

Remarks:

Borehole terminated at 1.40m bgl due to obstruction.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	27/05/2019 08:00	0.00	Start of shift.
Dry.	27/05/2019 18:00	1.40	End of borehole.

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Drilled By:	Borehole No.
GW	**RC12**
Logged By:	Sheet 1 of 2
OD	

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 685785E - 783585N	**Hole Type** Rotary cored
Location: Co. Meath		**Level:** 75.68m OD	**Scale** 1:50
Client: Meath County Council		**Dates:** 14/08/2019	15/08/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description
		0.50	D							Open hole boring. Refer to BH12 for detailed overburden description.
		1.50 1.50 - 2.20 N=8 (1,0/1,2,2,3) (S)	B D				1.50	74.18		Open hole boring. Brown, slightly gravelly CLAY. Gravel is fine to coarse and sub-angular to sub-rounded.
							2.20	73.48		Open hole boring. Driller described: Slightly sandy gravelly CLAY with cobble content.
	▼	~~3.00~~ 38 (5,5/38 for 160mm) (S) 3.00 - 4.10	D	46	6	0	3.00	72.68		Core run attempted. Poor recovery. Recovered as: Slightly sandy gravelly CLAY with cobble content.
		~~0 (75 for 0mm/0~~ for 0mm) (C) 4.10 - 5.60	120mm 400mm 180mm	80	47	30	4.10 6/m 4.80	71.58 70.88		Core run attempted. Assumed Boulder. Recovered as: Grey, COBBLES. Limestone lithology.
		N=60 (16,9/10,14,18,18) (C) 5.60 - 7.20		13	0	0				Core run attempted. Poor recovery. Recovered as: Slightly sandy gravelly CLAY with cobble content.
		~~N=29~~ (3,3/5,8,8,8) (C) 7.20 - 8.80		19	4	0				
		~~0 (39 for~~ 125mm/0 for								

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
3.50				See shift data.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
12.20	76	131

Equipment:	Soilmch PSM.
Method:	Compressed air mist.

Remarks:

Borehole terminated at 12.20m bgl. Standpipe (50mm dia) installed from GL to 10.00m bgl. Response zone from 1.00m to 10.00m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	14/08/2019 08:00	0.00	Start of shift,
3.5	14/08/2019 18:00	5.60	End of shift.
	15/08/2019 08:00	5.60	Start of shift.
	15/08/2019 18:00	12.20	End of borehole.

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Project Name:	N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 685785E - 783585N	**Hole Type** Rotary cored
Location:	Co. Meath		**Level:** 75.68m OD	**Scale** 1:50
Client:	Meath County Council		**Dates:** 14/08/2019	15/08/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description
		0mm) (C) 8.80 - 10.20		14	0	0				Core run attempted. Poor recovery. Recovered as: Slightly sandy gravelly CLAY with cobble content.
		~~0 (75 for 20mm/0~~ for 0mm) (C) 10.20 - 11.00		19	13	13				
		~~0 (38 for~~ 135mm/0 for 0mm) (C) 11.00 - 12.20		0	0	0				
		~~25 (16,16/25 for~~ 0mm) (C)					12.20	63.48		End of Borehole at 12.200m

10 11 12 13 14 15 16 17 18

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
3.50				See shift data.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
12.20	76	131

Equipment:	Soilmch PSM.
Method:	Compressed air mist.

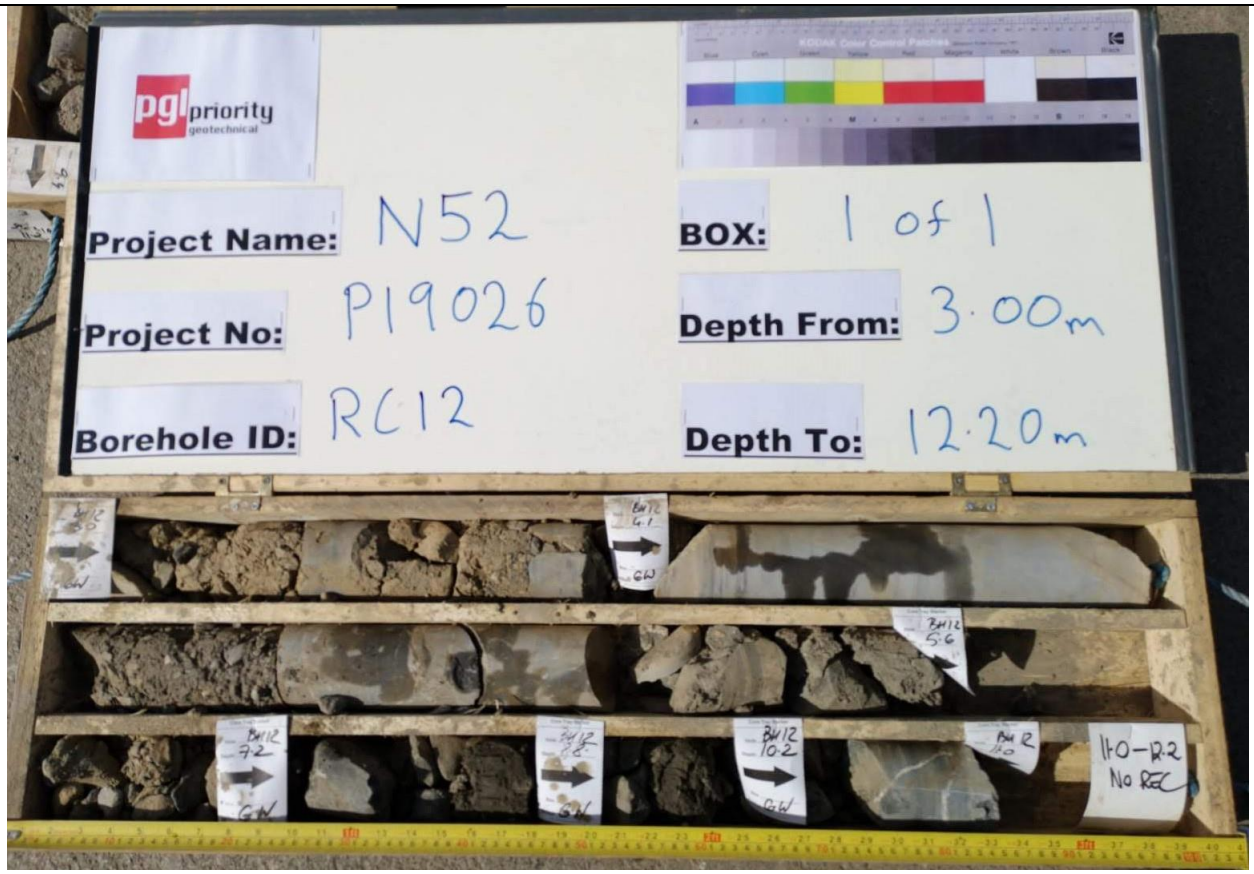
Remarks:

Borehole terminated at 12.20m bgl. Standpipe (50mm dia) installed from GL to 10.00m bgl. Response zone from 1.00m to 10.00m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	14/08/2019 08:00	0.00	Start of shift,
3.5	14/08/2019 18:00	5.60	End of shift.
	15/08/2019 08:00	5.60	Start of shift.
	15/08/2019 18:00	12.20	End of borehole.

Photographic Record



Number:	**RC12**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Project Name:	N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 685925E - 783659N	**Hole Type** CP
Location:	Co. Meath		**Level:** 74.83m OD	**Scale** 1:50
Client:	Meath County Council		**Date:** 27/05/2019 - 27/05/2019	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
					0.30	74.53		(TOPSOIL).
		0.50 - 1.00	B					Stiff, light brown, slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded.
		1.20	SPT (C)	N=21 (4,5/4,7,5,5)				
		1.50 - 2.00	B					
		2.00	SPT (C)	N=32 (4,4/5,5,6,16)				
		2.50	SPT (C)	50 (25 for 0mm/50 for 0mm)	2.50	72.33		End of Borehole at 2.500m

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)
2.50	200	200

Equipment: Dando 2000.

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
2.50	2.50	01:00	Chisel.

Remarks:

Borehole terminated at 2.50m bgl due to refusal.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	27/05/2019 08:00	0.00	Start of shift.
Dry.	27/05/2019 18:00	2.50	End of borehole.

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Project Name:	N52 Grange to Clontail	**Project No.** P19026	**Co-ords:**	685925E - 783659N	**Hole Type** Rotary cored
Location:	Co. Meath		**Level:**	74.83m OD	**Scale** 1:50
Client:	Meath County Council		**Dates:**	14/08/2019	14/08/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description
										Open hole boring. Refer to BH13 for detailed overburden description.
		~~50 (25 for 0mm/50 for 0mm)~~ (C) 1.50 - ~~2.00~~2.50	D	33	23	0	1.50 2.00	73.33 72.83		Open hole boring. Driller described: BOULDERS.
		N=24 (6,7/7,6,5,6) (C) 2.50 - 4.50		10	0	0				Core run attempted. Poor recovery. Recovered as: Slightly sandy gravelly CLAY with cobble and boulder content. Clasts are of Sandstone lithology.
		~~0 (42 for 85mm/0~~ for 0mm) (C) 4.50 - 6.10		81	6	0				
		~~N=64~~ (4,6/9,17,19,19) (C) 6.10 - 7.70		22	13	0				
		~~25 (3,6/25 for~~ 10mm) (C) 7.70 - 9.20		27	13	0				

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
				None encountered.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
12.10	76	131

Equipment:	Soilmech PSM.
Method:	Compressed air mist.

Remarks:

Borehole terminated at 12.10m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	14/08/2019 08:00	0.00	Start of shift.
Dry.	14/08/2019 18:00	12.10	End of borehole.

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Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 685925E - 783659N	**Hole Type** Rotary cored
Location: Co. Meath		**Level:** 74.83m OD	**Scale** 1:50
Client: Meath County Council		**Dates:** 14/08/2019	14/08/2019

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / FI (/m)	Level (mOD)	Legend	Stratum Description
		~~0 (41 for~~ 145mm/0 for 0mm) (C)								Core run attempted. Poor recovery. Recovered as: Slightly sandy gravelly CLAY with cobble and boulder content. Clasts are of Sandstone lithology.
		9.20 - 10.50		58	23	0				
		~~25 (14,21/25 for~~ 30mm) (C)								
		10.50 - 12.10		100	50	0				
		~~25 (12 for~~ 75mm/25 for 0mm) (C)					12.10	62.73		End of Borehole at 12.100m

10 11 12 13 14 15 16 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)
12.10	76	131

Equipment:	Soilmech PSM.
Method:	Compressed air mist.

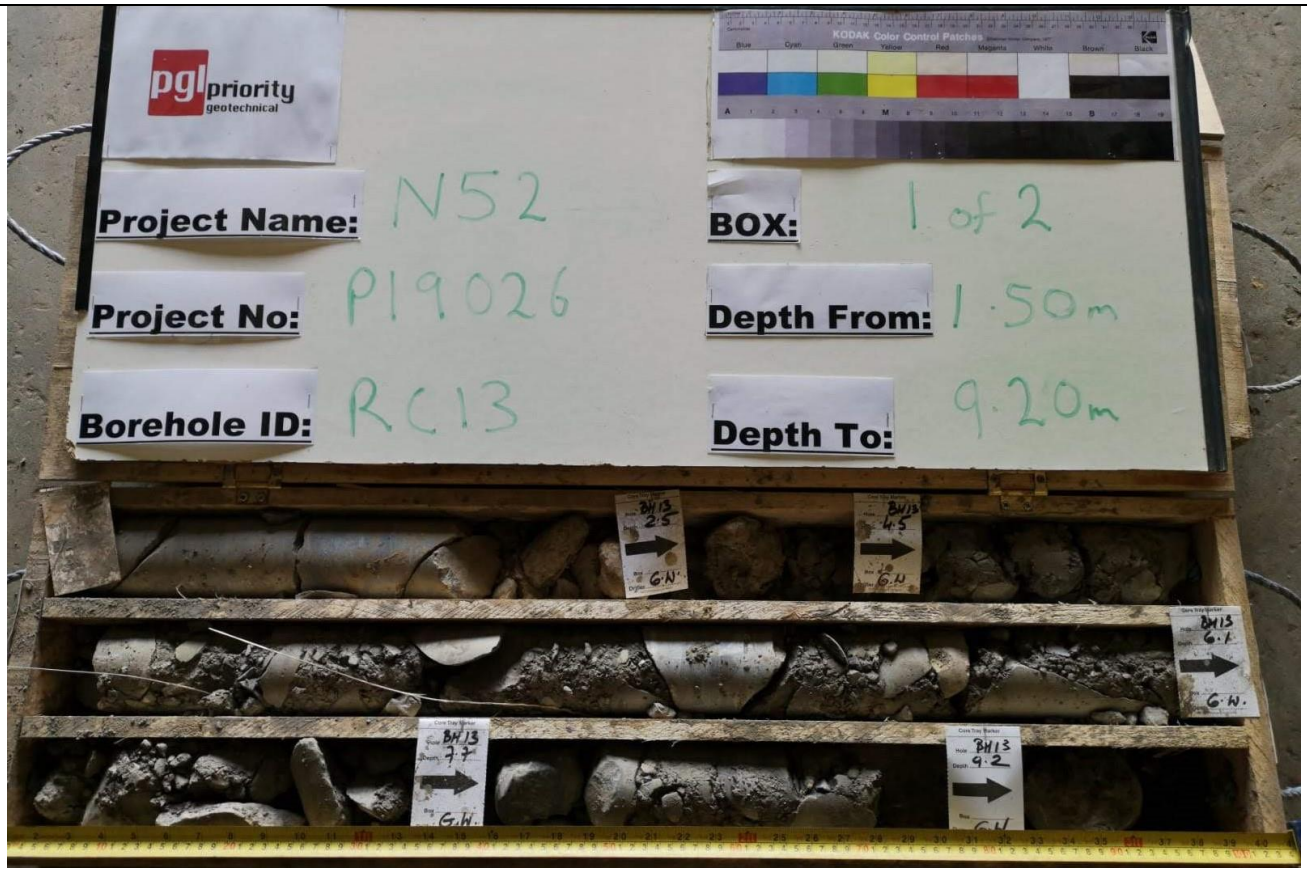
Remarks:

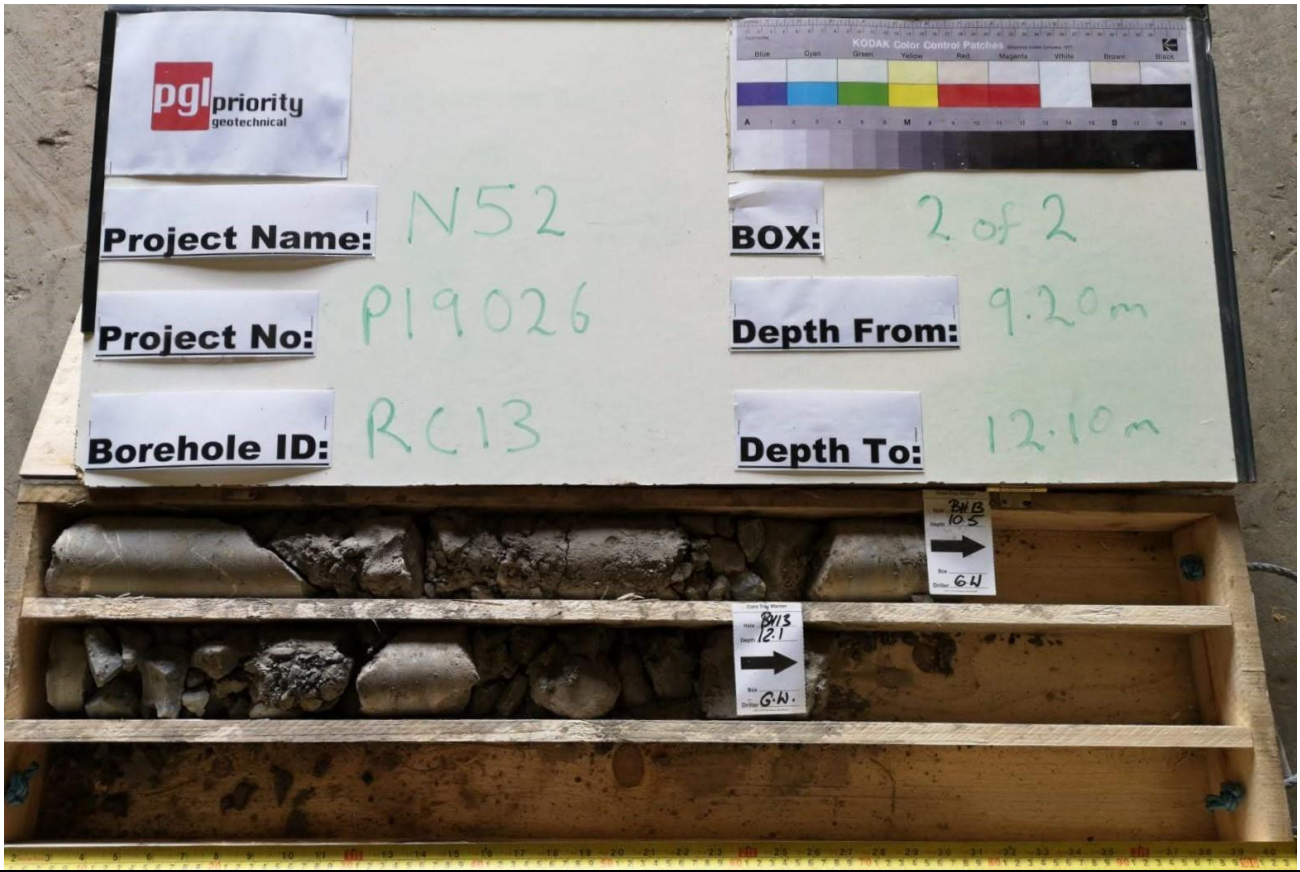
Borehole terminated at 12.10m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
Dry.	14/08/2019 08:00	0.00	Start of shift.
	14/08/2019 18:00	12.10	End of borehole.

Photographic Record





Number:	**RC13**	**Project** N52 Grange to Clontail Scheme **Project No** P19026 **Engineer** Atkins	

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Project Name:	N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 686542E - 783882N	**Hole Type** CP
Location:	Co. Meath		**Level:** 65.65m OD	**Scale** 1:50
Client:	Meath County Council		**Date:** 24/05/2019 - 24/05/2019	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
					0.30	65.35		(TOPSOIL)
		0.50 - 1.00	B					Firm, light brown, gravelly CLAY with cobble content. Gravel is fine to coarse and sub-angular to sub-rounded.
		1.20	SPT (C)	N=30 (4,5/6,7,8,9)				
		1.50 - 1.80	B		1.40	64.25		Light brown, slightly sandy gravelly CLAY with low cobble content. Driller noted broken rock. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Cobbles are 63mm to 130mm dia and sub-angular to sub-rounded.
		1.90	SPT (C)	50 (25 for 0mm/50 for 50mm)	1.90	63.75		End of Borehole at 1.900m

Groundwater:

Struck (m bgl)	Rose to	After (mins)	Sealed	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
1.90	200	200

Equipment: Dando 2000.

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
1.80	1.90	01:00	Chisel.

Remarks:

Borehole terminated at 1.90m bgl due to obstruction.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	24/05/2019 08:00	0.00	Start of shift.
Dry.	24/05/2019 18:00	1.90	End of borehole.

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Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 686542E - 783882N		**Hole Type** Rotary cored
Location: Co. Meath		**Level:** 65.65m OD		**Scale** 1:50
Client: Meath County Council		**Dates:** 12/08/2019	13/08/2019	

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 rig borehole depth. Refer to BH14 for detailed overburden description.
		N=23 (4,4/5,6,6,6) (S)								
							1.90	63.75		Open hole boring. Driller described: yellow to brown, slightly sandy gravelly CLAY.
		3.00 - 3.40	D							
		N=11 (2,2/3,3,2,3) (C)								
	▼						4.10	61.55		Open hole boring. Driller described: angular GRAVEL.
		~~50 (25 for 0mm/50 for 0mm)~~ (C)					4.30	61.35		Lithology: Green, interbedded FINE SANDSTONE and SILTSTONE with minor mudstone laminations. Bedding is very thin to medium spaced.
		4.30 - 5.90	10mm 250mm 80mm	100	65	50	7/m			Weathering: Slight clay smearing and mudstone lenses are oxidised between bedding.
		5.90 - 7.30	20mm 370mm 120mm	100	100	71	8/m			Fractures: Two major shear fracture sets from 4.75m to 4.95m and from 5.70m to 6.05m. Two major planar fracture sets from 7.30m to 7.75m and from 8.30m to 8.65m.
		7.30 - 8.30	5mm 340mm 150mm	100	100	83	6/m			*6.80m - 6.90m: Minor quartz veining*
		8.30 - 8.90	5mm 300mm 40mm	100	100	25	23/m			*8.45m: Minor quartz veining*
							8.90	56.75		End of Borehole at 8.900m

Groundwater:

Struck (m bgl)	Rose to	After (min)	Sealed	Comment
4.00				See shift data.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
8.90	76	131

Equipment:	Soilmech PSM.
Method:	Compressed air mist.

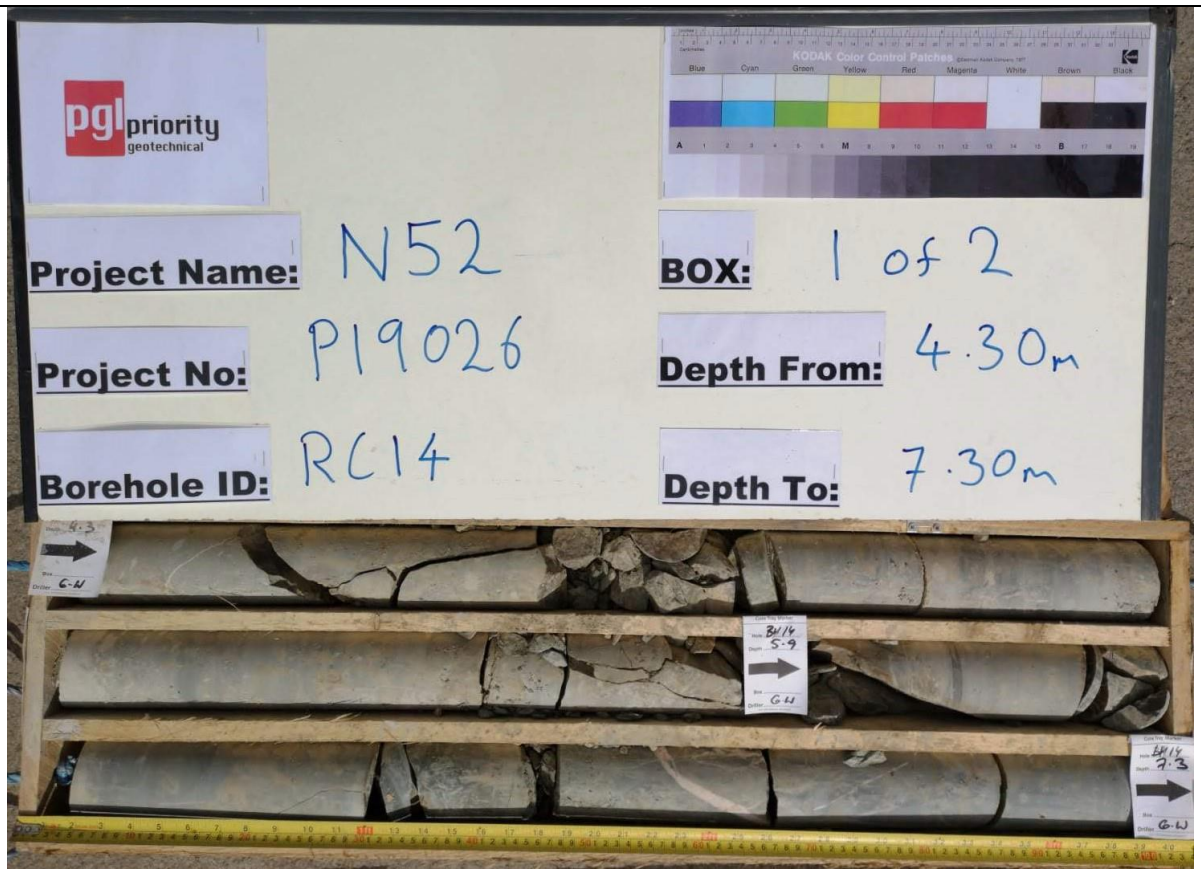
Remarks:

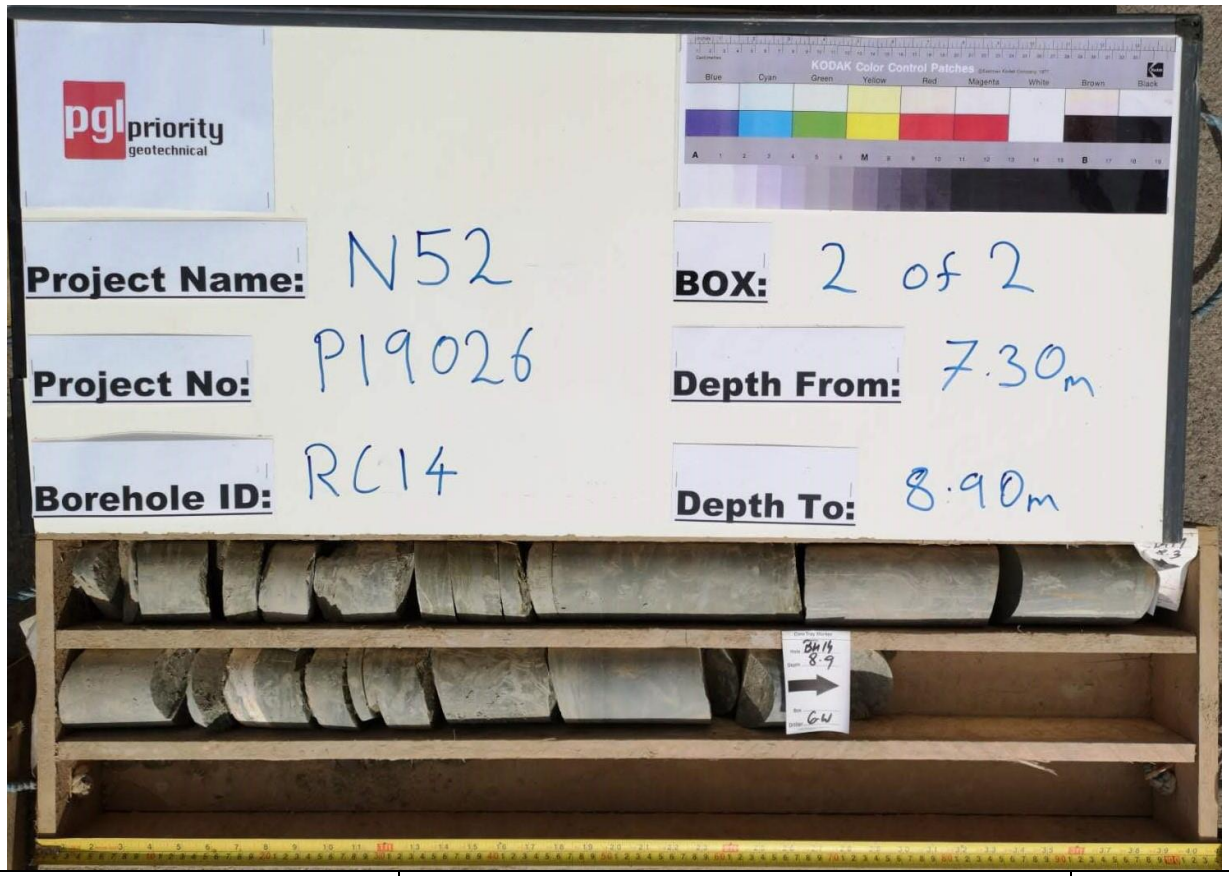
Borehole terminated at 8.90m bgl. Standpipe (50mm dia) installed from GL to 6.00m bgl. Response zone from 1.00m to 6.00m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
Dry.	12/08/2019 08:00	0.00	Start of shift.
Dry.	12/08/2019 18:00	1.50	End of shift.
Dry.	13/08/2019 08:00	1.90	Start of shift.
4.00	13/08/2019 18:00	8.90	End of borehole.

Photographic Record





Number:	**RC14**	**Project**	N52 Grange to Clontail Scheme
		Project No	P19026
		Engineer	Atkins

No	Job	Location	Date	Engineer
P19026	N52 GR-CL	DCP_TP01	28/05/2019	KH

Drop	Weight	Cone	Correlation
575mm	8kg	60^{o}	TRL DCP

Starting Depth mm	Ground Level	Easting	Northing
0	-	-	-

Blows	Depth (mm)	Penetration (mm)	Pen rate mm/blow	Penetration (m bgl)	Unadjusted CBR, % (Kleyn)
0	0	0	0	0	-
2	70	70	35	0.07	4
2	130	60	30	0.13	5
2	140	10	5	0.14	53
2	190	50	25	0.19	7
2	200	10	5	0.2	53
2	250	50	25	0.25	7
2	265	15	8	0.265	32
2	280	15	8	0.28	32
2	285	5	3	0.285	128
2	305	20	10	0.305	22
2	330	25	13	0.33	17
2	365	35	18	0.365	11
2	375	10	5	0.375	53
2	400	25	13	0.4	17
2	425	25	13	0.425	17
2	445	20	10	0.445	22
2	445	0	0	0.445	-
2	455	10	5	0.455	53
2	455	0	0	0.455	-
2	455	0	0	0.455	-
2	455	0	0	0.455	-

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Trial Pit No
TP01A
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 685371E - 783501N **Level:** 50.34m OD	**Date** 27/05/2019
Location: Co. Meath		**Dimensions (m):** 2.90 × 1.50 **Depth:** 2.20m BGL	**Scale** 1:25
Client: Meath County Council			**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.30	50.04		PEAT
	0.50 - 1.00 0.50 - 1.00	B D					Stiff, beige, grey, sandy CLAY. Sand is fine to coarse.
▼				1.10	49.24		Loose, beige, brown grey, very sandy GRAVEL with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to rounded. Cobbles are up to 180mm dia, angular to sub-rounded.
	1.50 - 2.00	B					
				2.20	48.14		End of Pit at 2.200m

1 2 3 4 5

Stability: Very poor.
Plant: 14t tracked excavator
Backfill: Arisings.

Groundwater: 1.30m: Fast flow rate.

Remarks: Trial pit (Archaeological Trench) terminated at 2.20m due to collapse of pit. Unsafe to carry out hand vane test.

Photographic Record

Number:	**TP01A**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No
TP02A
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 685348E - 783518N **Level:** 50.42m OD	**Date** 27/05/2019
Location: Co. Meath		**Dimensions (m):** 3.10 x 1.50 **Depth:** 3.40m BGL	**Scale** 1:25
Client: Meath County Council			**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.00	50.42		PEAT
	0.50 - 1.00 0.50 - 1.00	B D		0.50	49.92		Grey, beige, clayey SAND. Sand is fine to coarse.
▼				1.20	49.22		Grey, orange, wet, clayey gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded.
▼	1.50 - 2.00 1.50 - 2.00	B D					
	2.50 2.50 2.50		HVP=10 HVR=15kPa HVP=22 HVR=22kPa HVP=24 HVR=24kPa	2.10	48.32		Soft to stiff, grey, CLAY.
	3.00 - 3.40 3.00 - 3.40	B D		3.40	47.02		End of Pit at 3.400m

Stability: Poor to very poor.
Plant: 14t tracked excavator
Backfill: Arisings.

Groundwater: Fast flow rate.

Remarks: Trail pit (Archaeological Trench) terminated at 3.40m due to collapse of pit. Hand Vane test (19mm) carried out at 2.50m bgl.

Photographic Record

Number:	**TP02A**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No **TP02** Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 683473E - 782704N **Level:** 75.42m OD	**Date** 28/05/2019
Location: Co. Meath		**Dimensions (m):** 3.10 x 1.50 **Depth:** 3.70m BGL	**Scale** 1:25
Client: Meath County Council			**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
							(MADE GROUND)
	0.50 - 1.00 0.50 - 1.00 0.60	B D ENV		0.60	74.82		Soft to firm, brown, slightly sandy slightly gravelly SILT with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are up to 200mm dia, sub-angular to sub-rounded.
	1.00 1.00 1.00		HVP=27 HVR=27kPa HVP=30 HVR=30kPa HVP=55 HVR=55kPa				
	1.50 - 2.50 1.50 - 2.50	B D		1.40	74.02		Stiff, beige, brown, slightly sandy gravelly CLAY with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are up to 200mm dia, sub-angular to sub-rounded.
	3.00 - 3.50 3.00 - 3.50	B D		2.90	72.52		Stiff, beige brown, slightly sandy gravelly CLAY with medium cobble content with medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are up to 200mm dia, sub-angular to sub-rounded. Boulders are up to 650mm dia, sub-angular to sub-rounded.
				3.70 3.70	71.72 71.72		BOULDERS End of Pit at 3.700m

1 2 3 4 5

Stability: Moderate.
Plant: 14t tracked excavator
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 3.70m bgl due to large boulders. Hand Vane test (19mm) carried out at 1.00m bgl.

No	Job	Location	Date	Engineer
P19026	N52 GR-CL	DCP_TP02	28/05/2019	KH

Drop	Weight	Cone	Correlation
575mm	8kg	60^{o}	TRL DCP

Starting Depth mm	Ground Level	Easting	Northing
0.3	75.415	683473.112	782703.545

Blows	Depth (mm)	Penetration (mm)	Pen rate mm/blow	Penetration (m bgl)	Unadjusted CBR, % (Kleyn)
0	300	300	-	0.30	-
2	330	30	15	0.33	13
2	380	50	25	0.38	7
2	430	50	25	0.43	7
2	495	65	33	0.50	5
2	565	70	35	0.57	4
2	625	60	30	0.63	5
2	690	65	33	0.69	5
2	770	80	40	0.77	4
2	815	45	23	0.82	8
2	980	165	83	0.98	2
2	1060	80	40	1.06	4
2	1080	20	10	1.08	22
2	1080	0	0	1.08	-
2	1080	0	0	1.08	-
2	1080	0	0	1.08	-

Photographic Record

Number:	**TP02**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No
TP03
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 683567E - 782741N **Level:** 71.10m OD	**Date** 28/05/2019
Location: Co. Meath		**Dimensions (m):** 2.80 × 1.50 **Depth:** 2.00m BGL	**Scale** 1:25
Client: Meath County Council			**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.50	70.60		(TOPSOIL)
	0.50 0.50 - 1.00 0.50 - 1.00	ENV B D					Stiff, yellow beige orange, slightly sandy slightly gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded. Cobbles are up to 200mm dia, sub-angular to sub-rounded.
	1.00 1.00 1.00		HVP=27 HVR=27kPa HVP=30 HVR=30kPa HVP=46 HVR=46kPa	1.20	69.90		Stiff, grey orange, damp, slightly sandy gravelly CLAY with medium cobble content with medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are up to 200mm dia, angular to sub-rounded. Boulders are up to 500mm dia, angular to sub-rounded.
	1.50 - 2.00 1.50 - 2.00	B D					
				2.00 2.00	69.10 69.10		BOULDERS End of Pit at 2.000m

1 2 3 4 5

Stability: Moderate.
Plant: 14t tracked excavator
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 2.00m bgl due to large boulders. Hand Vane test (19mm) carried out at 1.00m bgl.

Photographic Record

Number:	**TP03**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No
TP04
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 683757E - 782809N **Level:** 71.31m OD	**Date** 29/03/2019
Location: Co. Meath		**Dimensions (m):** 2.50 x 1.40 **Depth:** 2.40m BGL	**Scale** 1:25
Client: Meath County Council			**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
							(MADE GROUND)
				0.60	70.70		
	1.00 - 1.30	B					Brown, beige, very clayey very sandy GRAVEL with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-angular. Cobbles are 63mm to 120mm dia, sub-angular to sub-rounded.
	1.20		HVP=14kPa				
	1.20		HVP=8kPa				
	1.20		HVP=9kPa				
	1.30	D					
	1.50 - 2.40	B					
▼	2.40	D		2.40	68.90		End of Pit at 2.400m

Stability: Moderate
Plant: 14t tracked excavator
Backfill: Arisings.

Groundwater: 2.40m: Trickling flow rate.

Remarks: Trial pit terminated at 2.40m bgl due to large boulders (refusal of track machine).

Photographic Record

Number:	**TP04**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No
TP05
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 683792E - 782826N **Level:** 69.02m OD	**Date** 29/03/2019
Location: Co. Meath		**Dimensions (m):** 2.40 × 1.40 **Depth:** 2.20m BGL	**Scale** 1:25
Client: Meath County Council			**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
							(MADE GROUND)
				0.40	68.62		Loose, beige orange, very clayey, very 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 180mm dia, angular to sub-rounded.
	1.00 - 1.20	B					
	1.10		HVP=14kPa				
	1.10		HVP=8kPa				
	1.10		HVP=9kPa	1.20	67.82		
	1.20	D					Loose to medium dense, beige light grey, very clayey, very sandy GRAVEL with medium cobble content with medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-angular. Cobbles are 63mm to 200mm dia, angular to sub-rounded. Boulders are 200mm to 300mm dia, angular to sub-rounded.
	1.50 - 2.20	B					
	2.20	D		2.20	66.82		End of Pit at 2.200m

1 2 3 4 5

Stability: Poor
Plant: 14t tracked excavator
Backfill: Arisings.

Groundwater: 2.00m: Trickling flow rate.

Remarks: Trial pit terminated at 2.20m bgl due to large boulder obstruction. Hand vane test carried out using 109mm dia. blade.

No	Job	Location	Date	Engineer
P19026	N52 GR-CL	DCP_TP05	24/05/2019	KH

Drop	Weight	Cone	Correlation
575mm	8kg	60^{o}	TRL DCP

Starting Depth mm	Ground Level	Easting	Northing
0	69.016	683791.62	782826.291

Blows	Depth (mm)	Penetration (mm)	Pen rate mm/blow	Penetration (m bgl)	Unadjusted CBR, % (Kleyn)
0	0	0	-	-	-
2	40	40	20	0.04	9
2	85	45	23	0.09	8
2	120	35	18	0.12	11
2	170	50	25	0.17	7
2	230	60	30	0.23	5
2	280	50	25	0.28	7
2	320	40	20	0.32	9
2	365	45	23	0.37	8
2	405	40	20	0.41	9
2	445	40	20	0.45	9
2	490	45	23	0.49	8
2	530	40	20	0.53	9
2	570	40	20	0.57	9
2	620	50	25	0.62	7
2	665	45	23	0.67	8
2	710	45	23	0.71	8
2	755	45	23	0.76	8
2	795	40	20	0.80	9
2	845	50	25	0.85	7
2	895	50	25	0.90	7
2	910	15	8	0.91	32
2	940	30	15	0.94	13
2	1005	65	33	1.01	5
2	1050	45	23	1.05	8
2	1090	40	20	1.09	9
2	1130	40	20	1.13	9
2	1135	5	3	1.14	128
2	1135	0	0	1.14	-
2	1140	5	3	1.14	128
2	1140	0	0	1.14	-
2	1140	0	0	1.14	-
2	1140	0	0	1.14	-

Photographic Record

Number:	**TP05**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No
TP06
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 683947E - 782913N **Level:** 69.67m OD	**Date** 29/03/2019
Location: Co. Meath		**Dimensions (m):** 2.00 × 1.40	**Scale** 1:25
Client: Meath County Council		**Depth:** 1.40m BGL	**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
							Topsoil
	0.50 - 1.40 0.50 - 1.40	B D		0.40	69.27		Firm, grey/orange, slightly sandy gravelly CLAY with moderate cobble content. Cobbles are up to 150mm and angular to sub rounded.
				1.40	68.27		End of Pit at 1.400m

Stability: Moderate
Plant: 14t tracked excavator
Backfill: Arisings

Groundwater: None encountered

Remarks: Trial pit terminated at 1.40m bgl due to obstruction on large boulders.

No	Job	Location	Date	Engineer
P19026	N52 Grange - Clontail	DCP_TP06	24/05/2019	KH

Drop	Weight	Cone	Correlation
575mm	8kg	60^{o}	TRL DCP

Starting Depth mm	Ground Level	Easting	Northing
0	69.667	683947.212	782913.325

Blows	Depth (mm)	Penetration (mm)	Pennetration Per blow (mm)	Penetration (m bgl)	CBR, % (Kleyn)
0	0	0	0	0.00	
2	35	35	17.5	0.04	11
2	50	15	7.5	0.05	32
2	65	15	7.5	0.07	32
2	85	20	10	0.09	22
2	110	25	12.5	0.11	17
2	145	35	17.5	0.15	11
2	170	25	12.5	0.17	17
2	210	40	20	0.21	9
2	245	35	17.5	0.25	11
2	265	20	10	0.27	22
2	290	25	12.5	0.29	17
2	335	45	22.5	0.34	8
2	345	10	5	0.35	53
2	405	60	30	0.41	5
2	415	10	5	0.42	53
2	425	10	5	0.43	53
2	440	15	7.5	0.44	32
2	455	15	7.5	0.46	32
2	465	10	5	0.47	53
2	475	10	5	0.48	53
2	475	0	0	0.48	-
2	480	5	2.5	0.48	128
2	480	0	0	0.48	-
2	480	0	0	0.48	-
2	480	0	0	0.48	-

Photographic Record

Number:	**TP06**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No
TP07
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 687243E - 784397N **Level:** 46.58m OD	**Date** 28/03/2019
Location: Co. Meath		**Dimensions (m):** 2.70 x 1.40	**Scale** 1:25
Client: Meath County Council		**Depth:** 2.90m BGL	**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
							(TOPSOIL)
				0.30	46.28		Stiff, brown, sandy SILT.
	0.50 - 1.00 0.50 - 1.00	B D					
	0.90 0.90 0.90		HVP=31kPa HVP=71kPa HVP=79kPa	1.00	45.58		Firm, grey, slightly sandy gravelly SILT with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse and sub angular to sub rounded. Cobbles are up to 110mm and angular to sub rounded.
	1.50 - 2.90 1.50 - 2.90	B D					
				2.90	43.68		End of Pit at 2.900m

Stability: Moderate
Plant: 14t tracked excavator
Backfill: Arisings

Groundwater: None encountered

Remarks: Trial pit terminated at 2.90m bgl due to obstruction on large boulders. Hand vane test carried out using 19mm dia. blade.

No	Job	Location	Date	Engineer
P19026	N52 Grange - Clontail	DCP_TP07	24/05/2019	KH

Drop	Weight	Cone	Correlation
575mm	8kg	60^{o}	TRL DCP

Starting Depth mm	Ground Level	Easting	Northing
0	46.58	687242.933	784396.588

Blows	Depth (mm)	Penetration (mm)	Pennetration Per blow (mm)	Penetration (m bgl)	CBR, % (Kleyn)
0	0	0	0	0.00	
2	25	25	13	0.03	17
2	70	45	23	0.07	8
2	130	60	30	0.13	5
2	200	70	35	0.20	4
2	240	40	20	0.24	9
2	250	10	5	0.25	53
2	310	60	30	0.31	5
2	390	80	40	0.39	4
2	470	80	40	0.47	4
2	565	95	48	0.57	3
2	685	120	60	0.69	2
2	740	55	28	0.74	6
2	810	70	35	0.81	4
2	860	50	25	0.86	7
2	895	35	18	0.90	11
2	960	65	33	0.96	5
2	1010	50	25	1.01	7
2	1070	60	30	1.07	5
2	1110	40	20	1.11	9
2	1140	30	15	1.14	13
2	1160	20	10	1.16	22
2	1165	5	3	1.17	128
2	1165	0	0	1.17	-
2	1170	5	3	1.17	128
2	1170	0	0	1.17	-
2	1170	0	0	1.17	-

Photographic Record

Number:	**TP07**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No
TP08
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 684044E - 782969N **Level:** 63.20m OD	**Date** 29/03/2019
Location: Co. Meath		**Dimensions (m):** 2.60 x 1.40 **Depth:** 1.00m BGL	**Scale** 1:25
Client: Meath County Council			**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.30	62.90		(TOPSOIL)
	0.50 - 1.00	B					Soft to firm, brown green orange, slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse and angular to sub rounded. Cobbles are up to 140mm and angular to sub rounded.
	0.90 0.90 0.90		HVP=31kPa HVP=35kPa HVP=39kPa	1.00	62.20		End of Pit at 1.000m

1
2
3
4
5

Stability: Moderate
Plant: 14t tracked excavator
Backfill: Arisings

Groundwater: None encountered

Remarks: Trial pit terminated at 1.00m bgl due to obstruction on large boulders. Hand vane test carried out using 19mm dia. blade.

Photographic Record

Number:	**TP08**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No
TP13
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 684685E - 783293N **Level:** 49.92m OD	**Date** 26/03/2019
Location: Co. Meath		**Dimensions (m):** 3.20 × 1.30	**Scale** 1:25
Client: Meath County Council		**Depth:** 2.80m BGL	**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.30	49.62		(TOPSOIL)
	0.50 - 1.00 0.50 - 1.00	B D					Soft to firm, brown beige, slightly sandy gravelly SILT with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse and sub angular to sub rounded. Cobbles are up to 150mm and sub angular to sub rounded.
	1.00 1.00 1.00		HVP=13kPa HVP=16kPa HVP=19kPa				
				1.20	48.72		Soft, beige, slightly gravelly sandy CLAY with low to high cobble content. Cobbles are up to 150mm and sub angular to sub rounded.
	1.50 - 2.80 1.50 - 2.80	B D					
				2.80	47.12		End of Pit at 2.800m

1 2 3 4 5

Stability: Very poor
Plant: 14t tracked excavator
Backfill: Arisings

Groundwater: 2.10m: Steady flow rate.

Remarks: Trial pit terminated at 2.80m bgl due to collapse of pit

Photographic Record

Number:	**TP13**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No
TP14
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 684827E - 783287N **Level:** 54.46m OD	**Date** 26/03/2019
Location: Co. Meath		**Dimensions (m):** 2.80 x 1.40 **Depth:** 2.90m BGL	**Scale** 1:25
Client: Meath County Council			**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.30	54.16		(TOPSOIL)
	0.50 - 1.00 0.50 - 1.00	B D					Firm, brown beige, slightly sandy gravelly SILT with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse and sub rounded to sub angular. Cobbles are up to 160mm and sub angular to sub rounded.
	1.00 1.00 1.00		HVP=16kPa HVP=22kPa HVP=25kPa	1.20	53.26		Firm, beige, slightly sandy gravelly CLAY with medium cobble content and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse and sub rounded to sub angular. Cobbles are up to 200mm and sub angular to sub rounded. Boulders are up to 300mm and sub angular to sub rounded.
	1.50 - 2.80 1.50 - 2.80	B D		2.80 2.90	51.66 51.56		(ASSUMED BEDROCK) Recovered as Cobbles and Boulders. lithology is Sandstone and Siltstone. End of Pit at 2.900m

1 2 3 4 5

Stability: Moderate
Plant: 14t tracked excavator
Backfill: Arisings

Groundwater: None encountered

Remarks: Trial pit terminated at 2.90m bgl due to assumed bedrock. Handvabe carried out using 19mm dia. blade.

No	Job	Location	Date	Engineer
P19026	N52 Grange - Clontail	DCP_TP14	24/05/2019	KH

Drop	Weight	Cone	Correlation
575mm	8kg	60^{o}	TRL DCP

Starting Depth mm	Ground Level	Easting	Northing
0	54.458	684827.149	783286.808

Blows	Depth (mm)	Penetration (mm)	Pennetration Per blow (mm)	Penetration (m bgl)	CBR, % (Kleyn)
0	0	0	0	0.00	
2	15	15	8	0.02	32
2	50	35	18	0.05	11
2	75	25	13	0.08	17
2	100	25	13	0.10	17
2	115	15	8	0.12	32
2	150	35	18	0.15	11
2	170	20	10	0.17	22
2	195	25	13	0.20	17
2	205	10	5	0.21	53
2	230	25	13	0.23	17
2	245	15	8	0.25	32
2	260	15	8	0.26	32
2	285	25	13	0.29	17
2	295	10	5	0.30	53
2	310	15	8	0.31	32
2	320	10	5	0.32	53
2	325	5	3	0.33	128
2	335	10	5	0.34	53
2	335	0	0	0.34	-
2	335	0	0	0.34	-
2	335	0	0	0.34	-

Adjustments	0.71	moderate
	0.5	dry
	0.35	very dry
	0.5	not assessed

Photographic Record

Number:	**TP14**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No
TP15
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 685315E - 783459N **Level:** 52.69m OD	**Date** 26/03/2019
Location: Co. Meath		**Dimensions (m):** 3.30 x 1.40 **Depth:** 2.70m BGL	**Scale** 1:25
Client: Meath County Council			**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.20	52.49		(TOPSOIL)
	0.50 - 1.00 0.50 - 1.00	B D					Soft to firm, grey beige, slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse and sub rounded to sub angular. Cobbles are up to 90mm and sub angular to sub rounded.
	0.90 0.90 0.90		HVP=24kPa HVP=30kPa HVP=33kPa	1.00	51.69		Firm, grey, slightly gravelly slightly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse and sub rounded to sub angular. Cobbles are up to 180mm and sub angular to sub rounded.
	1.50 - 2.00 1.50 - 2.00	B D					
▼				2.00	50.69		Firm, grey, slightly sandy gravelly CLAY with high cobble content and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse and sub rounded to sub angular. Cobbles are up to 200mm and sub angular to sub rounded. Boulders are up to 240mm and sub angular to sub rounded.
	2.20 - 2.70 2.20 - 2.70	B D					
				2.70	49.99		End of Pit at 2.700m

Stability: Very poor
Plant: 14t tracked excavator
Backfill: Arisings

Groundwater: 2.00m: Slow flow rate.

Remarks: Trial pit terminated at 2.70m bgl due to collapse of pit. Hand vane carried out using 19mm dia. blade.

Photographic Record

Number:	**TP15**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No
TP16
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 685487E - 783504N **Level:**	**Date** 27/03/2019
Location: Co. Meath	**Dimensions (m):** 2.50 x 1.40		**Scale** 1:25
Client: Meath County Council	**Depth:** 2.50m BGL		**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
							(TOPSOIL)
	0.20 - 0.70 0.20 - 0.70	B D		0.20			Firm, brown orange, slightly sandy slightly gravelly SILT with low cobble content. Sand is fine to coarse. Gravel is fine to coarse and sub rounded to sub angular. Cobbles are up to 150mm and sub angular to sub rounded.
	0.70 0.70 0.70		HVP=22kPa HVP=25kPa HVP=25kPa	0.70			Firm, beige, slightly sandy gravelly CLAY with medium cobble content and high boulder content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are angular to sub-angular, 63-200mm dia. Boulders are angular to rounded, 200-300mm dia.
	1.50 - 2.50 1.50 - 2.50	B D					
				2.50			End of Pit at 2.500m

Stability: Poor
Plant: 14t tracked excavator
Backfill: Arisings

Groundwater: 1.90m: Steady flow rate. 2.10m: Steady flow rate.

Remarks: Trial pit terminated at 2.50m bgl due to large boulder obstruction.

Photographic Record

Number:	**TP16**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No
TP17
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 685562E - 783530N **Level:**	**Date** 27/03/2019
Location: Co. Meath		**Dimensions (m):** 2.30 x 1.40 **Depth:** 1.70m BGL	**Scale** 1:25
Client: Meath County Council			**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
							(TOPSOIL)
	0.30 - 0.60 0.30 - 0.60	B D		0.20			Brown beige, slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse and sub rounded to sub angular. Cobbles are up to 150mm and sub angular to sub rounded.
				0.60			Soft, beige, slightly sandy gravelly CLAY with high cobble content and high boulder content. Sand is fine to coarse. Gravel is fine to coarse and sub rounded to sub angular. Cobbles are up to 200mm and angular to rounded. Boulders are up to 400mm and angular to rounded.
	1.20 - 1.70 1.20 - 1.70 1.20 1.20 1.20	B D	 HVP=16kPa HVP=24kPa HVP=25kPa				
				1.70			BOULDERS. End of Pit at 1.700m

Stability: Moderate
Plant: 14t tracked excavator
Backfill: Arisings

Groundwater: None encountered

Remarks: Trial pit terminated at 1.70m bgl due to large boulders obstruction.

No	Job	Location	Date	Engineer
P19026	N52 Grange - Clontail	DCP_TP17	24/05/2019	KH

Drop	Weight	Cone	Correlation
575mm	8kg	60^{o}	TRL DCP

Starting Depth mm	Ground Level	Easting	Northing
0	-	-	-

Blows	Depth (mm)	Penetration (mm)	Pennetration Per blow (mm)	Penetration (m bgl)	CBR, % (Kleyn)
0	0	0	0	0.00	-
2	10	10	5	0.01	53
2	40	30	15	0.04	13
2	80	40	20	0.08	9
2	140	60	30	0.14	5
2	180	40	20	0.18	9
2	210	30	15	0.21	13
2	230	20	10	0.23	22
2	260	30	15	0.26	13
2	300	40	20	0.30	9
2	325	25	13	0.33	17
2	340	15	8	0.34	32
2	375	35	18	0.38	11
2	395	20	10	0.40	22
2	425	30	15	0.43	13
2	475	50	25	0.48	7
2	525	50	25	0.53	7
2	555	30	15	0.56	13
2	595	40	20	0.60	9
2	650	55	28	0.65	6
2	690	40	20	0.69	9
2	710	20	10	0.71	22
2	735	25	13	0.74	17
2	785	50	25	0.79	7
2	840	55	28	0.84	6
2	910	70	35	0.91	4
2	940	30	15	0.94	13
2	985	45	23	0.99	8
2	1005	20	10	1.01	22
2	1015	10	5	1.02	53
2	1025	10	5	1.03	53
2	1055	30	15	1.06	13
2	1085	145	73	1.09	2
2	1105	120	60	1.11	2
2	1120	115	58	1.12	2
2	1125	110	55	1.13	3
2	1140	115	58	1.14	2
2	1150	65	33	1.15	5
2	1170	20	10	1.17	22
2	1196	26	13	1.20	16
2	1225	29	15	1.23	14
2	1225	0	0	1.23	-
2	1230	5	3	1.23	128
2	1235	5	3	1.24	128
2	1245	10	5	1.25	-
2	1245	0	0	1.25	-
2	1245	0	0	1.25	-

Photographic Record

Number:	**TP17**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No **TP18** Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 685674E - 783576N **Level:**	**Date** 27/03/2019
Location: Co. Meath		**Dimensions (m):** 2.70 x 1.40 **Depth:** 2.00m BGL	**Scale** 1:25
Client: Meath County Council			**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.20			(TOPSOIL)
	0.50 - 0.80 0.50 - 0.80	B D					Firm, brown, slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse and rounded to angular. Cobbles are up to 95mm and sub angular to sub rounded.
	0.80 0.80 0.80		HVP=31kPa HVP=31kPa HVP=33kPa	0.80			Soft, beige, slightly sandy slightly gravelly CLAY with medium coble content and moderate boulder content. Sand is fine to coarse. Gravel is fine to coarse and sub rounded to sub angular. Cobbles are up to 200mm and sub angular to sub rounded. Boulders are up to 400mm and sub angular to sub rounded.
	1.50 - 1.90 1.50 - 1.90	B D					
				1.90			(ASSUMED BEDROCK) Boulders and cobbles
				2.00			End of Pit at 2.000m

1
2
3
4
5

Stability: Moderate
Plant: 14t tracked excavator
Backfill: Arisings

Groundwater: None encountered

Remarks: Trial pit terminated at 2.00m bgl due to assumed boulder obstruction.

Photographic Record

Number:	**TP18**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No
TP19
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 685846E - 783609N **Level:** 73.28m OD	**Date** 26/03/2019
Location: Co. Meath		**Dimensions (m):** 3.20 x 1.40	**Scale** 1:25
Client: Meath County Council		**Depth:** 2.80m BGL	**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
							(TOPSOIL)
				0.30	72.98		
	0.50 - 1.00 0.50 - 1.00	B D					Firm, brown, slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse and sub rounded to sub angular. Cobbles are up to 180mm and sub angular to sub rounded.
	1.00 1.00 1.00		HVP=31kPa HVP=31kPa HVP=33kPa	1.00	72.28		Soft, beige brown, slightly sandy gravelly CLAY with medium cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse and sub rounded to sub angular. Cobbles are up to 160mm and sub angular to sub rounded. Boulders are up to 230mm.
	1.50 - 2.70 1.50 - 2.70	B D					
				2.70	70.58		BOULDERS and COBBLES.
				2.80	70.48		End of Pit at 2.800m

Stability: Moderate
Plant: 14t tracked excavator
Backfill: Arisings

Groundwater: 2.30m: Trickle of water

Remarks: Trial pit terminated at 2.80m bgl due to large boulders

Photographic Record

Number:	**TP19**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No
TP20
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 686008E - 783687N **Level:** 70.67m OD	**Date** 26/03/2019
Location: Co. Meath		**Dimensions (m):** 2.70 x 1.40 **Depth:** 2.00m BGL	**Scale** 1:25
Client: Meath County Council			**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.20	70.47		(TOPSOIL)
	0.50 - 0.80 0.50 - 0.80	B D					Soft, brown, slightly sandy slightly gravelly SILT with low to medium cobble content. Sand is fine to coarse. Gravel is fine to coarse and sub rounded to sub angular. Cobbles are up to 150mm and sub angular to sub rounded.
	0.80 - 2.00 0.80 - 2.00	B D		0.80	69.87		
	1.00 1.00 1.00		HVP=28kPa HVP=28kPa HVP=35kPa				Soft, beige brown, slightly sandy slightly gravelly CLAY with medium cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse and sub rounded to sub angular. Cobbles are up to 100mm and sub angular to sub rounded. Boulders are up to 220mm.
				2.00	68.67		(Assumed bedrock) Boulder and cobbles End of Pit at 2.000m

1 2 3 4 5

Stability: Moderate
Plant: 14t tracked excavator
Backfill: Arisings

Groundwater: None encountered

Remarks: Trial pit terminated at 2.00m bgl due assumed bedrock.

No	Job	Location	Date	Engineer
P19026	N52	DCP_TP20	24/05/2019	KH

Drop	Weight	Cone	Correlation
575mm	8kg	60^{o}	TRL DCP

Starting Depth mm	Ground Level	Easting	Northing
0	70.666	686007.534	783686.586

Blows	Depth (mm)	Penetration (mm)	Pennetration Per blow (mm)	Penetration (m bgl)	CBR, % (Kleyn)
0	0	0	0	0.00	
2	25	25	13	0.03	17
2	60	35	18	0.06	11
2	95	35	18	0.10	11
2	145	50	25	0.15	7
2	195	50	25	0.20	7
2	235	40	20	0.24	9
2	285	50	25	0.29	7
2	310	25	13	0.31	17
2	335	25	13	0.34	17
2	370	35	18	0.37	11
2	410	40	20	0.41	9
2	460	50	25	0.46	7
2	495	35	18	0.50	11
2	535	40	20	0.54	9
2	560	25	13	0.56	17
2	585	25	13	0.59	17
2	610	25	13	0.61	17
2	640	30	15	0.64	13
2	680	40	20	0.68	9
2	730	50	25	0.73	7
2	780	50	25	0.78	7
2	840	60	30	0.84	5
2	910	70	35	0.91	4
2	940	30	15	0.94	13
2	1010	70	35	1.01	4
2	1050	40	20	1.05	9
2	1100	50	25	1.10	7
2	1120	20	10	1.12	22
2	1160	40	20	1.16	9
2	1190	30	15	1.19	13
2	1225	35	18	1.23	11
2	1225	175	88	1.23	1
2	1225	125	63	1.23	2
2	1225	105	53	1.23	3

Photographic Record

Number:	**TP20**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No
TP21
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 686090E - 783712N **Level:** 68.16m OD	**Date** 26/03/2019
Location: Co. Meath		**Dimensions (m):** 3.00 x 1.40 **Depth:** 2.50m BGL	**Scale** 1:25
Client: Meath County Council			**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.20	67.96		(TOPSOIL)
	0.50 - 1.00 0.50 - 1.00	B D					Brown, slightly sandy slightly silty gravelly CLAY. with low cobble content. Sand is fine to coarse. Gravel is fine to coarse and sub rounded to sub angular. Cobbles are up to 80mm and sub angular to sub rounded.
	1.00 1.00 1.00		HVP=12kPa HVP=16kPa HVP=16kPa	1.00	67.16		Soft, beige, slightly sandy gravelly CLAY with medium cobble content and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse and sub rounded to sub angular. Cobbles are up to 200mm and sub angular to sub rounded. Boulders are up to 230mm.
	1.50 - 2.50 1.50 - 2.50	B D					
				2.50	65.66		(Assumed bedrock) Boulders and cobbles End of Pit at 2.500m

1
2
3
4
5

Stability: Moderate
Plant: 14t tracked excavator
Backfill: Arisings

Groundwater: None encountered

Remarks: Trial pit terminated at 2.50m bgl due to assumed bedrock.

Photographic Record

Number:	**TP21**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No
TP22
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 686237E - 783785N **Level:** 69.32m OD	**Date** 27/03/2019
Location: Co. Meath		**Dimensions (m):** 2.20 x 1.40 **Depth:** 2.10m BGL	**Scale** 1:25
Client: Meath County Council			**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
							(TOPSOIL)
				0.30	69.02		Firm, brown, slightly sandy slightly gravelly SILT with moderate cobble content. Sand is fine to coarse. Gravel is fine to coarse and angular to sub angular. Cobbles are up to 90mm and sub angular to angular.
	0.50 - 0.80 0.50 - 0.80	B D					
				0.80	68.52		Very soft to soft, beige orange, slightly sandy gravelly SILT with medium cobble content and high boulder content. Sand is fine to coarse. Gravel is fine to coarse and sub rounded to sub angular. Cobbles are up to 200mm and sub angular to sub rounded. Boulders are up to 400mm.
	1.50 - 2.10 1.50 - 2.10	B D					
				2.10	67.22		End of Pit at 2.100m

Stability: Moderate
Plant: 14t tracked excavator
Backfill: Arisings

Groundwater: None encountered

Remarks: Trial pit terminated at 2.10m bgl due to large boulders.

Photographic Record

Number:	**TP22**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No
TP23
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 686297E - 783793N **Level:** 66.27m OD	**Date** 27/03/2019
Location: Co. Meath		**Dimensions (m):** 2.60 x 1.40 **Depth:** 2.40m BGL	**Scale** 1:25
Client: Meath County Council			**Logged** KH.

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
							(TOPSOIL)
				0.30	65.97		
	0.50 - 0.90 0.50 - 0.90	B D					Firm, brown slightly gravelly SILT with low cobble content. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 120mm dia, angular to rounded.
	0.90 0.90 0.90		HVP=22kPa HVP=22kPa HVP=25kPa	0.90	65.37		Soft, red brown, slightly sandy slightly gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to rounded. Cobbles are 63mm to 100mm dia, sub-angular to sub-rounded.
	1.50 - 1.80 1.50 - 1.80	B D					
▼				1.80	64.47		Beige clayey gravelly SAND with medium cobble content and medium boulder content. Sand is fine to coarse. Gravel is sub-angular to rounded. Cobbles are 63mm to 200mm dia. Boulders are 200mm to 400mm dia.
	2.00 - 2.40 2.00 - 2.40	B D					
				2.40	63.87		End of Pit at 2.400m

Stability: Moderate
Plant: 14t tracked excavator
Backfill: Arisings.

Groundwater: 1.80m: Trickle flow rate.

Remarks: Trial pit terminated at 2.40m bgl on large boulder obstruction.

No	Job	Location	Date	Engineer
P19026	N52	DCP_TP23	24/05/2019	KH

Drop	Weight	Cone	Correlation
575mm	8kg	60^{o}	TRL DCP

Starting Depth mm	Ground Level	Easting	Northing
0	66.272	686296.544	783793.395

Blows	Depth (mm)	Penetration (mm)	Pennetration Per blow (mm)	Penetration (m bgl)	CBR, % (Kleyn)
0	0	0	0	0.00	
2	15	15	7.5	0.02	32
2	65	50	25	0.07	7
2	80	15	7.5	0.08	32
2	80	0	0	0.08	-
2	80	0	0	0.08	-
2	80	0	0	0.08	-

Photographic Record

Number:	**TP23**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No **TP24** Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 686437E - 783837N **Level:** 68.99m OD	**Date** 27/03/2019
Location: Co. Meath		**Dimensions (m):** 2.50 × 1.40 **Depth:** 2.40m BGL	**Scale** 1:25
Client: Meath County Council			**Logged** KH.

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
							(TOPSOIL)
				0.30	68.69		Brown, slightly gravelly SILT with medium cobble content. Cobbles are 63mm to 150mm dia, angular to sub-rounded.
	0.50 - 0.80	B					
	0.50 - 0.80	D					
	0.70		HVP=13kPa				
	0.70		HVP=8kPa				
	0.70		HVP=9kPa	0.80	68.19		Very soft, beige brown, very silty very sandy GRAVEL with medium cobble content and medium boulder content. Cobbles are up to 200mm and angular to sub angular. Boulders are up to 300mm and angular to sub rounded.
	1.50 - 2.40	B					
	1.50 - 2.40	D					
				2.40	66.59		End of Pit at 2.400m

1 2 3 4 5

Stability: Moderate.
Plant: 14t tracked excavator
Backfill: Arisings

Groundwater: None encountered

Remarks: Trial pit terminated at 2.40m bgl due to refusal of track machine on large boulders.

No	Job	Location	Date	Engineer
P19026	N52	DCP_TP24	24/05/2019	KH

Drop	Weight	Cone	Correlation
575mm	8kg	60^{o}	TRL DCP

Starting Depth mm	Ground Level	Easting	Northing
0	68.987	686436.577	783837.245

Blows	Depth (mm)	Penetration (mm)	Pennetration Per blow (mm)	Penetration (m bgl)	CBR, % (Kleyn)
0	0	0	0	0.00	
2	40	40	20	0.04	9
2	65	25	13	0.07	17
2	90	25	13	0.09	17
2	110	20	10	0.11	22
2	155	45	23	0.16	8
2	195	40	20	0.20	9
2	235	40	20	0.24	9
2	275	40	20	0.28	9
2	295	20	10	0.30	22
2	315	20	10	0.32	22
2	330	15	8	0.33	32
2	335	5	3	0.34	128
2	336	1	1	0.34	-

Photographic Record

Number:	**TP24**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No **TP25** Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 686546E - 783883N **Level:** 65.19m OD	**Date** 27/03/2019
Location: Co. Meath		**Dimensions (m):** 2.50 x 1.40 **Depth:** 2.30m BGL	**Scale** 1:25
Client: Meath County Council			**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.20	64.99		(TOPSOIL)
	0.50 - 0.70 0.50 - 0.70	B D					Brown orange, very sandy very clayey GRAVEL with low cobble content. Cobbles are up to 120mm and angular to sub angular.
	0.70 0.70 0.70		HVP=17kPa HVP=17kPa HVP=19kPa	0.70	64.49		Very soft, beige brown, very sandy very clayey GRAVEL with high cobble content and high boulder content. Sand is fine to coarse. Gravel is fine to coarse and sub rounded to sub angular. Cobbles are up to 200mm and sub angular to sub rounded. Boulders are up to 300mm.
	1.50 - 2.30 1.50 - 2.30	B D					
				2.30	62.89		End of Pit at 2.300m

1 2 3 4 5

Stability: Moderate
Plant: 14t tracked excavator
Backfill: Arisings

Groundwater: None encountered

Remarks: Trial pit terminated at 2.30m bgl due to refusal on large boulders.

No	Job	Location	Date	Engineer
P19026	N52	DCP_TP25	24/05/2019	KH

Drop	Weight	Cone	Correlation
575mm	8kg	60^{o}	TRL DCP

Starting Depth mm	Ground Level	Easting	Northing
0	65.193	686545.657	783883.125

Blows	Depth (mm)	Penetration (mm)	Pennetration Per blow (mm)	Penetration (m bgl)	CBR, % (Kleyn)
0	0	0	0	0.00	
2	30	30	15	0.03	13
2	55	25	13	0.06	17
2	65	10	5	0.07	53
2	90	25	13	0.09	17
2	145	55	28	0.15	6
2	180	35	18	0.18	11
2	220	40	20	0.22	9
2	240	20	10	0.24	22
2	245	5	3	0.25	128
2	245	0	0	0.25	-
2	245	0	0	0.25	-

Photographic Record

Number:	**TP25**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No
TP26
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 686585E - 783888N **Level:** 62.87m OD	**Date** 28/03/2019
Location: Co. Meath		**Dimensions (m):** 2.60 × 1.40	**Scale** 1:25
Client: Meath County Council		**Depth:** 3.10m BGL	**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.20	62.67		(TOPSOIL)
	0.50 - 0.80 0.50 - 0.80	B D					Brown, SILT with rootlets.
	0.80 0.80 0.80		HVP=16kPa HVP=17kPa HVP=17kPa	0.80	62.07		Very soft, beige orange CLAY with low cobble content. Cobbles are up to 85mm and angular.
	1.50 - 2.30 1.50 - 2.30	B D					
				2.30	60.57		Grey brown, slightly gravelly slightly sandy CLAY with medium cobble content.
	2.50 - 3.10 2.50 - 3.10	B D					
				3.10	59.77		End of Pit at 3.100m

Stability: Moderate
Plant: 14t tracked excavator
Backfill: Arisings

Groundwater: None encountered

Remarks: Trial pit terminated at 3.10m bgl due to large boulders.

Photographic Record

Number:	**TP26**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No
TP27
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 686759E - 783954N **Level:** 61.73m OD	**Date** 28/03/2019
Location: Co. Meath		**Dimensions (m):** 2.60 x 1.40 **Depth:** 2.50m BGL	**Scale** 1:25
Client: Meath County Council			**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
	0.20 - 0.50 0.20 - 0.50	B D		0.20	61.53		(TOPSOIL)
	0.50 - 1.20 0.50 - 1.20	B D		0.50	61.23		Brown SILT with rootlets.
	1.00 1.00 1.00		HVP=39kPa HVP=42kPa HVP=44kPa				Firm, beige orange, slightly gravelly slightly sandy CLAY with low cobble content. Sand is fine to coarse. Cobbles are up to 90mm and sub angular to sub rounded.
	1.50 - 2.50 1.50 - 2.50	B D		1.20	60.53		Grey brown, clayey SAND. Sand is fine to medium.
				2.50	59.23		End of Pit at 2.500m

Stability: Moderate
Plant: 14t tracked excavator
Backfill: Arisings

Groundwater: 1.80m: Steady flow rate.

Remarks: Trial pit terminated at 2.50m bgl due to large boulders.

No	Job	Location	Date	Engineer
P19026	N52	DCP_TP27	24/05/2019	KH

Drop	Weight	Cone	Correlation
575mm	8kg	60^{o}	TRL DCP

Starting Depth mm	Ground Level	Easting	Northing
0	61.73	686758.605	783954.096

Blows	Depth (mm)	Penetration (mm)	Pennetration Per blow (mm)	Penetration (m bgl)	CBR, % (Kleyn)
0	0	0	0	0.00	
2	23	23	12	0.02	18
2	70	47	24	0.07	7
2	120	50	25	0.12	7
2	155	35	18	0.16	11
2	195	40	20	0.20	9
2	235	40	20	0.24	9
2	270	35	18	0.27	11
2	315	45	23	0.32	8
2	385	70	35	0.39	4
2	460	75	38	0.46	4
2	525	65	33	0.53	5
2	590	65	33	0.59	5
2	630	40	20	0.63	9
2	660	30	15	0.66	13
2	680	20	10	0.68	22
2	720	40	20	0.72	9
2	740	20	10	0.74	22
2	775	35	18	0.78	11
2	820	45	23	0.82	8
2	855	35	18	0.86	11
2	900	45	23	0.90	8
2	940	40	20	0.94	9
2	990	50	25	0.99	7
2	1030	40	20	1.03	9
2	1090	60	30	1.09	5
2	1150	60	30	1.15	5
2	1220	70	35	1.22	4
2	1300	80	40	1.30	4
2	1360	60	30	1.36	5
2	1410	50	25	1.41	7
2	1460	50	25	1.46	7
2	1490	30	15	1.49	13
2	1520	665	333	1.52	0
2	1540	1080	540	1.54	0
2	1565	25	13	1.57	17
2	1575	10	5	1.58	53
2	1590	15	8	1.59	32
2	1605	15	8	1.61	32
2	1620	15	8	1.62	32
2	1635	15	8	1.64	32
2	1645	10	5	1.65	53
2	1665	20	10	1.67	22
2	1670	5	3	1.67	128
2	1685	15	8	1.69	32
2	1700	15	8	1.70	32
2	1710	10	5	1.71	53
2	1720	10	5	1.72	53
2	1720	0	0	1.72	-
2	1720	0	0	1.72	-
2	1725	5	3	1.73	128
2	1725	60	30	1.73	5
2	1725	120	60	1.73	2

Photographic Record

Number:	**TP27**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No
TP28
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 686844E - 783997N **Level:** 65.22m OD	**Date** 27/05/2019
Location: Co. Meath		**Dimensions (m):** 2.90 x 1.50 **Depth:** 1.90m BGL	**Scale** 1:25
Client: Meath County Council			**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
							(TOPSOIL)
				0.30	64.92		Soft, beige, slightly sandy gravelly CLAY with medium cobble content with high boulder content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are up to 200mm dia, sub-angular to sub-rounded. Boulders are up to 500mm dia, sub-angular to sub-rounded.
	0.50 - 1.00	B					
	0.50 - 1.00	D					
	1.10		HVP=15 HVR=15kPa				
	1.10		HVP=27 HVR=27kPa				
	1.10		HVP=9 HVR=9kPa				
	1.50 - 1.90	B					
	1.50 - 1.90	D					
				1.90	63.32		BOULDERS.
				1.90	63.32		End of Pit at 1.900m

Stability: Moderate.
Plant: 14t tracked excavator
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 1.90m bgl due to large boulders. Hand Vane test (19mm) carried out at 1.10m bgl.

Photographic Record

Number:	**TP28**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No
TP29
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 686952E - 784049N **Level:** 63.73m OD	**Date** 27/05/2019
Location: Co. Meath		**Dimensions (m):** 3.00 x 1.50 **Depth:** 2.10m BGL	**Scale** 1:25
Client: Meath County Council			**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
							(TOPSOIL)
	0.50 - 0.80 0.50 - 0.80	B D		0.40	63.33		Firm to stiff, 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 up to 200mm dia, angular to sub-angular.
	1.10 1.10 1.10		HVP=14 HVR=14kPa HVP=15 HVR=15kPa HVP=21 HVR=21kPa	0.80	62.93		Firm to stiff, beige orange, slightly sandy gravelly CLAY with medium cobble content with medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded. Cobbles are up to 200mm dia, angular to sub-rounded. Boulders are up to 450mm dia, angular to sub-rounded.
	1.50 - 2.00 1.50 - 2.00	B D					
				2.10 2.10	61.63 61.63		BOULDERS End of Pit at 2.100m

1
2
3
4
5

Stability: Moderate.
Plant: 14t tracked excavator
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 2.10m bgl, required depth reached. Hand Vane test (19mm) carried out at 1.10m bgl.

Photographic Record

Number:	**TP29**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No
TP30
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 687033E - 784128N **Level:** 59.33m OD	**Date** 27/05/2019
Location: Co. Meath		**Dimensions (m):** 2.80 x 1.50 **Depth:** 1.50m BGL	**Scale** 1:25
Client: Meath County Council			**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
							(TOPSOIL)
				0.40	58.93		
	0.50 - 1.00	B					Soft to firm, beige orange, slightly sandy gravelly CLAY with medium cobble content with medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded. Cobbles are up to 200mm dia, angular to sub-rounded. Boulders are up to 600mm dia, angular to sub-rounded.
	0.50 - 1.00	D					
	1.00 - 1.50	B					
	1.00 - 1.50	D					
	1.10		HVP=17 HVR=17kPa				
	1.10		HVP=21 HVR=21kPa				
	1.10		HVP=43 HVR=43kPa				
				1.50	57.83		BOULDERS
				1.50	57.83		End of Pit at 1.500m

Stability: Moderate.
Plant: 14t tracked excavator
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 1.50m bgl due to large boulders. Hand Vane test (19mm) carried out at 1.10m.

No	Job	Location	Date	Engineer
P19026	N52 Grange - Clontail	DCP_TP30	24/05/2019	KH

Drop	Weight	Cone	Correlation
575mm	8kg	60^{o}	TRL DCP

Starting Depth mm	Ground Level	Easting	Northing
0	59.333	687032.939	784127.609

Blows	Depth (mm)	Penetration (mm)	Pennetration Per blow (mm)	Penetration (m bgl)	CBR, % (Kleyn)
0	0	0	0	0.00	
2	45	45	23	0.05	8
2	65	20	10	0.07	22
2	100	35	18	0.10	11
2	153	53	27	0.15	6
2	210	57	29	0.21	6
2	260	50	25	0.26	7
2	285	25	13	0.29	17
2	330	45	23	0.33	8
2	380	50	25	0.38	7
2	390	10	5	0.39	53
2	390	0	0	0.39	-
2	390	0	0	0.39	-

Photographic Record

Number:	**TP30**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No **TP31** Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 687107E - 784179N **Level:** 55.27m OD	**Date** 27/05/2019
Location: Co. Meath		**Dimensions (m):** 2.80 x 1.50 **Depth:** 2.00m BGL	**Scale** 1:25
Client: Meath County Council			**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.30	54.97		(TOPSOIL)
	0.50 - 0.70 0.50 - 0.70	B D		0.70	54.57		Firm to stiff, brown, slightly gravelly CLAY with low cobble content and plant roots. Gravel is fine to coarse, angular to sub-rounded. Cobbles are up to 110mm dia, angular.
	1.10 1.10 1.10		HVP=30 HVR=30kPa HVP=36 HVR=36kPa HVP=40 HVR=40kPa				Soft to firm, grey beige, CLAY.
	1.50 - 2.00 1.50 - 2.00	B D		2.00 2.00	53.27 53.27		BOULDERS End of Pit at 2.000m

Stability: Moderate.
Plant: 14t tracked excavator
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 2.00m bgl due to large boulders. Hand vane test (19mm) carried out at 1.10m bgl.

Photographic Record

Number:	**TP31**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No
TP32
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 687223E - 784260N **Level:** 53.98m OD	**Date** 28/03/2019
Location: Co. Meath		**Dimensions (m):** 1.70 x 1.40	**Scale** 1:25
Client: Meath County Council		**Depth:** 1.70m BGL	**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
							(TOPSOIL)
	0.20 - 0.60 0.20 - 0.60	B D		0.20	53.78		Brown, slightly gravelly sandy SILT.
				0.60	53.38		Soft, beige, slightly sandy gravelly CLAY with moderate cobble content. Cobbles are up to 180mm and sub angular to sub rounded.
	1.00 - 1.70 1.00 - 1.70	B D					
				1.70	52.28		End of Pit at 1.700m

Stability: Moderate
Plant: 14t tracked excavator
Backfill: Arisings

Groundwater: None encountered

Remarks: Trial pit terminated at 1.70m bgl due to large boulders.

No	Job	Location	Date	Engineer
P19026	N52	DCP_TP32	24/05/2019	KH

Drop	Weight	Cone	Correlation
575mm	8kg	60^{o}	TRL DCP

Starting Depth mm	Ground Level	Easting	Northing
0	53.982	687222.91	784259.629

Blows	Depth (mm)	Penetration (mm)	Pennetration Per blow (mm)	Penetration (m bgl)	CBR, % (Kleyn)
0	0	0	0	0.00	
2	20	20	10	0.02	22
2	45	25	13	0.05	17
2	55	10	5	0.06	53
2	75	20	10	0.08	22
2	115	40	20	0.12	9
2	140	25	13	0.14	17
2	180	40	20	0.18	9
2	215	35	18	0.22	11
2	240	25	13	0.24	17
2	245	5	3	0.25	128
2	255	10	5	0.26	53
2	255	0	0	0.26	-
2	255	0	0	0.26	-
2	255	0	0	0.26	-

Photographic Record

Number:	**TP32**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No **TP33**
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 687292E - 784337N **Level:** 53.86m OD	**Date** 26/03/2019
Location: Co. Meath		**Dimensions (m):** 2.50 x 1.40 **Depth:** 1.30m BGL	**Scale** 1:25
Client: Meath County Council			**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
							(TOPSOIL)
	0.20 - 0.50 0.20 - 0.50	B D		0.20	53.66		Brown, slightly clayey slightly gravelly SILT with low cobble content and low boulder content. Cobbles are up to 100mm and angular to sub rounded. Boulders are up to 230mm and angular to sub rounded.
				0.50	53.36		Soft, beige, slightly sandy gravelly SILT with high cobble content and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse and sub rounded to sub angular. Cobbles are up to 200mm and sub angular to sub rounded. Boulders are up to 300mm and angular to sub rounded.
	1.00 - 1.30 1.00 - 1.30 1.10 1.10 1.10	B D	 HVP=35kPa HVP=36kPa HVP=36kPa	1.30	52.56		End of Pit at 1.300m

1
2
3
4
5

Stability: Moderate
Plant: 14t tracked excavator
Backfill: Arisings

Groundwater: None encountered

Remarks: Trial pits terminated at 1.30m bgl due to large boulders.

Photographic Record

Number:	**TP33**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No
TP34
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 687365E - 784431N **Level:** 44.54m OD	**Date** 28/03/2019
Location: Co. Meath		**Dimensions (m):** 2.50 x 1.40 **Depth:** 2.40m BGL	**Scale** 1:25
Client: Meath County Council			**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
							(TOPSOIL)
				0.30	44.24		
	0.50 - 1.20 0.50 - 1.20	B D					Brown, slightly gravelly SILT with low cobble content and rootlets. Gravel is angular to sub rounded. Cobbles are up to 90mm and sub rounded.
	1.20 1.20 1.20		HVP=31kPa HVP=35kPa HVP=53kPa	1.20	43.34		
	1.50 - 2.40 1.50 - 2.40	B D					Soft to firm, beige/orange, slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Cobbles are up to 150mm.
				2.40	42.14		End of Pit at 2.400m

Stability: Moderate
Plant: 14t tracked excavator
Backfill: Arisings

Groundwater: None encountered

Remarks: Trial pit terminated at 2.40m bgl due to large boulders.

Photographic Record

Number:	**TP34**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No
TP35
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 687462E - 784572N **Level:** 42.64m OD	**Date** 28/03/2019
Location: Co. Meath		**Dimensions (m):** 2.70 x 1.40 **Depth:** 2.80m BGL	**Scale** 1:25
Client: Meath County Council			**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
							(TOPSOIL)
				0.20	42.44		
	0.50 - 0.80 0.50 - 0.80	B D					Brown, slightly gravelly slightly sandy SILT. Gravel is fine to coarse and sub angular to sub rounded.
	0.80	ENV		0.80	41.84		
	1.10 1.10 1.10		HVP=36kPa HVP=38kPa HVP=47kPa				Soft to firm, beige/orange, slightly sandy gravelly CLAY with high cobble content and high boulder content. Sand is fine to coarse Gravel is fine to coarse and sub angular to sub rounded. Cobbles are up to 200mm and angular to sub rounded. Boulders are up to 300mm and angular to sub rounded.
	1.50 - 2.80 1.50 - 2.80	B D					
				2.80	39.84		End of Pit at 2.800m

1
2
3
4
5

Stability: Moderate
Plant: 14t tracked excavator
Backfill: Arisings

Groundwater: None encountered

Remarks: Trial pit terminated at 2.80m bgl due to refusal of track machine.

No	Job	Location	Date	Engineer
P19026	N52	DCP_TP35	24/05/2019	KH

Drop	Weight	Cone	Correlation
575mm	8kg	60^{o}	TRL DCP

Starting Depth mm	Ground Level	Easting	Northing
0	42.636	687461.725	784572.406

Blows	Depth (mm)	Penetration (mm)	Pennetration Per blow (mm)	Penetration (m bgl)	CBR, % (Kleyn)
0	0	0	0	0.00	
2	30	30	15	0.03	13
2	55	25	13	0.06	17
2	70	15	8	0.07	32
2	85	15	8	0.09	32
2	100	15	8	0.10	32
2	135	35	18	0.14	11
2	160	25	13	0.16	17
2	170	10	5	0.17	53
2	185	15	8	0.19	32
2	195	10	5	0.20	53
2	215	20	10	0.22	22
2	225	10	5	0.23	53
2	230	5	3	0.23	128
2	240	10	5	0.24	53
2	255	15	8	0.26	32
2	260	5	3	0.26	128
2	265	5	3	0.27	128
2	275	10	5	0.28	53
2	275	0	0	0.28	-
2	275	0	0	0.28	-
2	275	0	0	0.28	-

Photographic Record

Number:	**TP35**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

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Trial Pit No
TP36
Sheet 1 of 1

Project Name: N52 Grange to Clontail	**Project No.** P19026	**Co-ords:** 687571E - 784697N **Level:** 37.85m OD	**Date** 29/03/2019
Location: Co. Meath		**Dimensions (m):** 2.90 x 1.40 **Depth:** 3.40m BGL	**Scale** 1:25
Client: Meath County Council			**Logged** KH

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
							(TOPSOIL)
	0.20 - 0.70	B		0.20	37.65		Brown, dark brown, SILT.
	0.70 0.70	D ENV		0.70	37.15		Firm, grey beige, slightly sandy CLAY. Sand is fine to medium.
▼	2.50 - 3.40 2.50 2.50 2.50	B	 HVP=47kPa HVP=50kPa HVP=63kPa				
	3.40	D		3.40	34.45		End of Pit at 3.400m

1
2
3
4
5

Stability: Moderate.
Plant: 14t tracked excavator
Backfill: Arisings.

Groundwater: 2.40m: Trickle flow rate.

Remarks: Trial pit terminated at 3.40m bgl, required depth reached.

No	Job	Location	Date	Engineer
P19026	N52	DCP_TP36	24/05/2019	KH

Drop	Weight	Cone	Correlation
575mm	8kg	60^{o}	TRL DCP

Starting Depth mm	Ground Level	Easting	Northing
0	37.851	687570.591	784697.195

Blows	Depth (mm)	Penetration (mm)	Pennetration Per blow (mm)	Penetration (m bgl)	CBR, % (Kleyn)
0	0	0	0	0.00	
2	40	40	20	0.04	9
2	115	75	38	0.12	4
2	190	75	38	0.19	4
2	245	55	28	0.25	6
2	310	65	33	0.31	5
2	375	65	33	0.38	5
2	440	65	33	0.44	5
2	495	55	28	0.50	6
2	560	65	33	0.56	5
2	615	55	28	0.62	6
2	680	65	33	0.68	5
2	740	60	30	0.74	5
2	820	80	40	0.82	4
2	920	100	50	0.92	3
2	940	20	10	0.94	22
2	1025	85	43	1.03	4
2	1090	65	33	1.09	5
2	1140	50	25	1.14	7
2	1210	70	35	1.21	4
2	1285	75	38	1.29	4
2	1355	70	35	1.36	4
2	1405	50	25	1.41	7
2	1460	55	28	1.46	6
2	1500	40	20	1.50	9
2	1545	45	23	1.55	8
2	1580	35	18	1.58	11
2	1615	1175	588	1.62	0
2	1650	1155	578	1.65	0
2	1685	1125	563	1.69	0
2	1695	1080	540	1.70	0
2	1705	1025	513	1.71	0
2	1715	975	488	1.72	0
2	1715	895	448	1.72	0
2	1715	100	50	1.72	3
2	1715	0	0	1.72	-

Photographic Record

Number:	**TP36**	**Project**	N52 Grange to Clontail Scheme	
		Project No	P19026	
		Engineer	Atkins	

APPENDIX B

LABORATORY RESULTS

Type
Natural Moisture Content
Atterberg Limit
Particle Size Distribution
Organic content
Dry Density/Moisture Content Relationship
Moisture Condition Value, MCV
MCV/ Moisture Content Relationship
Point Load Index
Unconfined Compressive Strength
Environmental results Suite I
Environmental results Suite E

DRAFT

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 1st Load	
**	Failed under 2nd 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	

pgl priority geotechnical	**Natural Moisture Content/Atterberg Limits Summary** **BS 1377 : Part 2 : 1990 : Clause 3**	**Job Ref**
Location	**N52 Grange to Clontail**	**P19026**

Hole ID	Sample Ref	Depth (m)	Sample Type	Sample Description	MC	LL	PL	PI	% Pass 425
BH01	1	0.5	B	Very silty very sandy GRAVEL	21	50	32	18	58.1
BH01	D	1	D	Very silty very sandy GRAVEL	18				
BH01	D	2	D	Slightly sandy gravelly CLAY	9				
BH01	4	2.5	B	Clayey very sandy GRAVEL with medium cobble content	12				
BH01	D	3	D	Slightly sandy gravelly CLAY	11				
BH02	D	1	D	Clayey very sandy GRAVEL	55				
BH02	2	1.5	B	Clayey very sandy GRAVEL	15				
BH02	3	2.5	B	Clayey very sandy GRAVEL with medium cobble content	10	24	15	9	48.5
BH02	D	2.5	D	Clayey very sandy GRAVEL	13				
BH02	D	4	D	Clayey very sandy GRAVEL	13				
BH03	1	0.5	B	Clayey sandy GRAVEL with high cobble content	20	37	23	14	53.5
BH03	D	1	D	Clayey sandy GRAVEL	12				
BH03	3	2.5	B	Clayey sandy GRAVEL with high cobble content	12				
BH03	D	2.5	D	Clayey sandy GRAVEL	30				
BH04A	1	0.5	B	Slightly sandy gravelly SILT	26	63	40	23	63.3
BH07	1	0.5	B	Slightly sandy gravelly SILT	30	51	31	20	74.9
BH07	D	1	D	Slightly sandy gravelly SILT	25				
BH07	3	1.5	B	Slightly sandy gravelly CLAY with low cobble content	25				
BH07	4	2.5	B	Slightly sandy gravelly CLAY with low cobble content	21				
BH07	D	2.5	D	Slightly sandy gravelly CLAY	23				

pgl priority geotechnical	**Natural Moisture Content/Atterberg Limits Summary** **BS 1377 : Part 2 : 1990 : Clause 3**	**Job Ref**
Location	**N52 Grange to Clontail**	**P19026**

Hole ID	Sample Ref	Depth (m)	Sample Type	Sample Description	MC	LL	PL	PI	% Pass 425
BH08	1	0.5	B	Slightly sandy slightly gravelly CLAY with medium cobble content	13				
BH08	D	1	D	Slightly sandy slightly gravelly CLAY	18				
BH08	2	1.5	B	Slightly sandy slightly gravelly CLAY with medium cobble content	12	23	15	8	53.5
BH08	3	2.5	B	Slightly sandy slightly gravelly CLAY with medium cobble content	13	24	13	11	64.3
BH08	D	2.5	D	Slightly sandy slightly gravelly CLAY	17				
BH10	D	1	D	CLAY	13				
BH10	2	1.5	B	Slightly gravelly sandy SILT	15				
BH10	D	2	D	Slightly gravelly sandy SILT	24				
BH10	3	2.5	B	Slightly gravelly sandy SILT	18				
BH11	1	0.5	B	Slightly gravelly sandy CLAY	34				
BH11	2	1.5	B	Slightly gravelly sandy CLAY	10				
BH11	3	2.5	B	Slightly gravelly sandy CLAY	4				
BH11	4	3.5	B	Slightly silty slightly sandy GRAVEL and COBBLES	5				
BH12	1	0.5	B	Slightly sandy slightly gravelly CLAY with low cobble content	22	36	21	15	75
BH12	D	0.5	D	Slightly sandy slightly gravelly CLAY	20				
BH12	D	1.5	D	Slightly sandy slightly gravelly CLAY	19				
BH12	D	3	D	Slightly sandy slightly gravelly CLAY	13				
BH13	D	1	D	Slightly silty slightly sandy GRAVEL and COBBLES	13				
BH13	2	1.5	B	Slightly silty slightly sandy GRAVEL and COBBLES	19	32	18	14	69.1
BH13	D	2	D	Slightly silty slightly sandy GRAVEL and COBBLES	12				

pgl priority geotechnical	**Natural Moisture Content/Atterberg Limits Summary** **BS 1377 : Part 2 : 1990 : Clause 3**	**Job Ref**
Location	**N52 Grange to Clontail**	**P19026**

Hole ID	Sample Ref	Depth (m)	Sample Type	Sample Description	MC	LL	PL	PI	% Pass 425
BH14	1	0.5	B	Gravelly CLAY	23				
BH14	D	1	D	Gravelly CLAY	17				
BH14	D	3	D	Gravelly CLAY	18				
RC09	RC09	3	C	Slightly sandy gravelly CLAY	1	22	15	7	74.7
RC11	RC	6	C	Slightly sandy gravelly CLAY	2	23	16	7	57.3
RC12	RC	3	C	Slightly sandy gravelly CLAY	4	32	20	12	58
RC12	RC	7.2	C	Slightly sandy gravelly CLAY	4	27	18	9	58.2
RC12	RC	10.2	C	Slightly sandy gravelly CLAY	3	26	18	8	45.8
RC13	RC	4.5	C	Slightly sandy gravelly CLAY	7	29	19	10	59.9
RC13	RC	7.7	C	Slightly sandy gravelly CLAY	4	25	16	9	56.5
RC13	RC	10.5	C	Slightly sandy gravelly CLAY	3	25	16	9	54.2
TP02	1	0.5	B	Very sandy very clayey GRAVEL		36	22	14	59.1
TP02	2	0.5	D	Very sandy very clayey GRAVEL	23				
TP02	4	1.5	D	Slightly sandy gravelly CLAY	21				
TP02	6	3	D	Slightly sandy gravelly CLAY	10				
TP02A	2	0.5	D	Clayey SAND	21				
TP02A	4	1.5	D	Clayey gravelly SAND	24				
TP02A	6	3	D	CLAY	30				
TP03	4	1.5	D	Slightly sandy slightly gravelly CLAY	14				
TP04	2	1.3	D	Very clayey very sandy GRAVEL	17				

pgl priority geotechnical	**Natural Moisture Content/Atterberg Limits Summary** **BS 1377 : Part 2 : 1990 : Clause 3**	**Job Ref**
Location	**N52 Grange to Clontail**	**P19026**

Hole ID	Sample Ref	Depth (m)	Sample Type	Sample Description	MC	LL	PL	PI	% Pass 425
TP04	3	1.5	B	Very clayey very sandy GRAVEL with high cobble content	17	31	19	12	54.3
TP05	4	2.2	D	Very clayey very sandy GRAVEL	16				
TP06	1	0.5	B	Slightly sandy gravelly CLAY with medium cobble content		35	22	13	69.9
TP06	2	0.5	D	Slightly sandy gravelly CLAY	26				
TP07	1	0.5	B	Slightly gravelly sandy SILT		87	54	33	99.2
TP07	2	0.5	D	Slightly gravelly sandy SILT	58				
TP08	1	0.5	B	Slightly sandy slightly gravelly CLAY with medium cobble content	26	37	23	14	87.9
TP13	1	0.5	B	Slightly sandy gravelly CLAY with medium cobble content		41	25	16	87.4
TP13	2	0.5	D	Slightly sandy gravelly CLAY	27				
TP13	3	1.5	B	Slightly gravelly slightly sandy CLAY with low cobble content		34	22	12	76.6
TP13	4	1.5	D	Slightly gravelly slightly sandy CLAY with low cobble content	32				
TP14	1	0.5	B	Very sandy very silty GRAVEL with high cobble content		36	23	13	53.1
TP14	2	0.5	D	Very sandy very silty GRAVEL with high cobble content	19				
TP15	2	0.5	D	Slightly sandy gravelly CLAY	11				
TP15	4	1.5	D	Slightly gravelly slightly sandy CLAY	13				
TP15	6	2.2	D	Slightly sandy slightly gravelly CLAY	9				
TP16	1	0.2	B	Slightly sandy slightly gravelly SILT with low cobble content		48	29	19	80.9
TP16	2	0.2	D	Slightly sandy slightly gravelly SILT with low cobble content	32				
TP16	4	1.5	D	Slightly sandy gravelly CLAY	14				
TP17	2	0.3	D	Slightly sandy gravelly CLAY	17				

pgl priority geotechnical	**Natural Moisture Content/Atterberg Limits Summary** **BS 1377 : Part 2 : 1990 : Clause 3**	**Job Ref**
Location	**N52 Grange to Clontail**	**P19026**

Hole ID	Sample Ref	Depth (m)	Sample Type	Sample Description	MC	LL	PL	PI	% Pass 425
TP17	3	1.2	B	Very sandy very clayey GRAVEL with high cobble content		30	19	11	59.4
TP17	4	1.2	D	Very silty very clayey GRAVEL	12				
TP18	1	0.5	B	Slightly sandy gravelly CLAY		37	22	15	82.2
TP18	2	0.5	D	Slightly sandy gravelly CLAY	23				
TP18	3	1.5	B	Slightly sandy slightly gravelly CLAY with high cobble content		31	20	11	75.1
TP18	4	1.5	D	Slightly sandy slightly gravelly CLAY with high cobble content	17				
TP19	1	0.5	B			41	23	18	67.8
TP19	3	1.5	B	Slightly sandy gravelly CLAY with high cobble content		41	23	18	67.8
TP19	4	1.5	D	Slightly sandy gravelly CLAY	23				
TP20	1	0.5	B	Slightly sandy slightly gravelly SILT with low cobble content		46	28	18	71.5
TP20	2	0.5	D	Slightly sandy slightly gravelly SILT with low cobble content	25				
TP20	3	0.8	B	Slightly sandy slightly gravelly CLAY with medium cobble content		33	19	14	64.2
TP20	4	0.8	D	Slightly sandy slightly gravelly CLAY	16				
TP22	1	0.5	B	Slightly sandy gravelly SILT with medium cobble content		46	29	17	70.5
TP22	2	0.5	D	Slightly sandy gravelly SILT with medium cobble content	33				
TP22	3	1.5	B	Slightly sandy slightly gravelly CLAY with medium cobble content		42	26	16	73.1
TP22	4	1.5	D	Slightly sandy slightly gravelly CLAY	29				
TP23	2	0.5	D	Slightly gravelly SILT	19				
TP23	4	1.5	D	Slightly sandy slightly gravelly CLAY	24				
TP23	6	2	D	Very clayey very sandy GRAVEL with high cobble content	12				

pgl priority geotechnical	**Natural Moisture Content/Atterberg Limits Summary** **BS 1377 : Part 2 : 1990 : Clause 3**	**Job Ref**
Location	**N52 Grange to Clontail**	**P19026**

Hole ID	Sample Ref	Depth (m)	Sample Type	Sample Description	MC	LL	PL	PI	% Pass 425
TP24	1	0.5	B	Slightly gravelly CLAY with medium cobble content		34	22	12	70.5
TP24	2	0.5	D	Slightly gravelly CLAY	23				
TP24	3	1.5	B	Very silty very sandy GRAVEL with high cobble content		38	25	13	52.6
TP24	4	1.5	D	Very silty very sandy GRAVEL with high cobble content	20				
TP25	1	0.5	B	Very sandy very clayey GRAVEL with low cobble content		36	22	14	63.8
TP25	2	0.5	D	Very sandy very clayey GRAVEL with low cobble content	23				
TP25	3	1.5	B	Very sandy very clayey GRAVEL with high cobble content		36	21	15	50.3
TP25	4	1.5	D	Very sandy very clayey GRAVEL with high cobble content	17				
TP26	2	0.5	D	Slightly gravelly SILT	40				
TP26	4	1.5	D	Slightly gravelly slightly sandy CLAY	33				
TP26	6	2.5	D	Slightly gravelly slightly sandy CLAY with medium cobble content	23				
TP27	2	0.2	D	SILT	46				
TP27	3	0.5	B	Slightly gravelly slightly sandy CLAY with low cobble content		32	21	11	97.7
TP27	4	0.5	D	Slightly gravelly slightly sandy CLAY with low cobble content	23				
TP27	6	1.5	D	Clayey SAND	18				
TP28	2	0.5	D	Slightly gravelly slightly sandy CLAY	17				
TP29	2	0.5	D	Slightly sandy slightly gravelly CLAY	24				
TP29	4	1.5	D	Slightly sandy gravelly CLAY	23				
TP30	2	0.5	D	Slightly sandy gravelly CLAY	18				
TP30	4	1	D	Slightly sandy gravelly CLAY	16				

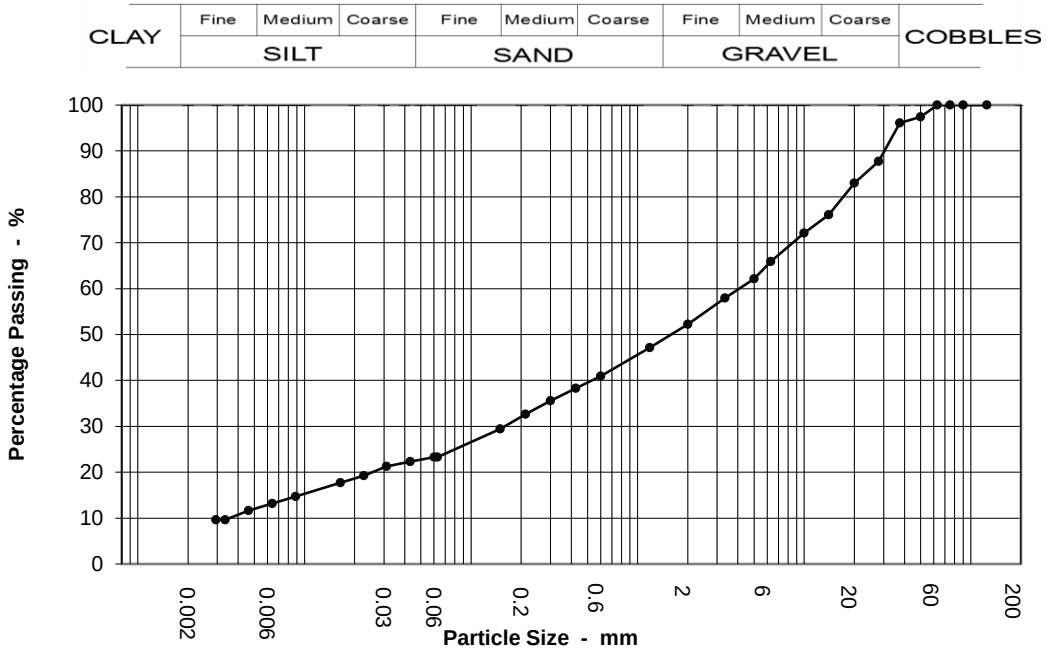
pgl priority geotechnical	**Natural Moisture Content/Atterberg Limits Summary** **BS 1377 : Part 2 : 1990 : Clause 3**	**Job Ref**
Location	**N52 Grange to Clontail**	**P19026**

Hole ID	Sample Ref	Depth (m)	Sample Type	Sample Description	MC	LL	PL	PI	% Pass 425
TP31	2	0.5	D	Slightly gravelly CLAY	21				
TP31	3	1.5	B	Slightly gravelly slightly sandy CLAY		56	NP	NP	96.9
TP31	4	1.5	D	Slightly gravelly slightly sandy CLAY	27				
TP32	1	0.2	B	Slightly gravelly sandy SILT		46	29	17	88.8
TP32	2	0.2	D	Slightly gravelly sandy SILT	20				
TP32	3	1	B	CLAY		40	24	16	72.8
TP32	4	1	D	CLAY	24				
TP33	1	0.2	B	SILT		53	33	20	85.3
TP33	2	0.2	D	SILT	39				
TP33	3	1	B	Slightly sandy gravelly SILT with high cobble content		45	27	18	66.5
TP33	4	1	D	Slightly sandy gravelly SILT with high cobble content	23				
TP34	1	0.5	B	Slightly gravelly SILT	45				
TP34	3	1.5	B	Slightly gravelly slightly sandy CLAY		44	26	18	90.7
TP34	4	1.5	D	Slightly gravelly slightly sandy CLAY	17				
TP35	1	0.5	B	Slightly gravelly slightly sandy SILT		45	28	17	77.3
TP35	2	0.5	D	Slightly gravelly slightly sandy SILT	36				
TP35	3	1.5	B	Slightly sandy gravelly CLAY		49	27	22	77.1
TP35	4	1.5	D	Slightly sandy gravelly CLAY	28				

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	BH01
Location	**N52 Grange to Clontail**	Sample No	1
		Depth	0.50 m
Soil Description	Very silty very sandy GRAVEL	Sample type	B



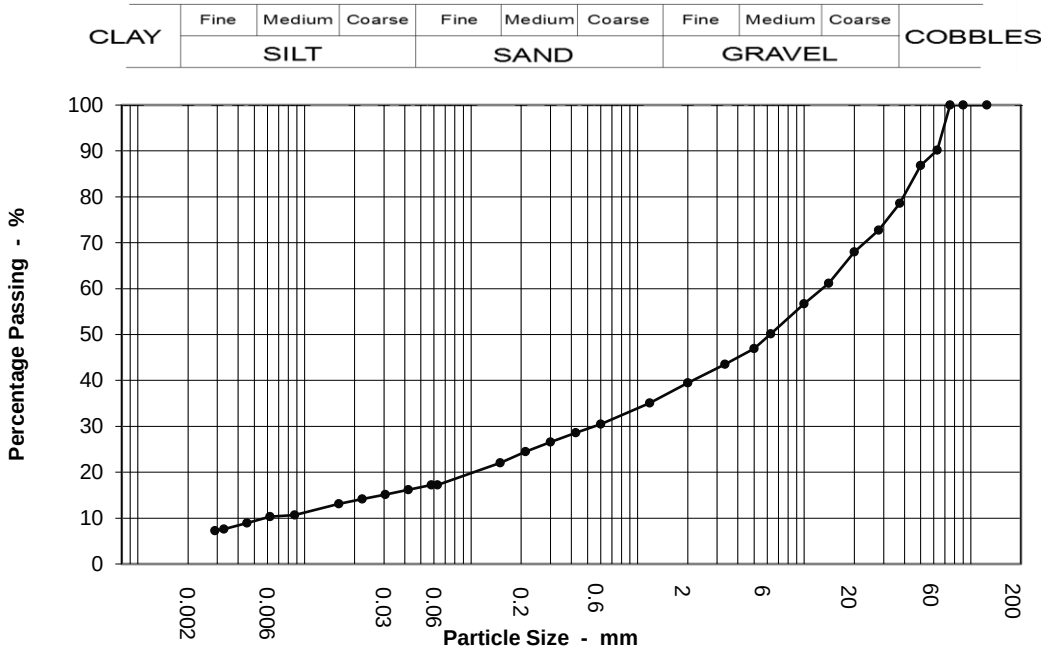
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.060	23
90	100	0.043	22
75	100	0.031	21
63	100	0.023	19
50	97	0.016	18
37.5	96	0.009	15
28	88	0.006	13
20	83	0.005	12
14	76	0.003	10
10	72	0.003	10
6.3	66	0.001	6
5	62		
3.35	58		
2	52		
1.18	47		
0.6	41		
0.425	38		
0.3	36		
0.212	33		
0.15	29		
0.063	23		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

Sample Proportions	
Cobbles	0.0
Gravel	48.0
Sand	29.0
Silt	15.0
Clay	8.0

Grading Analysis	
D100	63.00
D60	4.07
D10	0.00
Uniformity Coefficient	1100.00

pgl priority geotechnical	**PARTICLE SIZE DISTRIBUTION** **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P19026**
		Borehole / Pit No	BH02
Location	**N52 Grange to Clontail**	Sample No	3
		Depth	2.50 m
Soil Description	Clayey very sandy GRAVEL with medium cobble content	Sample type	B



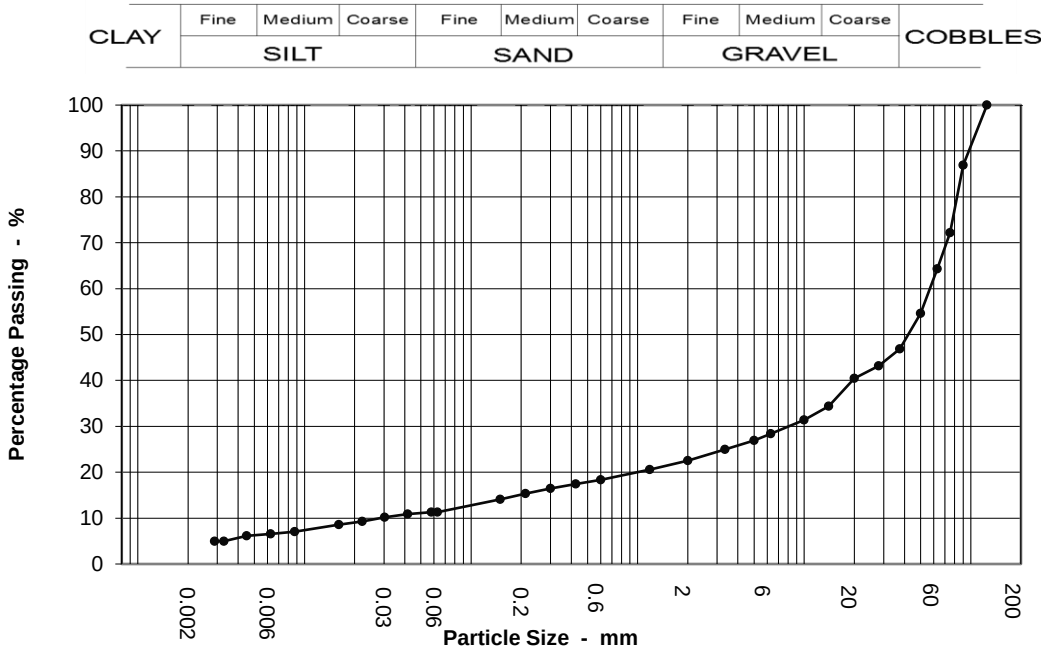
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.058	17
90	100	0.042	16
75	100	0.031	15
63	90	0.022	14
50	87	0.016	13
37.5	79	0.009	11
28	73	0.006	10
20	68	0.005	9
14	61	0.003	8
10	57	0.003	7
6.3	50	0.001	4
5	47		
3.35	43		
2	39		
1.18	35		
0.6	30		
0.425	29		
0.3	27		
0.212	24		
0.15	22		
0.063	17		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

Sample Proportions	
Cobbles	10.0
Gravel	51.0
Sand	22.0
Silt	11.0
Clay	6.0

Grading Analysis	
D100	75.00
D60	12.80
D10	0.01
Uniformity Coefficient	2200.00

pgl priority geotechnical	**PARTICLE SIZE DISTRIBUTION** **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P19026**
		Borehole / Pit No	BH03
Location	**N52 Grange to Clontail**	Sample No	1
		Depth	0.50 m
Soil Description	Clayey sandy GRAVEL with high cobble content	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.058	11
90	87	0.042	11
75	72	0.030	10
63	64	0.022	9
50	55	0.016	9
37.5	47	0.009	7
28	43	0.006	7
20	40	0.004	6
14	34	0.003	5
10	31	0.003	5
6.3	28	0.001	3
5	27		
3.35	25		
2	23		
1.18	21		
0.6	18		
0.425	17		
0.3	16		
0.212	15		
0.15	14		
0.063	11		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

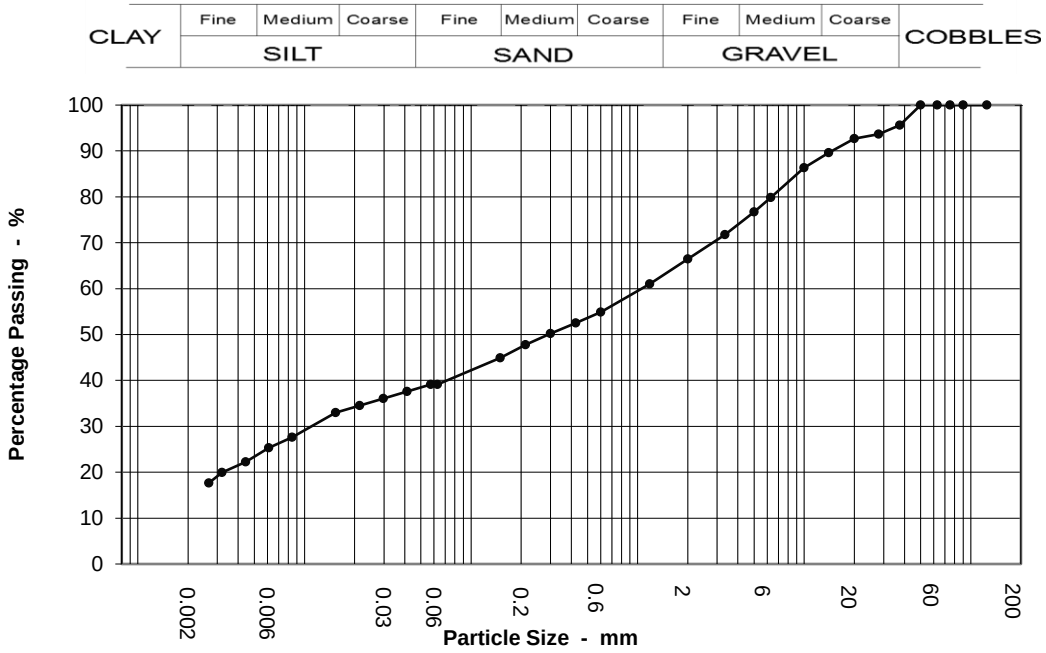
Sample Proportions	
Cobbles	36.0
Gravel	42.0
Sand	11.0
Silt	7.0
Clay	4.0

Grading Analysis	
D100	125.00
D60	56.90
D10	0.03
Uniformity Coefficient	2000.00

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	BH07
Location	**N52 Grange to Clontail**	Sample No	1
		Depth	0.50 m
Soil Description	Slightly sandy gravelly SILT	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.057	39
90	100	0.041	38
75	100	0.030	36
63	100	0.021	35
50	100	0.015	33
37.5	96	0.008	28
28	94	0.006	25
20	93	0.004	22
14	90	0.003	20
10	86	0.003	18
6.3	80	0.001	12
5	77		
3.35	72		
2	66		
1.18	61		
0.6	55		
0.425	53		
0.3	50		
0.212	48		
0.15	45		
0.063	39		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

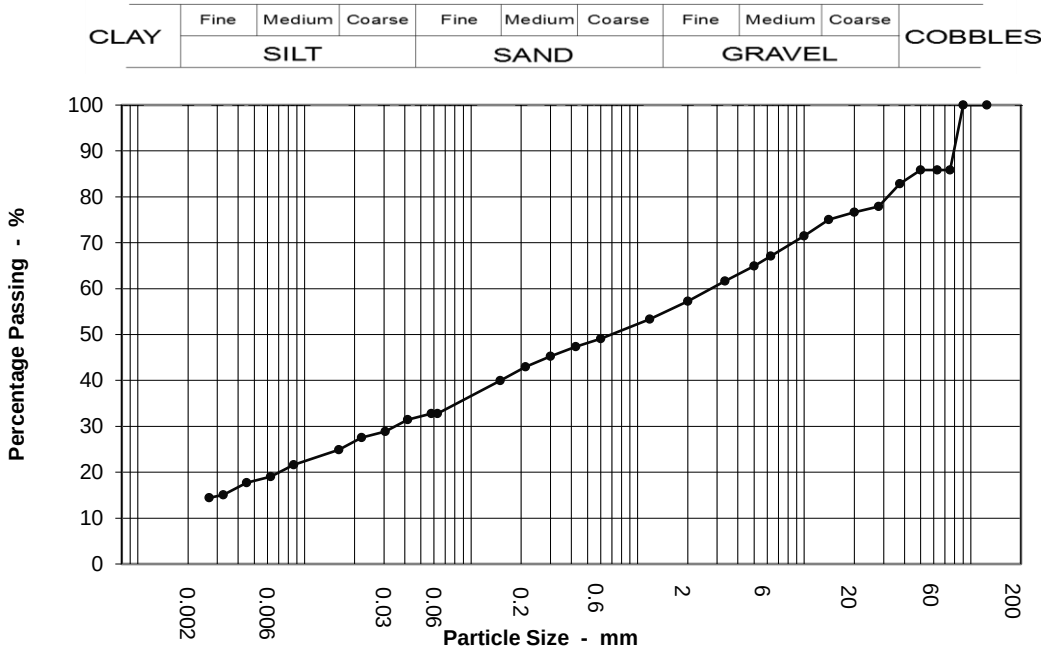
Sample Proportions	
Cobbles	0.0
Gravel	34.0
Sand	27.0
Silt	24.0
Clay	15.0

Grading Analysis	
D100	50.00
D60	1.06
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	BH08
Location	**N52 Grange to Clontail**	Sample No	3
		Depth	2.50 m
Soil Description	Slightly sandy slightly gravelly CLAY with medium cobble content	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.058	33
90	100	0.042	31
75	86	0.031	29
63	86	0.022	28
50	86	0.016	25
37.5	83	0.009	22
28	78	0.006	19
20	77	0.004	18
14	75	0.003	15
10	71	0.003	14
6.3	67	0.001	12
5	65		
3.35	62		
2	57		
1.18	53		
0.6	49		
0.425	47		
0.3	45		
0.212	43		
0.15	40		
0.063	33		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

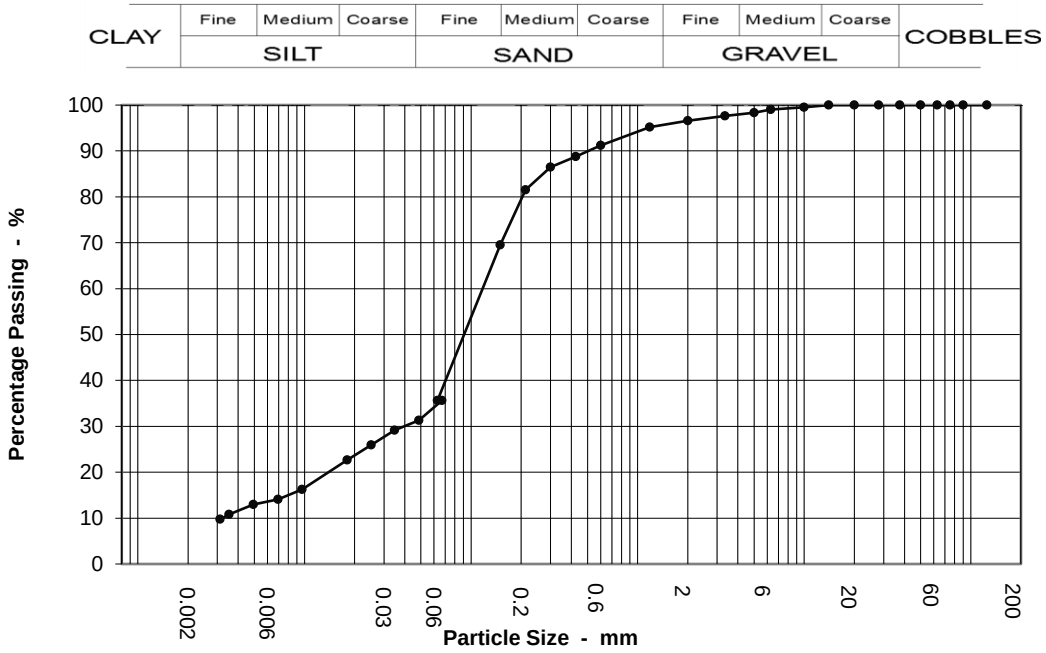
Sample Proportions	
Cobbles	14.0
Gravel	29.0
Sand	25.0
Silt	20.0
Clay	13.0

Grading Analysis	
D100	90.00
D60	2.75
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	BH10
Location	**N52 Grange to Clontail**	Sample No	3
		Depth	2.50 m
Soil Description	Slightly gravelly sandy SILT	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.067	36
90	100	0.049	31
75	100	0.035	29
63	100	0.025	26
50	100	0.018	23
37.5	100	0.010	16
28	100	0.007	14
20	100	0.005	13
14	100	0.004	11
10	100	0.003	10
6.3	99	0.001	8
5	98		
3.35	98		
2	97		
1.18	95		
0.6	91		
0.425	89		
0.3	86		
0.212	82		
0.15	70		
0.063	36		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

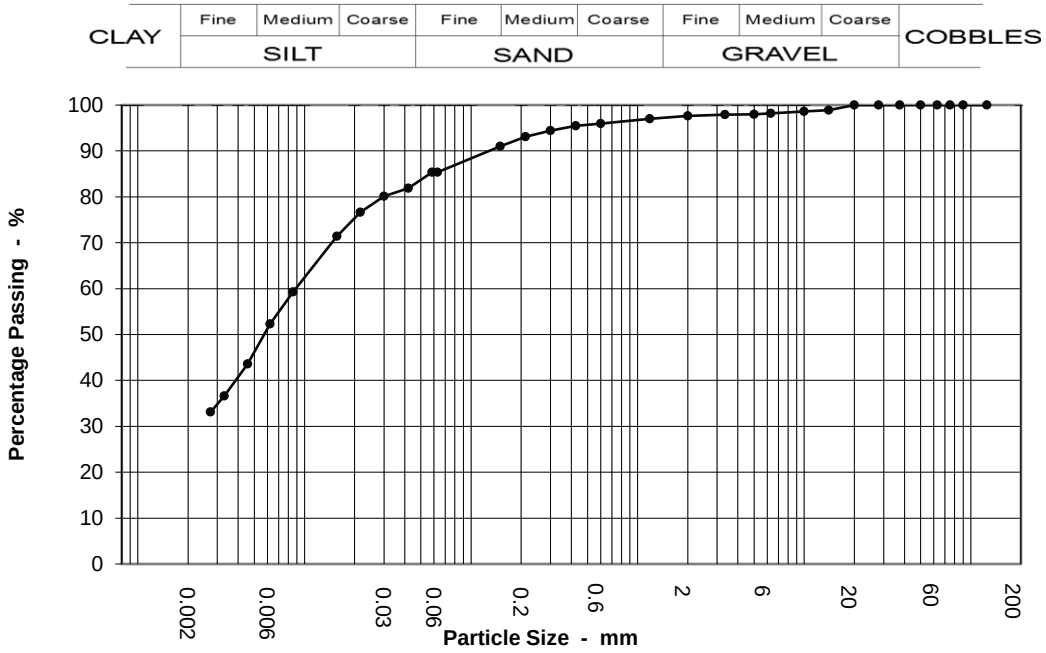
Sample Proportions	
Cobbles	0.0
Gravel	3.0
Sand	61.0
Silt	27.0
Clay	9.0

Grading Analysis	
D100	14.00
D60	0.12
D10	0.00
Uniformity Coefficient	37.00

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	BH11
Location	**N52 Grange to Clontail**	Sample No	1
		Depth	0.50 m
Soil Description	Slightly gravelly sandy CLAY	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.058	85
90	100	0.042	82
75	100	0.030	80
63	100	0.022	77
50	100	0.016	71
37.5	100	0.009	59
28	100	0.006	52
20	100	0.005	44
14	99	0.003	37
10	99	0.003	33
6.3	98	0.001	23
5	98		
3.35	98		
2	98		
1.18	97		
0.6	96		
0.425	95		
0.3	94		
0.212	93		
0.15	91		
0.063	85		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

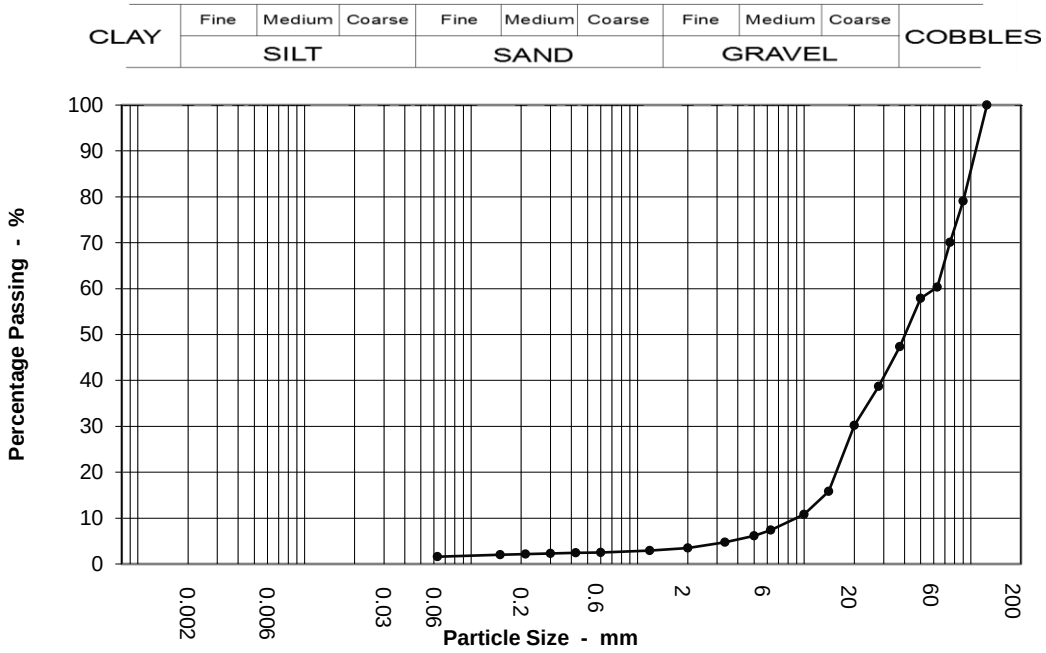
Sample Proportions	
Cobbles	0.0
Gravel	2.0
Sand	12.0
Silt	58.0
Clay	28.0

Grading Analysis	
D100	20.00
D60	0.01
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	BH11
Location	**N52 Grange to Clontail**	Sample No	4
		Depth	3.50 m
Soil Description	Slightly silty slightly sandy GRAVEL and COBBLES	Sample type	B



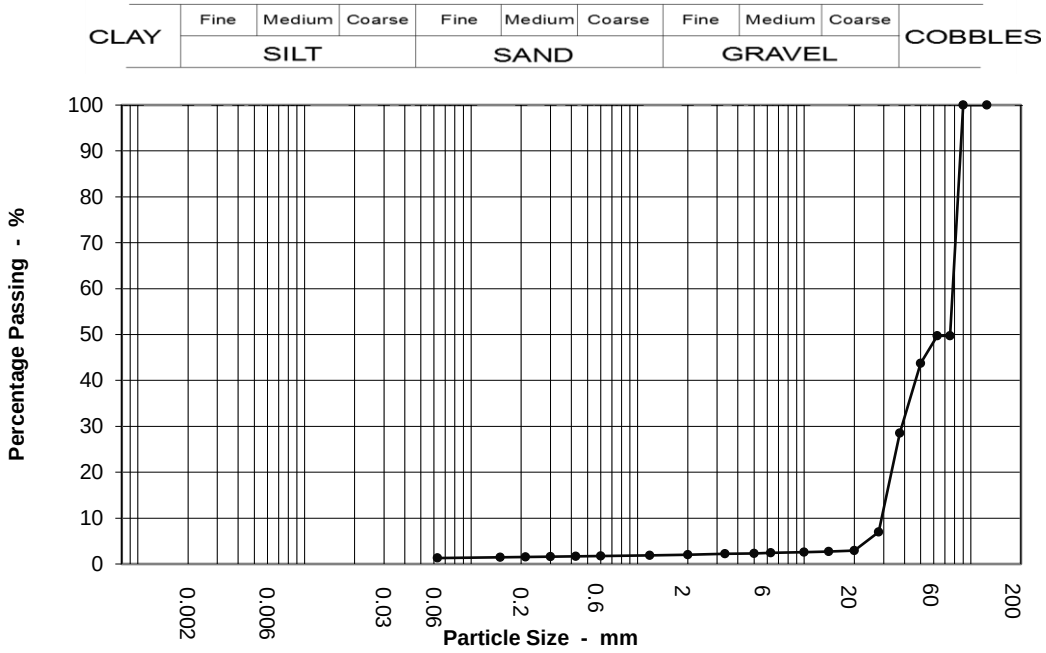
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	79		
75	70		
63	60		
50	58		
37.5	47		
28	39		
20	30		
14	16		
10	11		
6.3	7		
5	6		
3.35	5		
2	4		
1.18	3		
0.6	3		
0.425	2		
0.3	2		
0.212	2		
0.15	2		
0.063	2		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	40.0
Gravel	57.0
Sand	2.0
Silt & Clay	2.0

Grading Analysis	
D100	125.00
D60	61.10
D10	8.93
Uniformity Coefficient	6.80

pgl priority geotechnical	**PARTICLE SIZE DISTRIBUTION** **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P19026**
		Borehole / Pit No	BH13
Location	**N52 Grange to Clontail**	Sample No	2
		Depth	1.50 m
Soil Description	Slightly silty slightly sandy GRAVEL and COBBLES	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	50		
63	50		
50	44		
37.5	29		
28	7		
20	3		
14	3		
10	3		
6.3	2		
5	2		
3.35	2		
2	2		
1.18	2		
0.6	2		
0.425	2		
0.3	2		
0.212	2		
0.15	1		
0.063	1		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

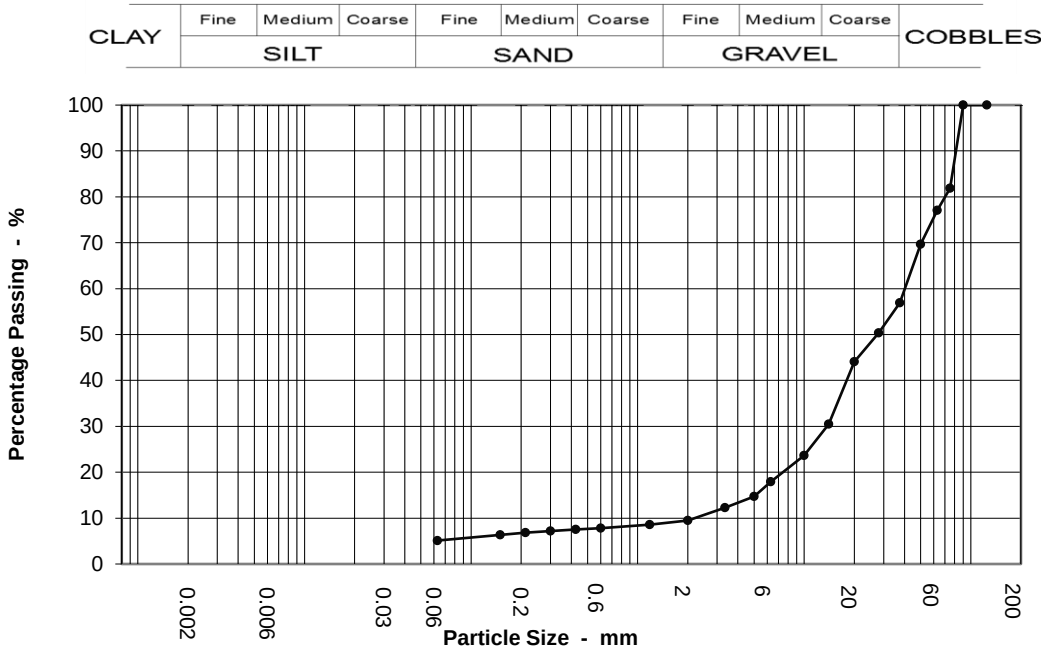
Sample Proportions	
Cobbles	50.0
Gravel	48.0
Sand	1.0
Silt & Clay	1.0

Grading Analysis	
D100	90.00
D60	77.90
D10	29.20
Uniformity Coefficient	2.70

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	RC09
Location	**N52 Grange to Clontail**	Sample No	RC09
		Depth	3.00 m
Soil Description	Slightly sandy gravelly CLAY	Sample type	C



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	82		
63	77		
50	70		
37.5	57		
28	50		
20	44		
14	30		
10	24		
6.3	18		
5	15		
3.35	12		
2	9		
1.18	9		
0.6	8		
0.425	8		
0.3	7		
0.212	7		
0.15	6		
0.063	5		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

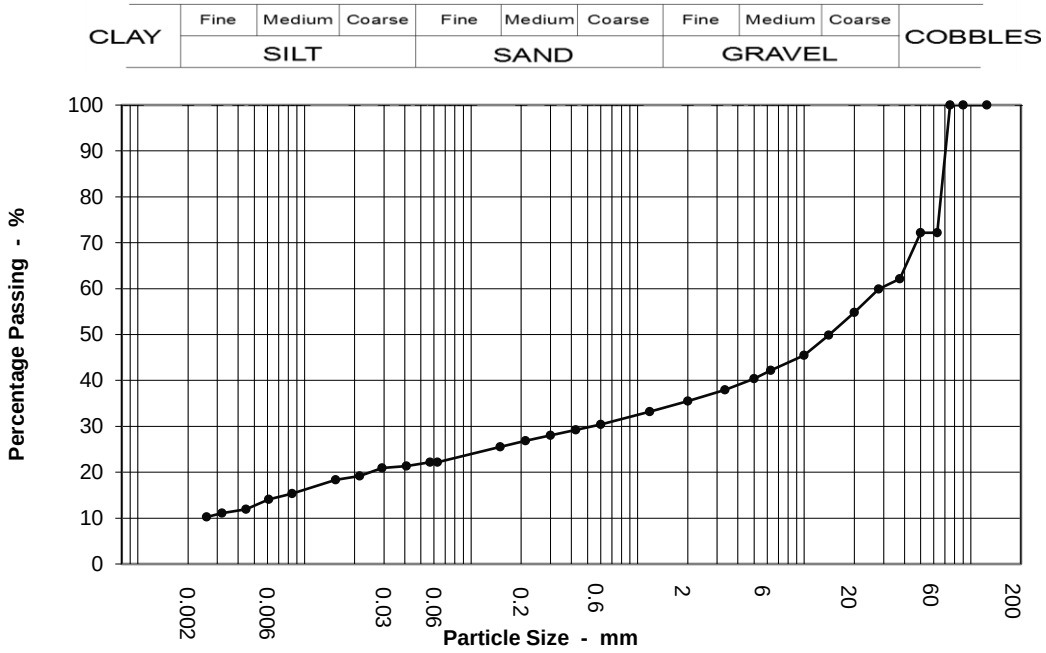
Sample Proportions	
Cobbles	23.0
Gravel	68.0
Sand	4.0
Silt & Clay	5.0

Grading Analysis	
D100	90.00
D60	40.20
D10	2.20
Uniformity Coefficient	18.00

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	RC12
Location	**N52 Grange to Clontail**	Sample No	RC
		Depth	3.00 m
Soil Description	Slightly sandy gravelly CLAY	Sample type	C



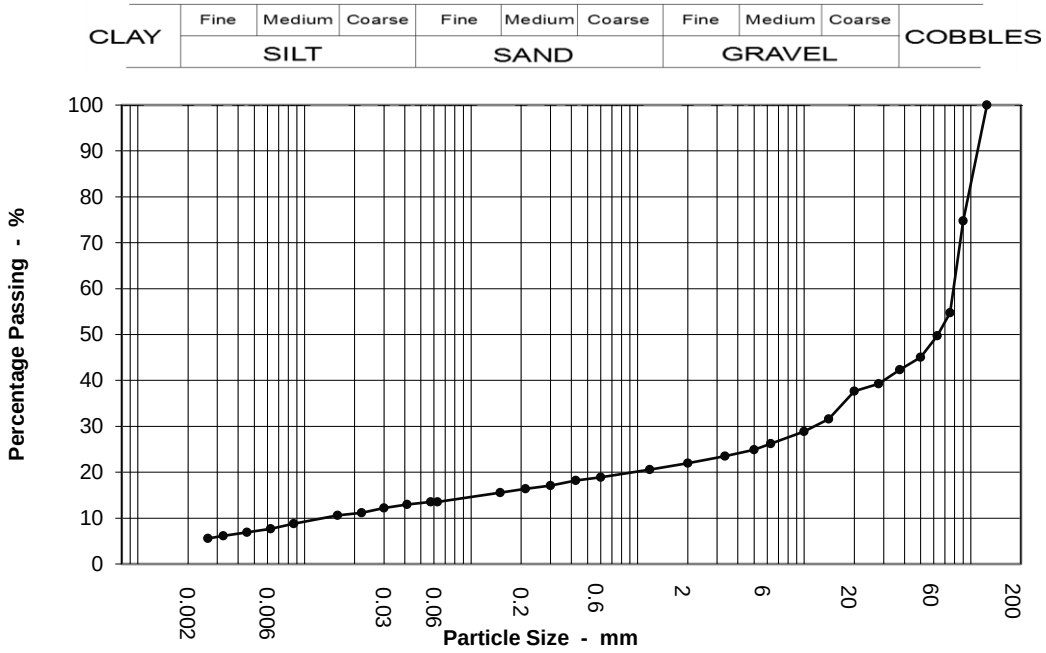
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.057	22
90	100	0.041	21
75	100	0.029	21
63	72	0.021	19
50	72	0.015	18
37.5	62	0.008	15
28	60	0.006	14
20	55	0.004	12
14	50	0.003	11
10	45	0.003	10
6.3	42	0.001	9
5	40		
3.35	38		
2	36		
1.18	33		
0.6	30		
0.425	29		
0.3	28		
0.212	27		
0.15	25		
0.063	22		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

Sample Proportions	
Cobbles	28.0
Gravel	37.0
Sand	13.0
Silt	13.0
Clay	10.0

Grading Analysis	
D100	75.00
D60	28.30
D10	0.00
Uniformity Coefficient	12000.00

pgl priority geotechnical	**PARTICLE SIZE DISTRIBUTION** **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P19026**
		Borehole / Pit No	RC12
Location	**N52 Grange to Clontail**	Sample No	RC
		Depth	7.20 m
Soil Description	Slightly sandy gravelly CLAY	Sample type	C



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.057	14
90	75	0.041	13
75	55	0.030	12
63	50	0.022	11
50	45	0.016	11
37.5	42	0.009	9
28	39	0.006	8
20	38	0.005	7
14	32	0.003	6
10	29	0.003	6
6.3	26	0.001	5
5	25		
3.35	24		
2	22		
1.18	21		
0.6	19		
0.425	18		
0.3	17		
0.212	16		
0.15	16		
0.063	14		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

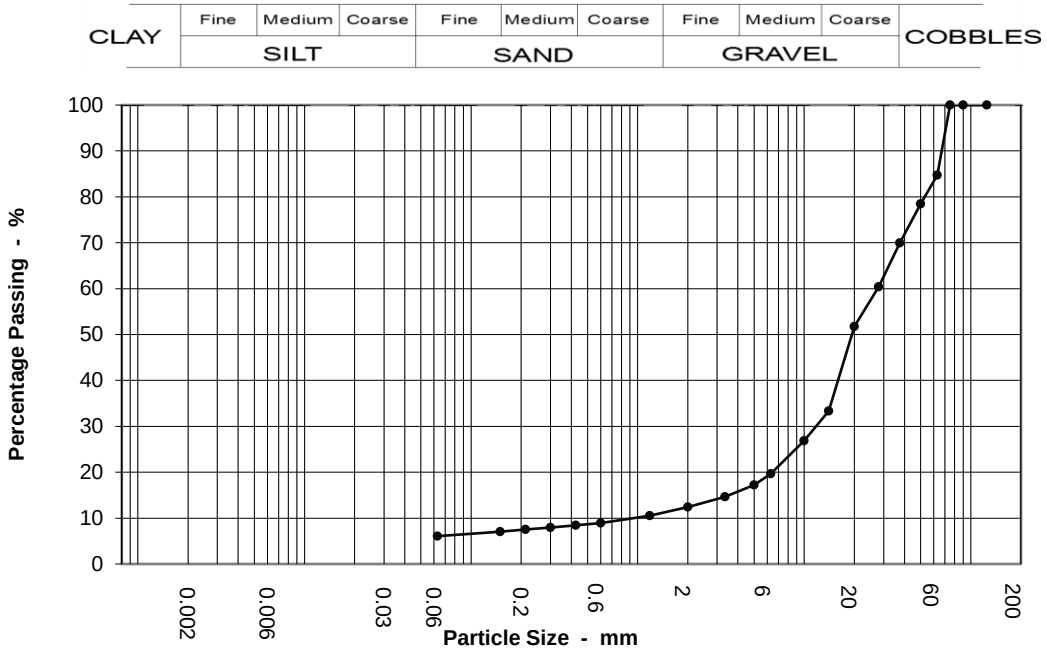
Sample Proportions	
Cobbles	50.0
Gravel	28.0
Sand	8.0
Silt	8.0
Clay	5.0

Grading Analysis	
D100	125.00
D60	78.70
D10	0.01
Uniformity Coefficient	6100.00

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	RC12
Location	**N52 Grange to Clontail**	Sample No	RC
		Depth	10.20 m
Soil Description	Slightly sandy gravelly CLAY	Sample type	C



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	85		
50	78		
37.5	70		
28	60		
20	52		
14	33		
10	27		
6.3	20		
5	17		
3.35	15		
2	12		
1.18	11		
0.6	9		
0.425	8		
0.3	8		
0.212	8		
0.15	7		
0.063	6		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

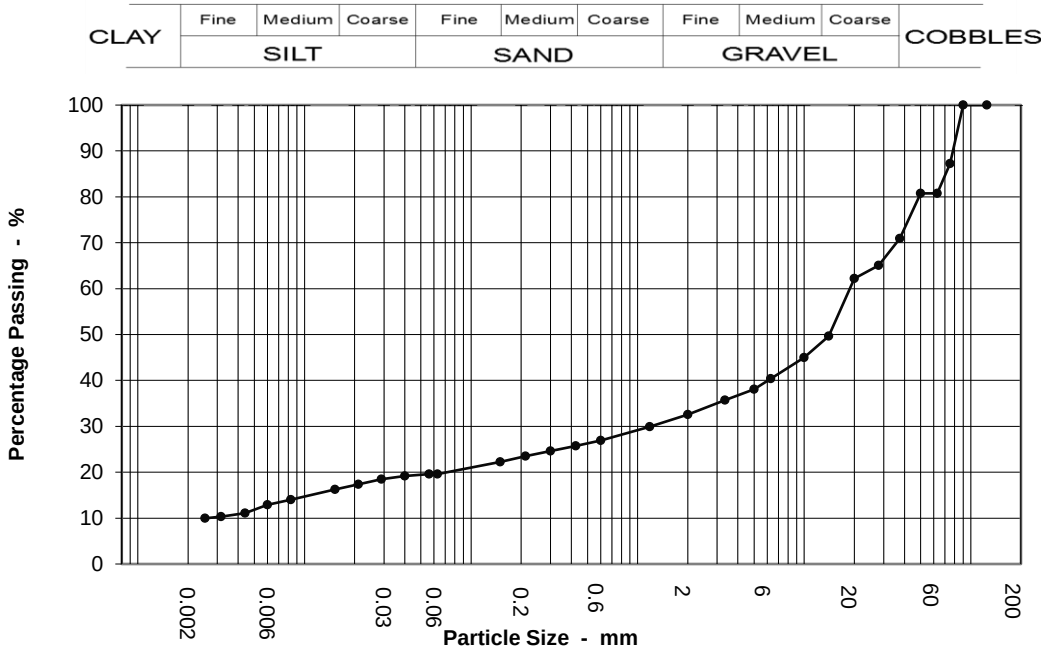
Sample Proportions	
Cobbles	15.0
Gravel	72.0
Sand	6.0
Silt & Clay	6.0

Grading Analysis	
D100	75.00
D60	27.60
D10	0.94
Uniformity Coefficient	29.00

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	RC13
Location	**N52 Grange to Clontail**	Sample No	RC
		Depth	4.50 m
Soil Description	Slightly sandy gravelly CLAY	Sample type	C



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.056	20
90	100	0.040	19
75	87	0.029	18
63	81	0.021	17
50	81	0.015	16
37.5	71	0.008	14
28	65	0.006	13
20	62	0.004	11
14	50	0.003	10
10	45	0.003	10
6.3	40	0.001	8
5	38		
3.35	36		
2	33		
1.18	30		
0.6	27		
0.425	26		
0.3	25		
0.212	23		
0.15	22		
0.063	20		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

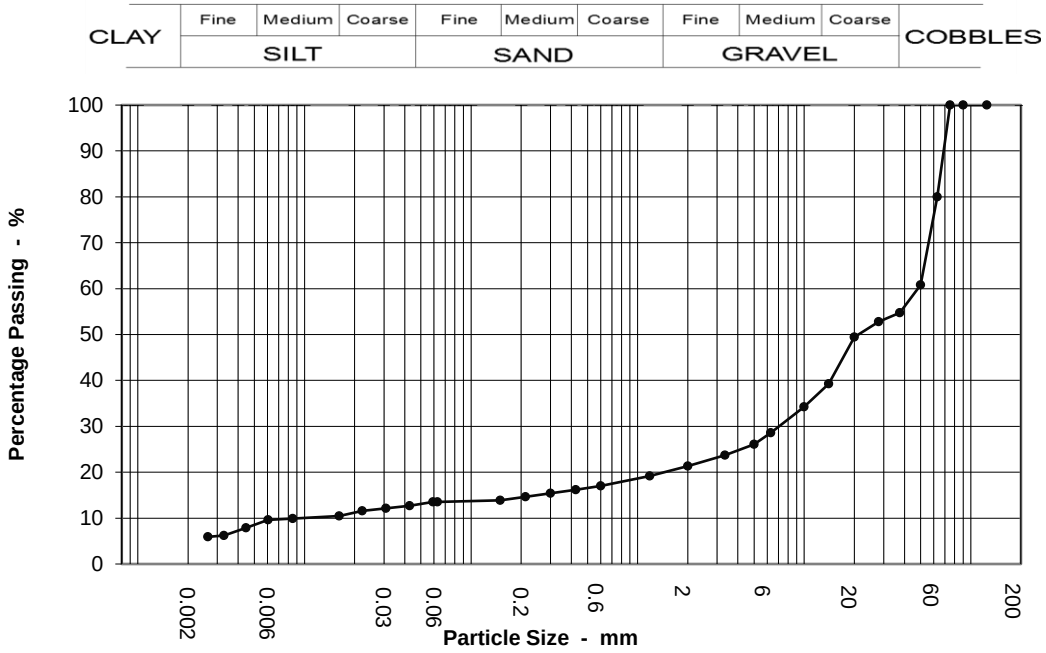
Sample Proportions	
Cobbles	19.0
Gravel	48.0
Sand	13.0
Silt	10.0
Clay	9.0

Grading Analysis	
D100	90.00
D60	18.80
D10	0.00
Uniformity Coefficient	7300.00

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	RC13
Location	**N52 Grange to Clontail**	Sample No	RC
		Depth	7.70 m
Soil Description	Slightly sandy gravelly CLAY	Sample type	C



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.059	14
90	100	0.043	13
75	100	0.031	12
63	80	0.022	12
50	61	0.016	10
37.5	55	0.008	10
28	53	0.006	10
20	49	0.004	8
14	39	0.003	6
10	34	0.003	6
6.3	29	0.001	5
5	26		
3.35	24		
2	21		
1.18	19		
0.6	17		
0.425	16		
0.3	15		
0.212	15		
0.15	14		
0.063	14		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

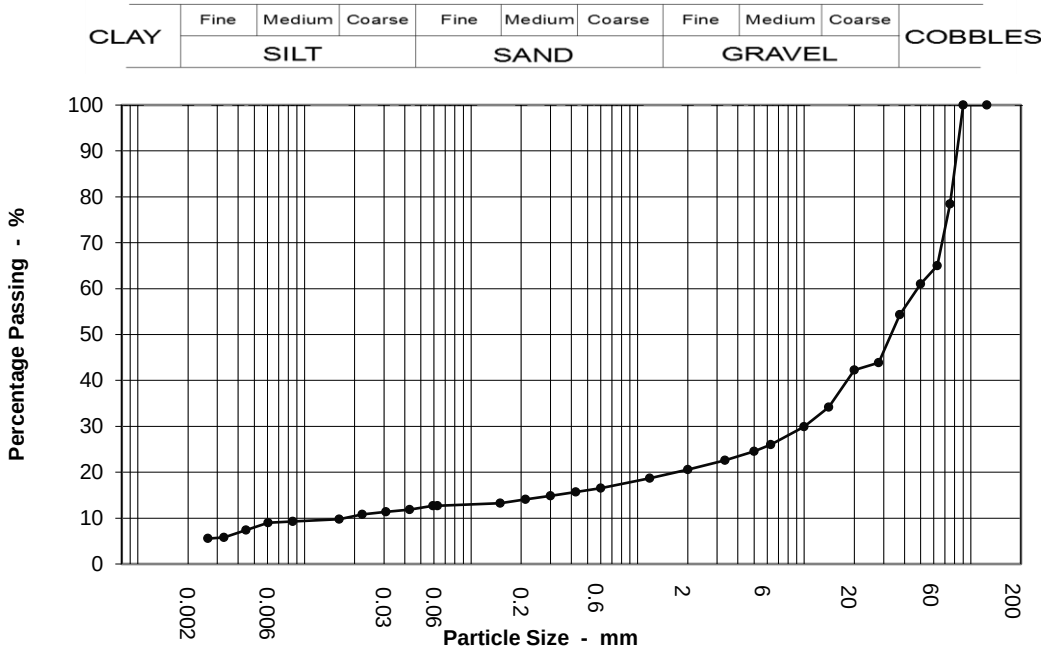
Sample Proportions	
Cobbles	20.0
Gravel	59.0
Sand	8.0
Silt	8.0
Clay	5.0

Grading Analysis	
D100	75.00
D60	48.10
D10	0.01
Uniformity Coefficient	4900.00

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	RC13
Location	**N52 Grange to Clontail**	Sample No	RC
		Depth	10.50 m
Soil Description	Slightly sandy gravelly CLAY	Sample type	C



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.059	13
90	100	0.043	12
75	78	0.031	11
63	65	0.022	11
50	61	0.016	10
37.5	54	0.008	9
28	44	0.006	9
20	42	0.004	7
14	34	0.003	6
10	30	0.003	6
6.3	26	0.001	4
5	25		
3.35	23		
2	21		
1.18	19		
0.6	17		
0.425	16		
0.3	15		
0.212	14		
0.15	13		
0.063	13		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

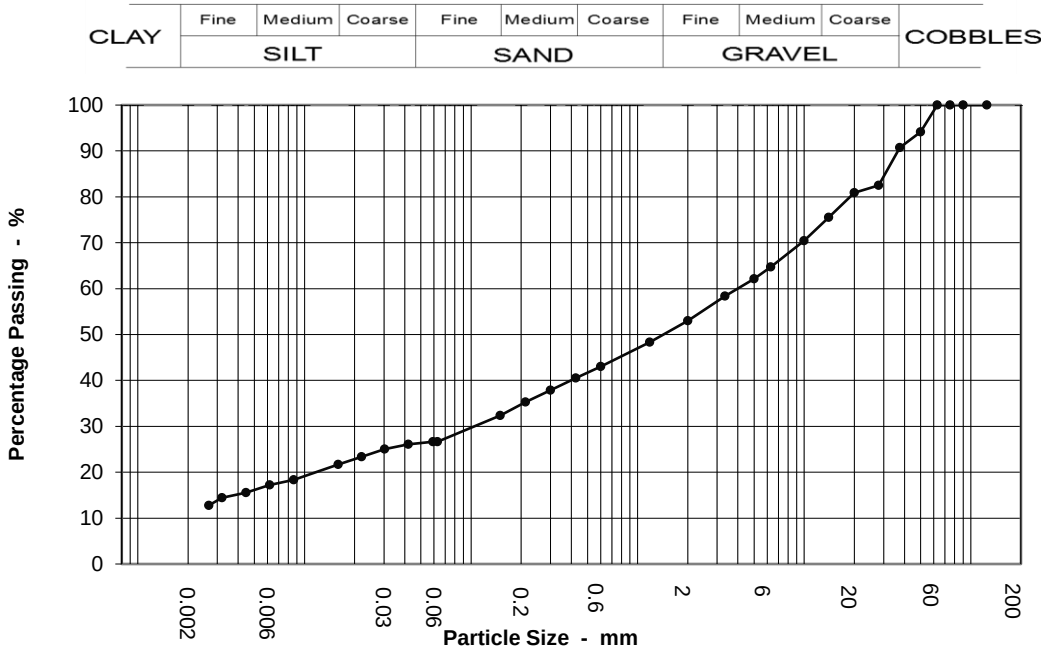
Sample Proportions	
Cobbles	35.0
Gravel	44.0
Sand	8.0
Silt	8.0
Clay	5.0

Grading Analysis	
D100	90.00
D60	47.90
D10	0.02
Uniformity Coefficient	2800.00

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	TP02
Location	**N52 Grange to Clontail**	Sample No	1
		Depth	0.50 m
Soil Description	Very sandy very clayey GRAVEL	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.059	27
90	100	0.042	26
75	100	0.030	25
63	100	0.022	23
50	94	0.016	22
37.5	91	0.009	18
28	82	0.006	17
20	81	0.004	16
14	76	0.003	14
10	70	0.003	13
6.3	65	0.001	11
5	62		
3.35	58		
2	53		
1.18	48		
0.6	43		
0.425	40		
0.3	38		
0.212	35		
0.15	32		
0.063	27		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

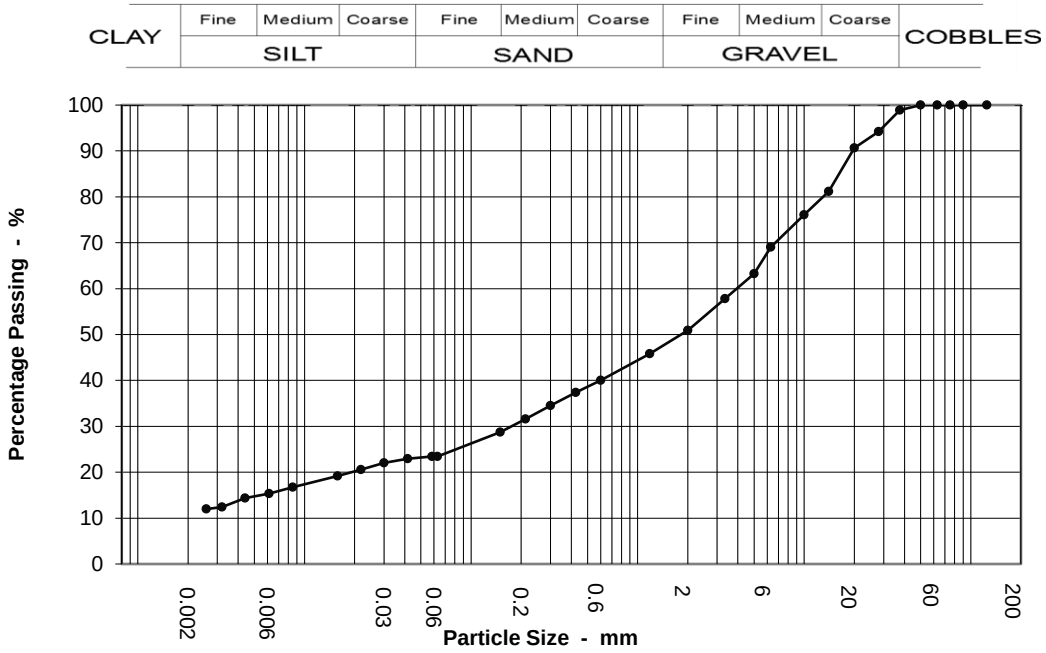
Sample Proportions	
Cobbles	0.0
Gravel	47.0
Sand	26.0
Silt	15.0
Clay	12.0

Grading Analysis	
D100	63.00
D60	3.99
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	TP04
Location	**N52 Grange to Clontail**	Sample No	1
		Depth	1.00 m
Soil Description	Very clayey very sandy GRAVEL	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.058	23
90	100	0.042	23
75	100	0.030	22
63	100	0.022	21
50	100	0.016	19
37.5	99	0.008	17
28	94	0.006	15
20	91	0.004	14
14	81	0.003	12
10	76	0.003	12
6.3	69	0.001	9
5	63		
3.35	58		
2	51		
1.18	46		
0.6	40		
0.425	37		
0.3	34		
0.212	32		
0.15	29		
0.063	23		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

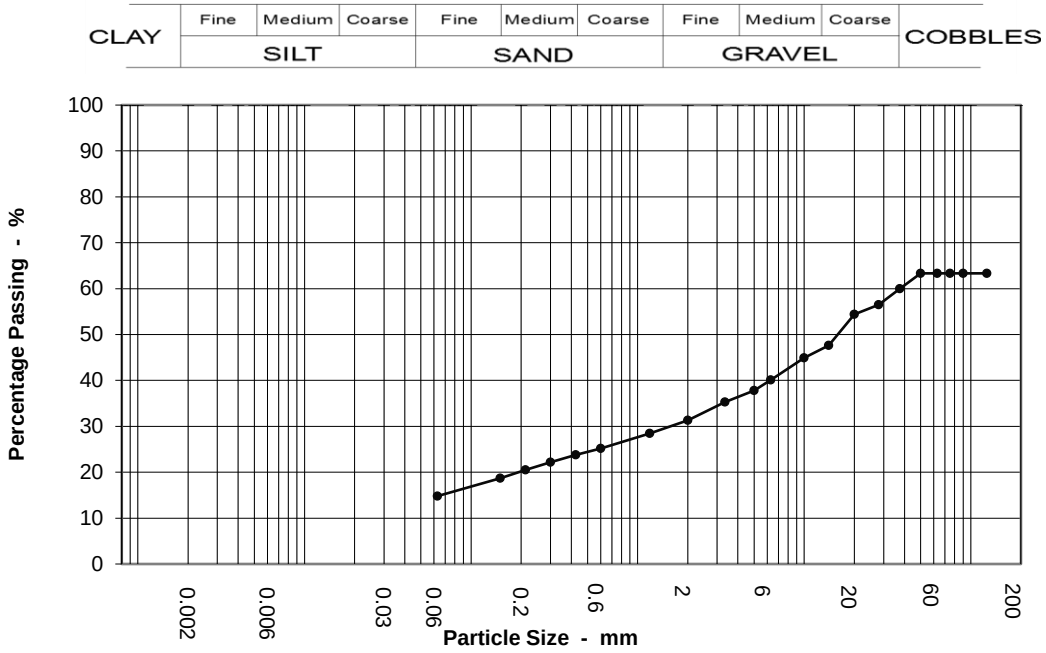
Sample Proportions	
Cobbles	0.0
Gravel	49.0
Sand	27.0
Silt	13.0
Clay	11.0

Grading Analysis	
D100	50.00
D60	3.94
D10	0.00
Uniformity Coefficient	2300.00

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	TP04
Location	**N52 Grange to Clontail**	Sample No	3
		Depth	1.50 m
Soil Description	Very clayey very sandy GRAVEL with high cobble content	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	63		
90	63		
75	63		
63	63		
50	63		
37.5	60		
28	57		
20	54		
14	48		
10	45		
6.3	40		
5	38		
3.35	35		
2	31		
1.18	28		
0.6	25		
0.425	24		
0.3	22		
0.212	20		
0.15	19		
0.063	15		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

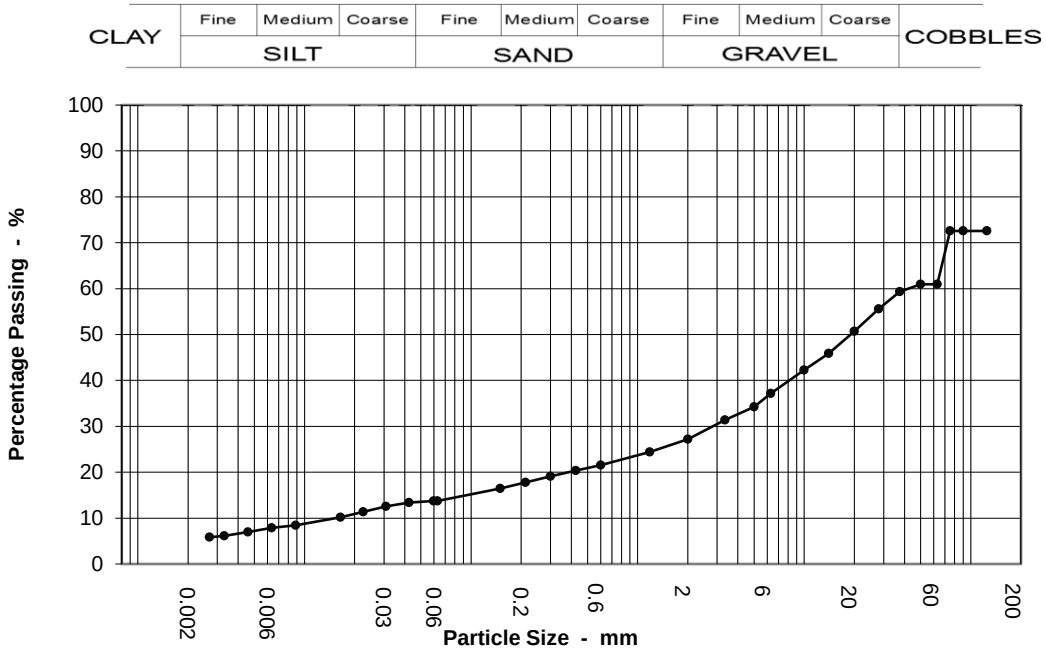
Sample Proportions	
Cobbles	37.0
Gravel	32.0
Sand	17.0
Silt & Clay	15.0

Grading Analysis	
D100	
D60	37.50
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	TP05
Location	**N52 Grange to Clontail**	Sample No	3
		Depth	1.50 m
Soil Description	Very clayey very sandy GRAVEL with high cobble content	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	73	0.060	14
90	73	0.042	13
75	73	0.031	13
63	61	0.023	11
50	61	0.016	10
37.5	59	0.009	8
28	56	0.006	8
20	51	0.005	7
14	46	0.003	6
10	42	0.003	6
6.3	37	0.001	5
5	34		
3.35	31		
2	27		
1.18	24		
0.6	22		
0.425	20		
0.3	19		
0.212	18		
0.15	16		
0.063	14		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

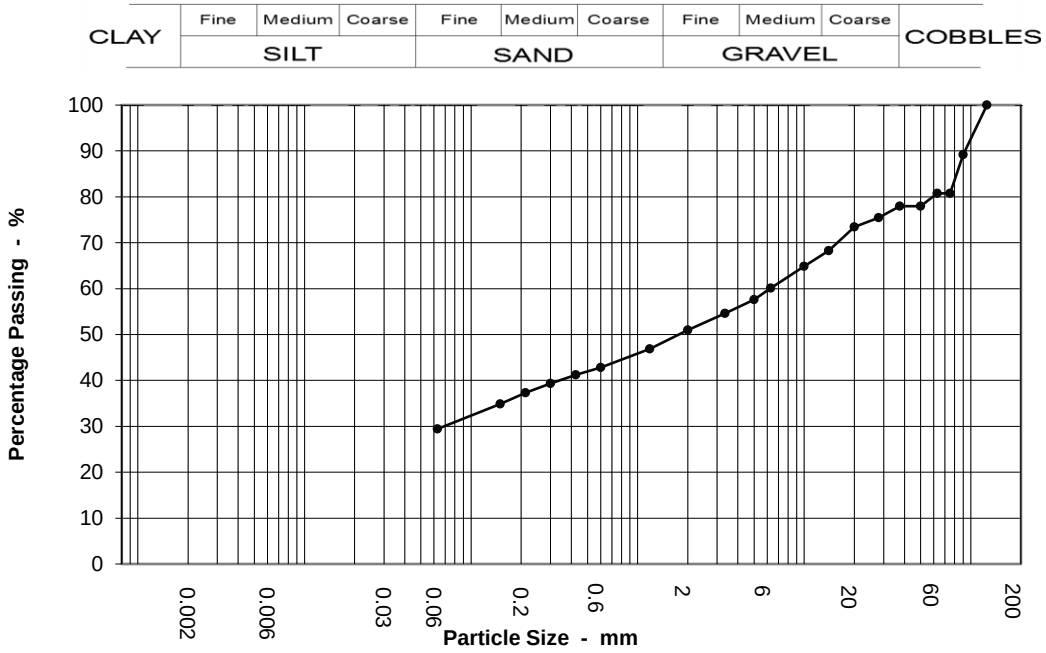
Sample Proportions	
Cobbles	39.0
Gravel	34.0
Sand	14.0
Silt	8.0
Clay	5.0

Grading Analysis	
D100	
D60	42.10
D10	0.02
Uniformity Coefficient	2800.00

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	TP06
Location	**N52 Grange to Clontail**	Sample No	1
		Depth	0.50 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	89		
75	81		
63	81		
50	78		
37.5	78		
28	75		
20	73		
14	68		
10	65		
6.3	60		
5	58		
3.35	55		
2	51		
1.18	47		
0.6	43		
0.425	41		
0.3	39		
0.212	37		
0.15	35		
0.063	29		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

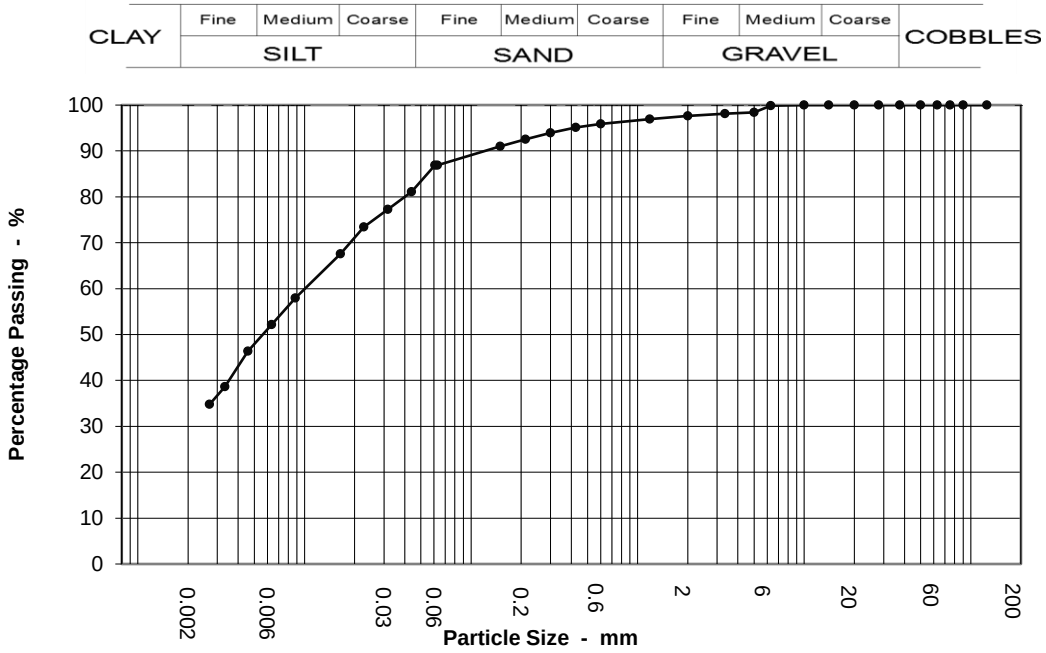
Sample Proportions	
Cobbles	19.0
Gravel	30.0
Sand	22.0
Silt & Clay	29.0

Grading Analysis	
D100	125.00
D60	6.24
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	TP07
Location	**N52 Grange to Clontail**	Sample No	1
		Depth	0.50 m
Soil Description	Slightly gravelly sandy SILT	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.061	87
90	100	0.044	81
75	100	0.032	77
63	100	0.023	73
50	100	0.016	68
37.5	100	0.009	58
28	100	0.006	52
20	100	0.005	46
14	100	0.003	39
10	100	0.003	35
6.3	100	0.001	25
5	98		
3.35	98		
2	98		
1.18	97		
0.6	96		
0.425	95		
0.3	94		
0.212	93		
0.15	91		
0.063	87		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	
Sedimentation	Clause 9.5

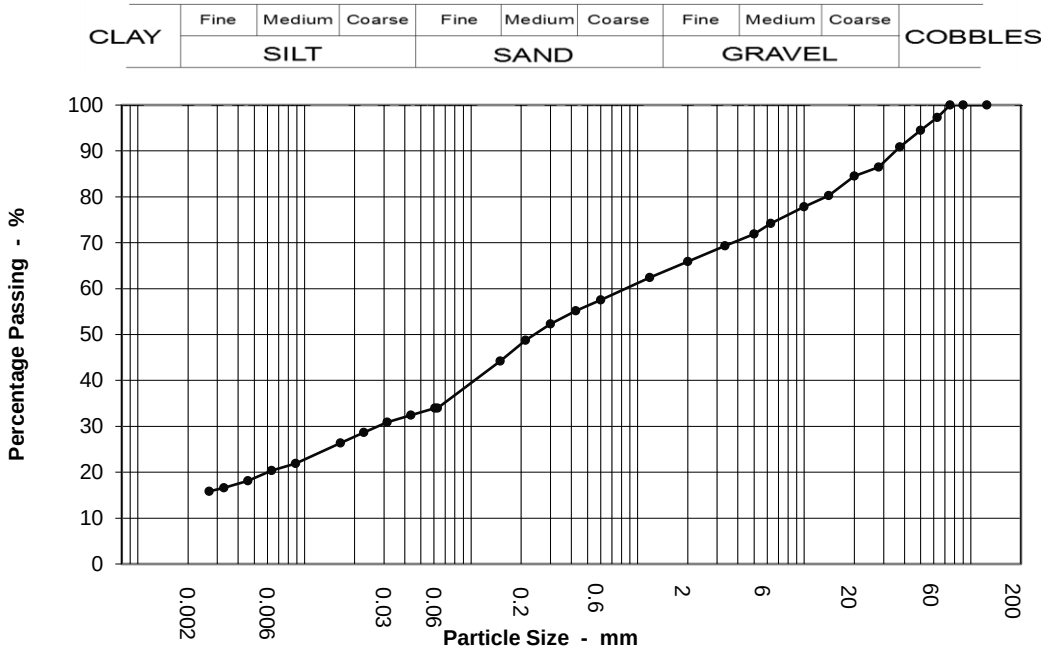
Sample Proportions	
Cobbles	0.0
Gravel	2.0
Sand	11.0
Silt	57.0
Clay	30.0

Grading Analysis	
D100	10.00
D60	0.01
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	TP13
Location	**N52 Grange to Clontail**	Sample No	3
		Depth	1.50 m
Soil Description	Slightly gravelly slightly sandy CLAY with low cobble content	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.061	34
90	100	0.044	32
75	100	0.031	31
63	97	0.023	29
50	94	0.016	26
37.5	91	0.009	22
28	86	0.006	20
20	85	0.005	18
14	80	0.003	17
10	78	0.003	16
6.3	74	0.001	13
5	72		
3.35	69		
2	66		
1.18	62		
0.6	58		
0.425	55		
0.3	52		
0.212	49		
0.15	44		
0.063	34		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

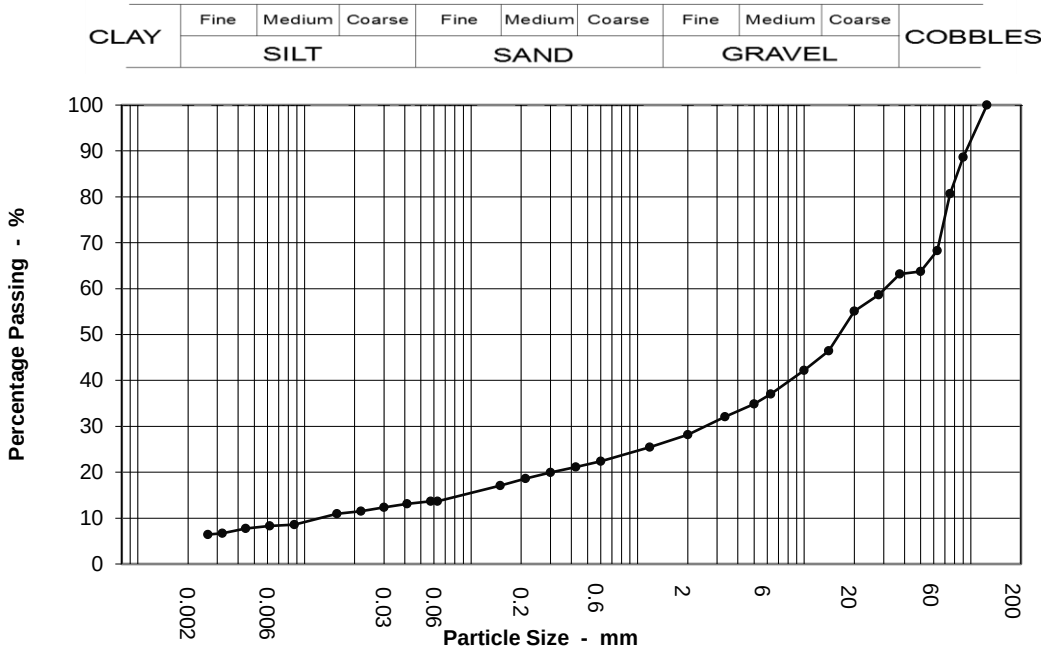
Sample Proportions	
Cobbles	3.0
Gravel	31.0
Sand	32.0
Silt	20.0
Clay	14.0

Grading Analysis	
D100	75.00
D60	0.85
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	TP14
Location	**N52 Grange to Clontail**	Sample No	1
		Depth	0.50 m
Soil Description	Very sandy very silty GRAVEL with high cobble content	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.057	14
90	89	0.041	13
75	81	0.030	12
63	68	0.022	12
50	64	0.016	11
37.5	63	0.009	9
28	59	0.006	8
20	55	0.004	8
14	46	0.003	7
10	42	0.003	6
6.3	37	0.001	5
5	35		
3.35	32		
2	28		
1.18	25		
0.6	22		
0.425	21		
0.3	20		
0.212	19		
0.15	17		
0.063	14		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

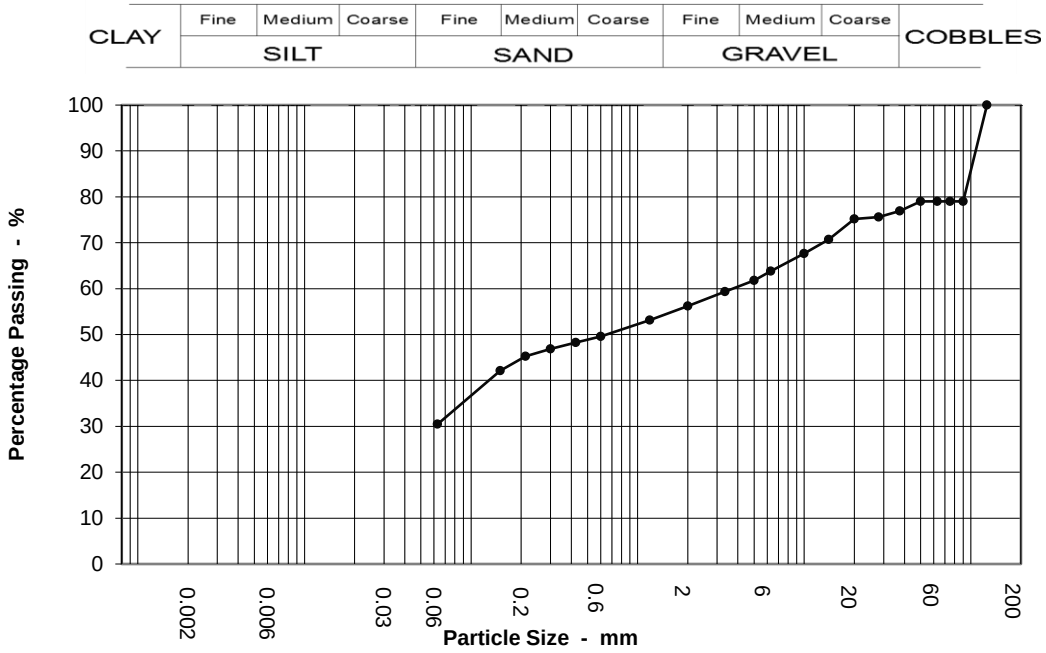
Sample Proportions	
Cobbles	32.0
Gravel	40.0
Sand	15.0
Silt	8.0
Clay	6.0

Grading Analysis	
D100	125.00
D60	30.50
D10	0.01
Uniformity Coefficient	2500.00

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	TP15
Location	**N52 Grange to Clontail**	Sample No	3
		Depth	1.50 m
Soil Description	Slightly gravelly slightly sandy CLAY	Sample type	B



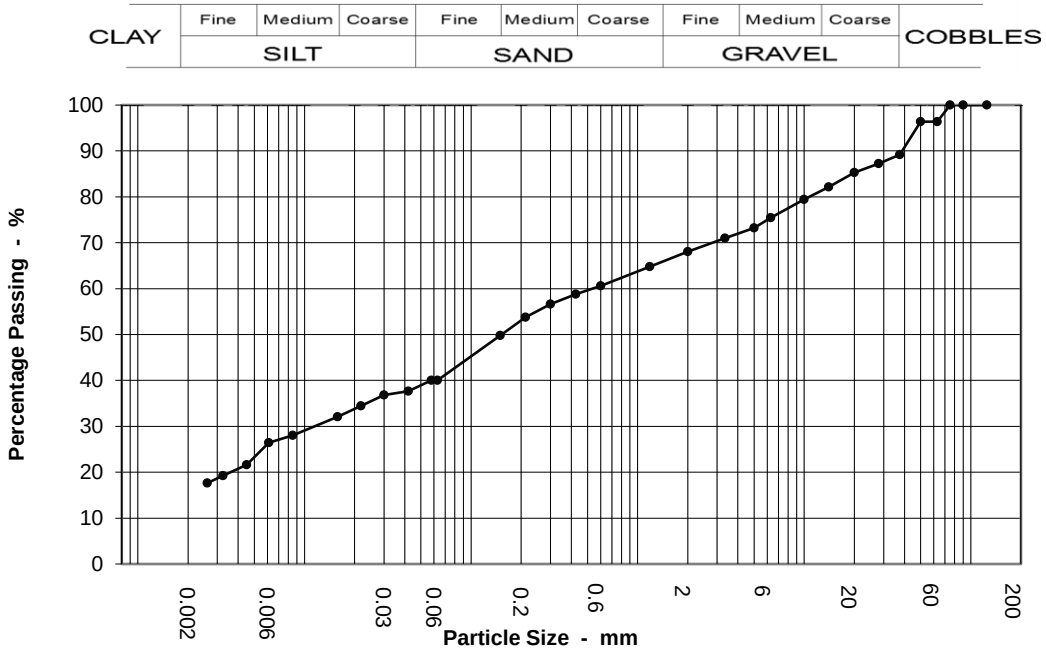
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	79		
75	79		
63	79		
50	79		
37.5	77		
28	76		
20	75		
14	71		
10	68		
6.3	64		
5	62		
3.35	59		
2	56		
1.18	53		
0.6	50		
0.425	48		
0.3	47		
0.212	45		
0.15	42		
0.063	30		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	21.0
Gravel	23.0
Sand	26.0
Silt & Clay	30.0

Grading Analysis	
D100	125.00
D60	3.75
D10	
Uniformity Coefficient	

pgl priority geotechnical	**PARTICLE SIZE DISTRIBUTION** **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P19026**
		Borehole / Pit No	TP16
Location	**N52 Grange to Clontail**	Sample No	1
		Depth	0.20 m
Soil Description	Slightly sandy slightly gravelly SILT with low cobble content	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.058	40
90	100	0.042	38
75	100	0.030	37
63	96	0.022	34
50	96	0.016	32
37.5	89	0.008	28
28	87	0.006	26
20	85	0.004	22
14	82	0.003	19
10	79	0.003	18
6.3	75	0.001	14
5	73		
3.35	71		
2	68		
1.18	65		
0.6	61		
0.425	59		
0.3	57		
0.212	54		
0.15	50		
0.063	40		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

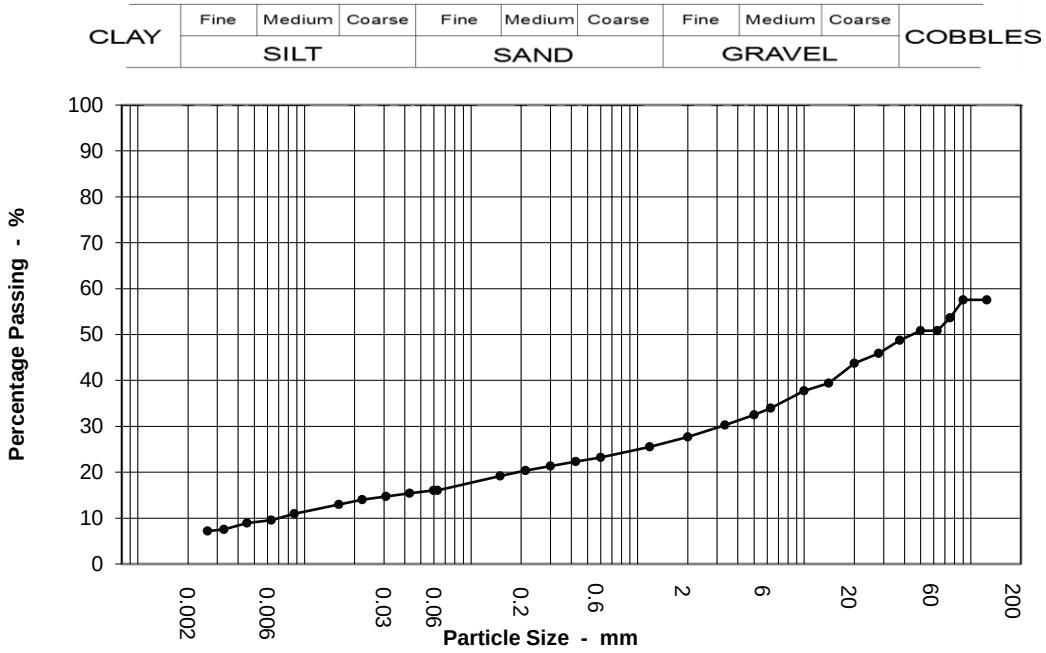
Sample Proportions	
Cobbles	4.0
Gravel	28.0
Sand	28.0
Silt	24.0
Clay	16.0

Grading Analysis	
D100	75.00
D60	0.53
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	TP17
Location	**N52 Grange to Clontail**	Sample No	3
		Depth	1.20 m
Soil Description	Very sandy very clayey GRAVEL with high cobble content	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	58	0.060	16
90	58	0.043	15
75	54	0.031	15
63	51	0.022	14
50	51	0.016	13
37.5	49	0.009	11
28	46	0.006	10
20	44	0.005	9
14	39	0.003	8
10	38	0.003	7
6.3	34	0.001	6
5	32		
3.35	30		
2	28		
1.18	26		
0.6	23		
0.425	22		
0.3	21		
0.212	20		
0.15	19		
0.063	16		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

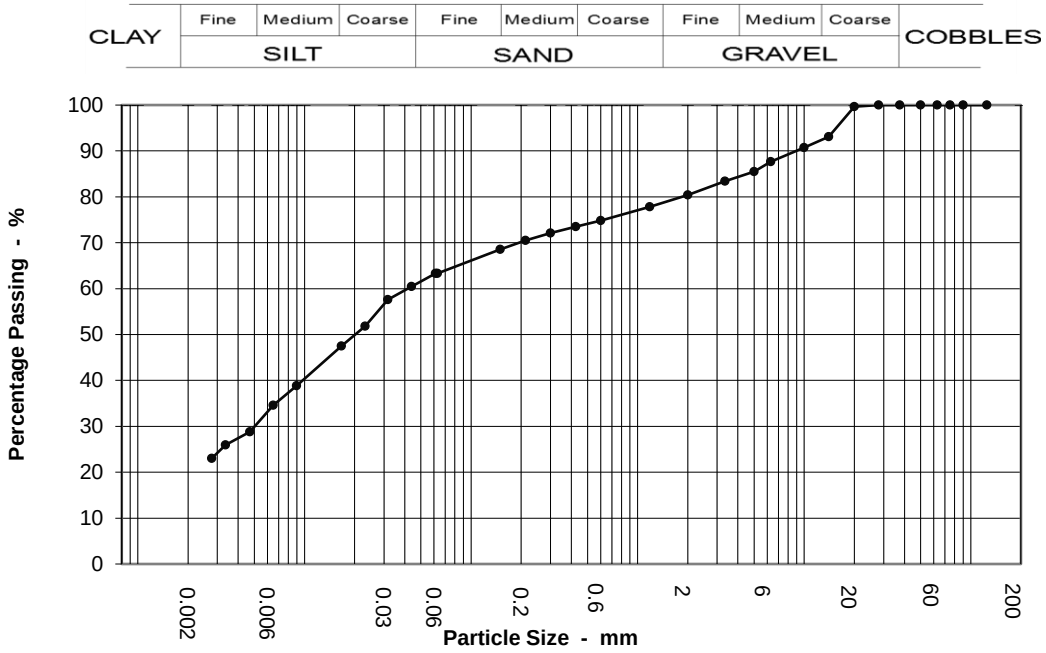
Sample Proportions	
Cobbles	49.0
Gravel	23.0
Sand	12.0
Silt	9.0
Clay	7.0

Grading Analysis	
D100	
D60	
D10	0.01
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	TP18
Location	**N52 Grange to Clontail**	Sample No	1
		Depth	0.50 m
Soil Description	Slightly sandy gravelly CLAY	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.061	63
90	100	0.044	60
75	100	0.032	58
63	100	0.023	52
50	100	0.017	48
37.5	100	0.009	39
28	100	0.006	35
20	100	0.005	29
14	93	0.003	26
10	91	0.003	23
6.3	88	0.001	17
5	86		
3.35	83		
2	80		
1.18	78		
0.6	75		
0.425	74		
0.3	72		
0.212	70		
0.15	69		
0.063	63		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

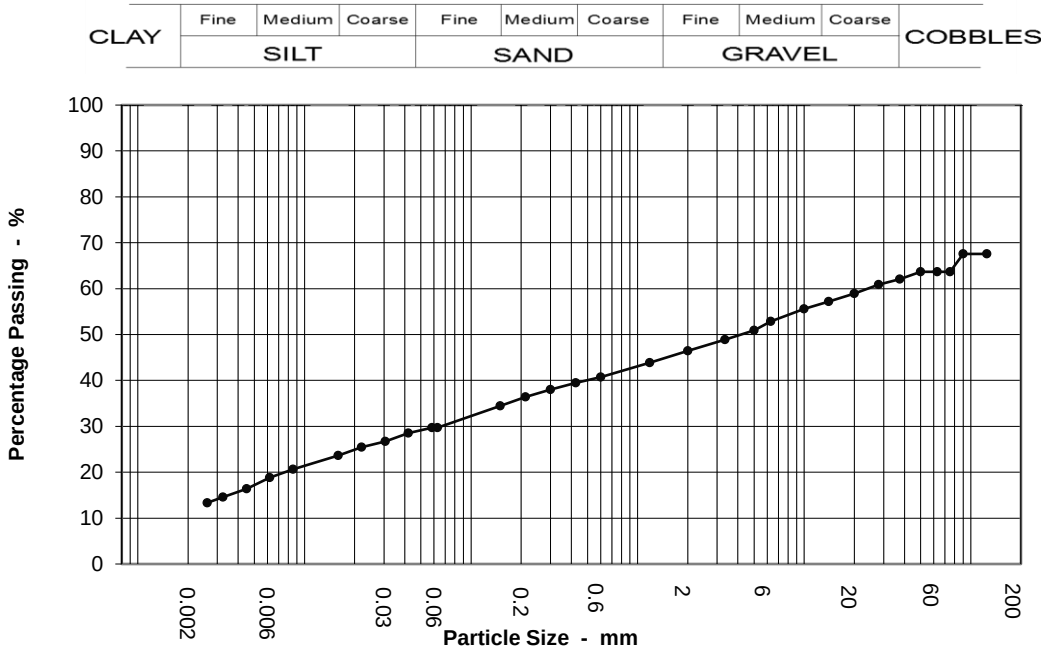
Sample Proportions	
Cobbles	0.0
Gravel	20.0
Sand	17.0
Silt	43.0
Clay	20.0

Grading Analysis	
D100	28.00
D60	0.04
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	TP18
Location	**N52 Grange to Clontail**	Sample No	3
		Depth	1.50 m
Soil Description	Slightly sandy slightly gravelly CLAY with high cobble content	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	68	0.058	30
90	68	0.042	28
75	64	0.031	27
63	64	0.022	25
50	64	0.016	24
37.5	62	0.009	21
28	61	0.006	19
20	59	0.004	16
14	57	0.003	15
10	56	0.003	13
6.3	53	0.001	12
5	51		
3.35	49		
2	46		
1.18	44		
0.6	41		
0.425	39		
0.3	38		
0.212	36		
0.15	34		
0.063	30		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

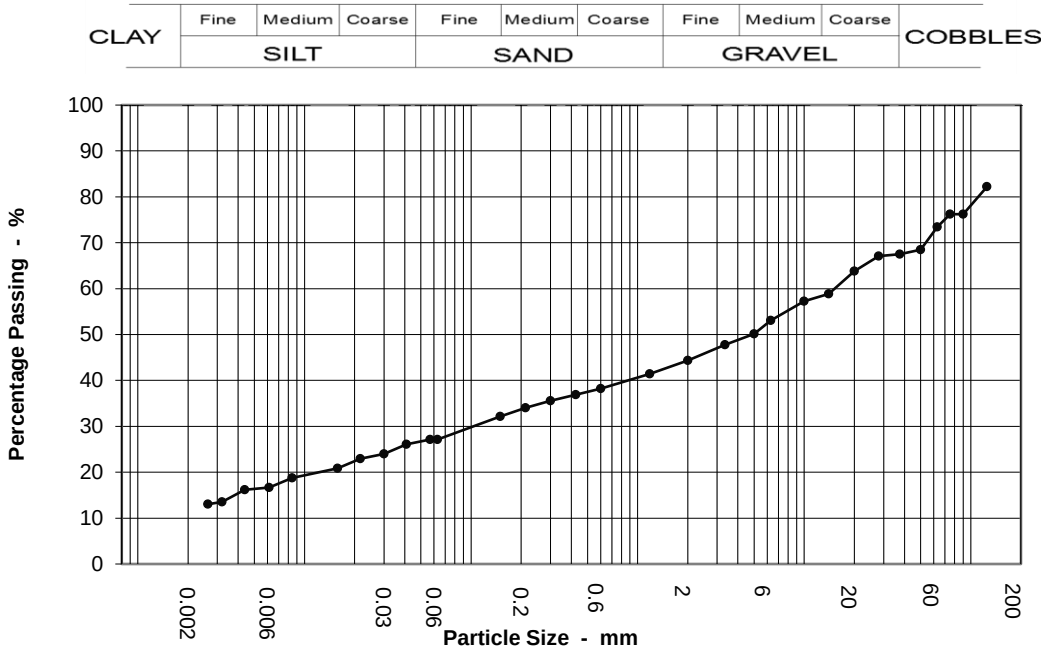
Sample Proportions	
Cobbles	36.0
Gravel	17.0
Sand	17.0
Silt	17.0
Clay	13.0

Grading Analysis	
D100	
D60	24.00
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	TP19
Location	**N52 Grange to Clontail**	Sample No	3
		Depth	1.50 m
Soil Description	Slightly sandy gravelly CLAY with high cobble content	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	82	0.057	27
90	76	0.041	26
75	76	0.030	24
63	73	0.022	23
50	68	0.016	21
37.5	67	0.008	19
28	67	0.006	17
20	64	0.004	16
14	59	0.003	14
10	57	0.003	13
6.3	53	0.001	10
5	50		
3.35	48		
2	44		
1.18	41		
0.6	38		
0.425	37		
0.3	36		
0.212	34		
0.15	32		
0.063	27		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

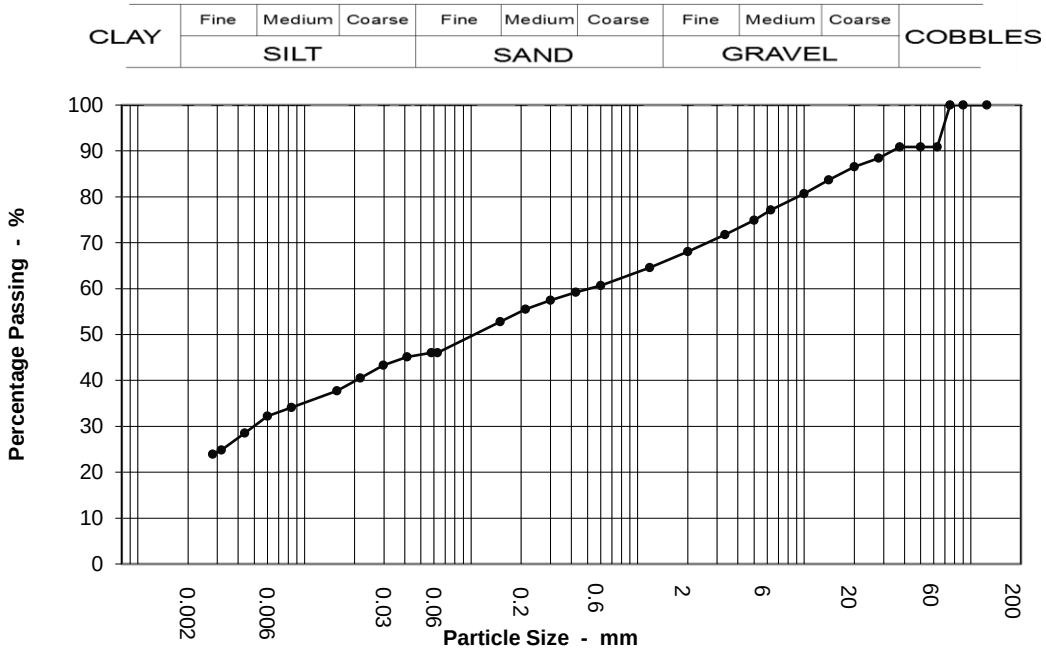
Sample Proportions	
Cobbles	27.0
Gravel	29.0
Sand	17.0
Silt	15.0
Clay	12.0

Grading Analysis	
D100	
D60	15.20
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	TP20
Location	**N52 Grange to Clontail**	Sample No	1
		Depth	0.50 m
Soil Description	Slightly sandy slightly gravelly SILT with low cobble content	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.058	46
90	100	0.041	45
75	100	0.030	43
63	91	0.022	41
50	91	0.016	38
37.5	91	0.008	34
28	88	0.006	32
20	87	0.004	29
14	84	0.003	25
10	81	0.003	24
6.3	77	0.001	13
5	75		
3.35	72		
2	68		
1.18	65		
0.6	61		
0.425	59		
0.3	57		
0.212	56		
0.15	53		
0.063	46		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

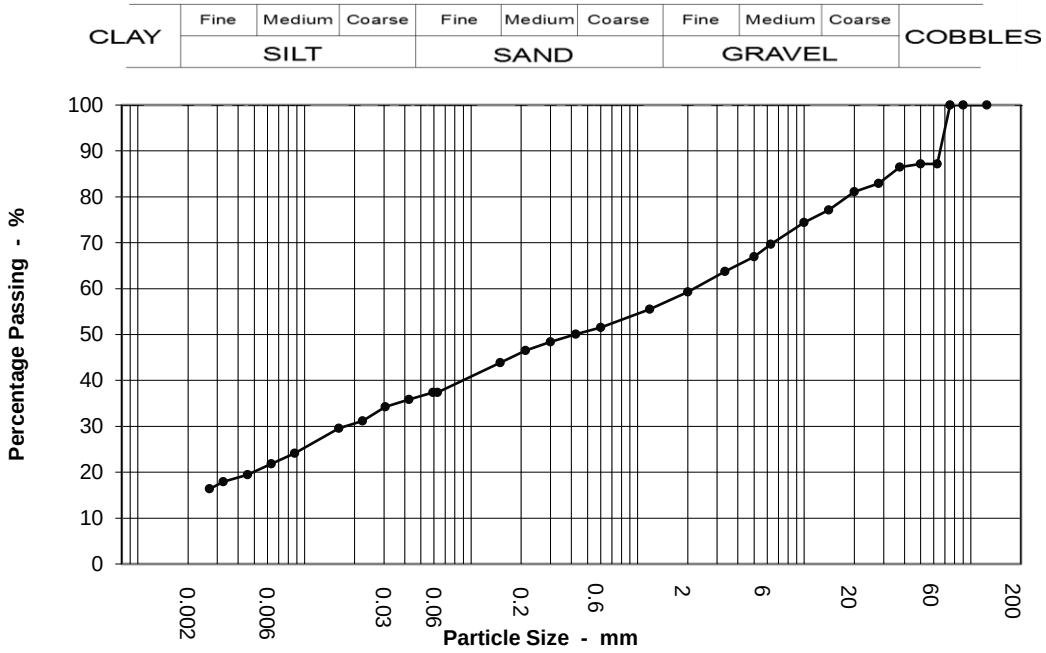
Sample Proportions	
Cobbles	9.0
Gravel	23.0
Sand	22.0
Silt	25.0
Clay	21.0

Grading Analysis	
D100	75.00
D60	0.51
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	TP22
Location	**N52 Grange to Clontail**	Sample No	1
		Depth	0.50 m
Soil Description	Slightly sandy gravelly SILT with medium cobble content	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.059	37
90	100	0.042	36
75	100	0.031	34
63	87	0.022	31
50	87	0.016	30
37.5	86	0.009	24
28	83	0.006	22
20	81	0.005	19
14	77	0.003	18
10	74	0.003	16
6.3	70	0.001	14
5	67		
3.35	64		
2	59		
1.18	56		
0.6	52		
0.425	50		
0.3	48		
0.212	47		
0.15	44		
0.063	37		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

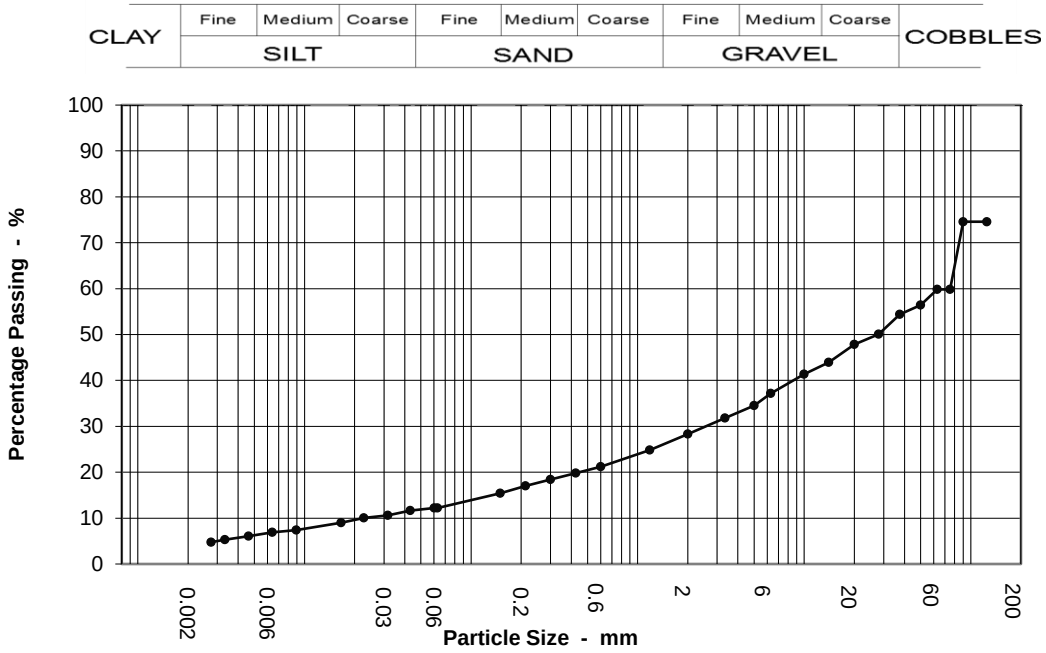
Sample Proportions	
Cobbles	13.0
Gravel	28.0
Sand	22.0
Silt	22.0
Clay	15.0

Grading Analysis	
D100	75.00
D60	2.18
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	TP23
Location	**N52 Grange to Clontail**	Sample No	5
		Depth	2.00 m
Soil Description	Very clayey very sandy GRAVEL with high cobble content	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	75	0.060	12
90	75	0.043	12
75	60	0.032	11
63	60	0.023	10
50	56	0.017	9
37.5	54	0.009	7
28	50	0.006	7
20	48	0.005	6
14	44	0.003	5
10	41	0.003	5
6.3	37	0.001	4
5	34		
3.35	32		
2	28		
1.18	25		
0.6	21		
0.425	20		
0.3	18		
0.212	17		
0.15	15		
0.063	12		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

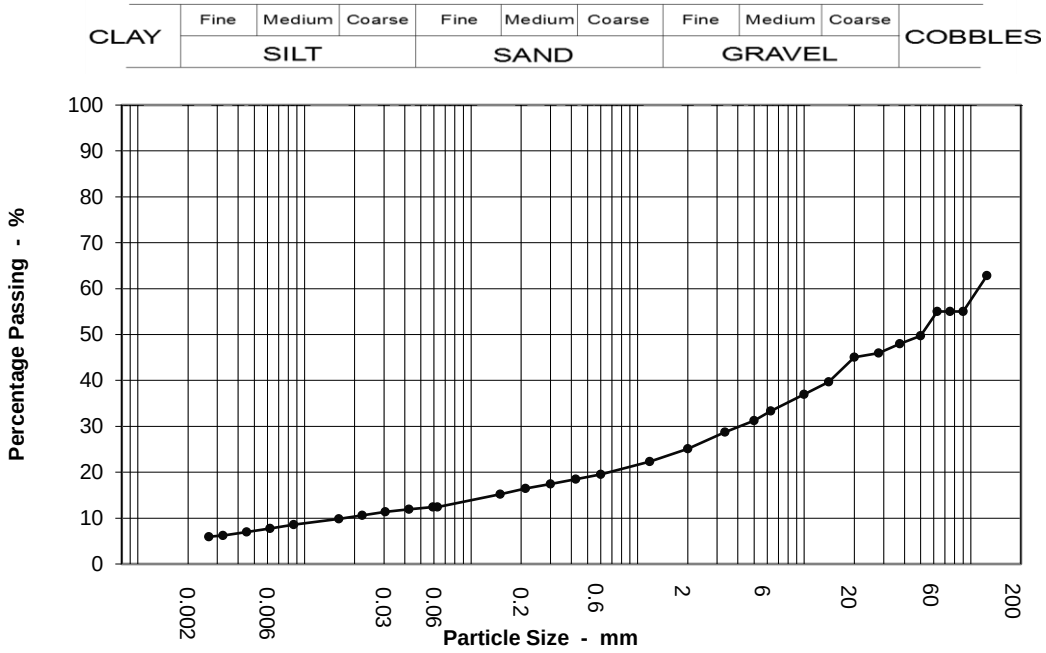
Sample Proportions	
Cobbles	40.0
Gravel	32.0
Sand	16.0
Silt	8.0
Clay	4.0

Grading Analysis	
D100	
D60	75.10
D10	0.02
Uniformity Coefficient	3400.00

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	TP24
Location	**N52 Grange to Clontail**	Sample No	3
		Depth	1.50 m
Soil Description	Very silty very sandy GRAVEL with high cobble content	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	63	0.059	12
90	55	0.042	12
75	55	0.031	11
63	55	0.022	11
50	50	0.016	10
37.5	48	0.009	9
28	46	0.006	8
20	45	0.004	7
14	40	0.003	6
10	37	0.003	6
6.3	33	0.001	5
5	31		
3.35	29		
2	25		
1.18	22		
0.6	19		
0.425	18		
0.3	17		
0.212	16		
0.15	15		
0.063	12		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

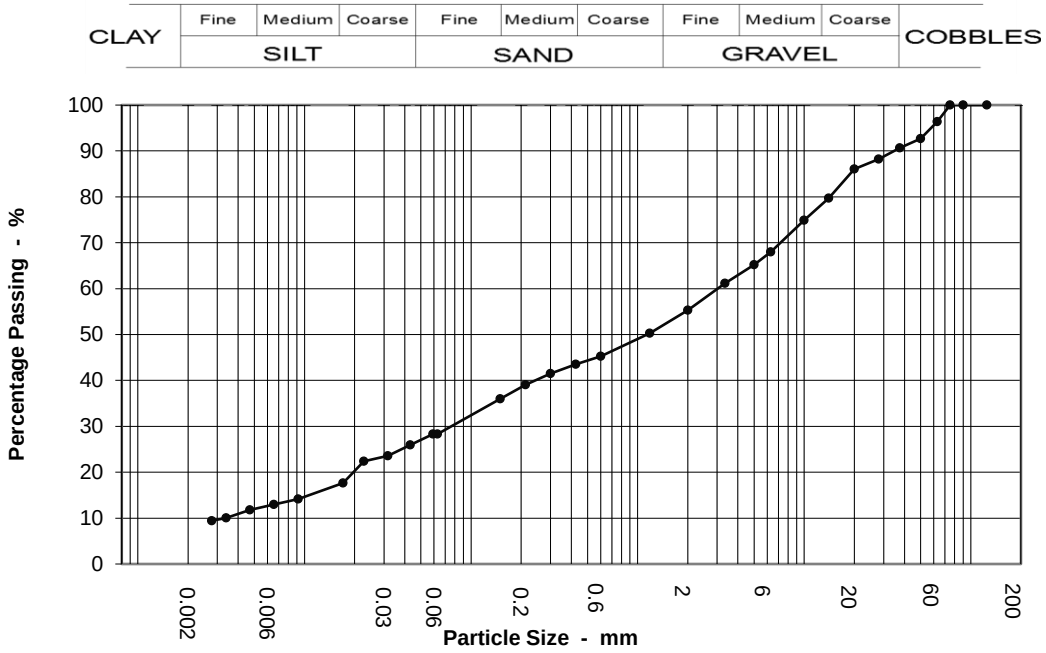
Sample Proportions	
Cobbles	45.0
Gravel	30.0
Sand	13.0
Silt	7.0
Clay	5.0

Grading Analysis	
D100	
D60	111.00
D10	0.02
Uniformity Coefficient	6500.00

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	TP25
Location	**N52 Grange to Clontail**	Sample No	1
		Depth	0.50 m
Soil Description	Very sandy very clayey GRAVEL with low cobble content	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.059	28
90	100	0.043	26
75	100	0.032	24
63	96	0.023	22
50	93	0.017	18
37.5	91	0.009	14
28	88	0.007	13
20	86	0.005	12
14	80	0.003	10
10	75	0.003	9
6.3	68	0.002	7
5	65		
3.35	61		
2	55		
1.18	50		
0.6	45		
0.425	44		
0.3	41		
0.212	39		
0.15	36		
0.063	28		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

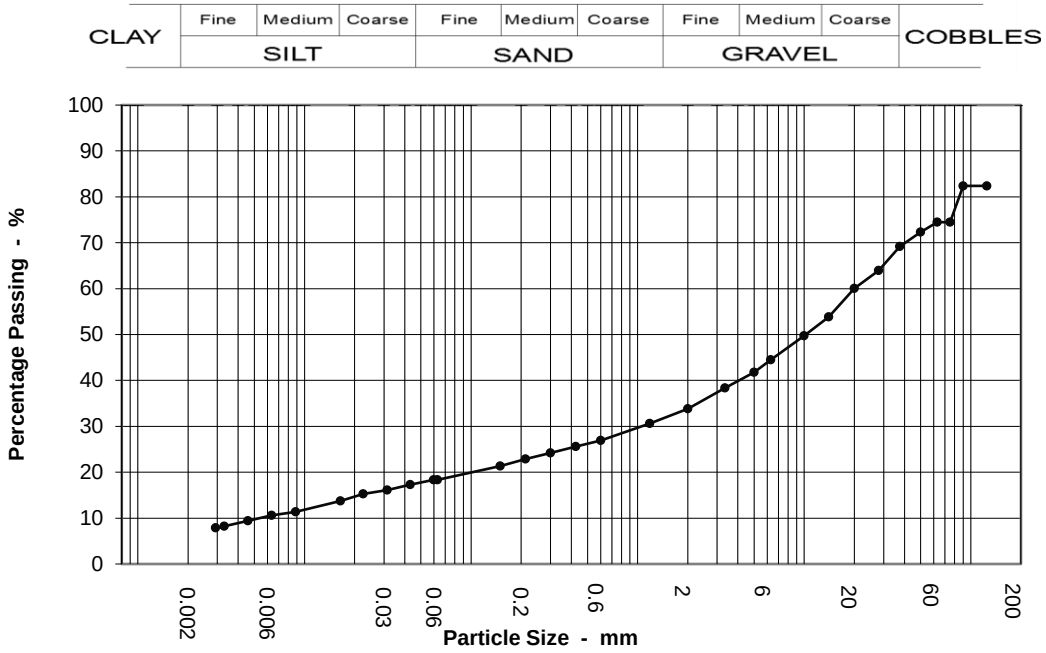
Sample Proportions	
Cobbles	4.0
Gravel	41.0
Sand	27.0
Silt	20.0
Clay	8.0

Grading Analysis	
D100	75.00
D60	3.03
D10	0.00
Uniformity Coefficient	900.00

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	TP25
Location	**N52 Grange to Clontail**	Sample No	3
		Depth	1.50 m
Soil Description	Very sandy very clayey GRAVEL with high cobble content	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	82	0.060	18
90	82	0.043	17
75	74	0.031	16
63	74	0.023	15
50	72	0.016	14
37.5	69	0.009	11
28	64	0.006	11
20	60	0.005	9
14	54	0.003	8
10	50	0.003	8
6.3	44	0.001	5
5	42		
3.35	38		
2	34		
1.18	31		
0.6	27		
0.425	26		
0.3	24		
0.212	23		
0.15	21		
0.063	18		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

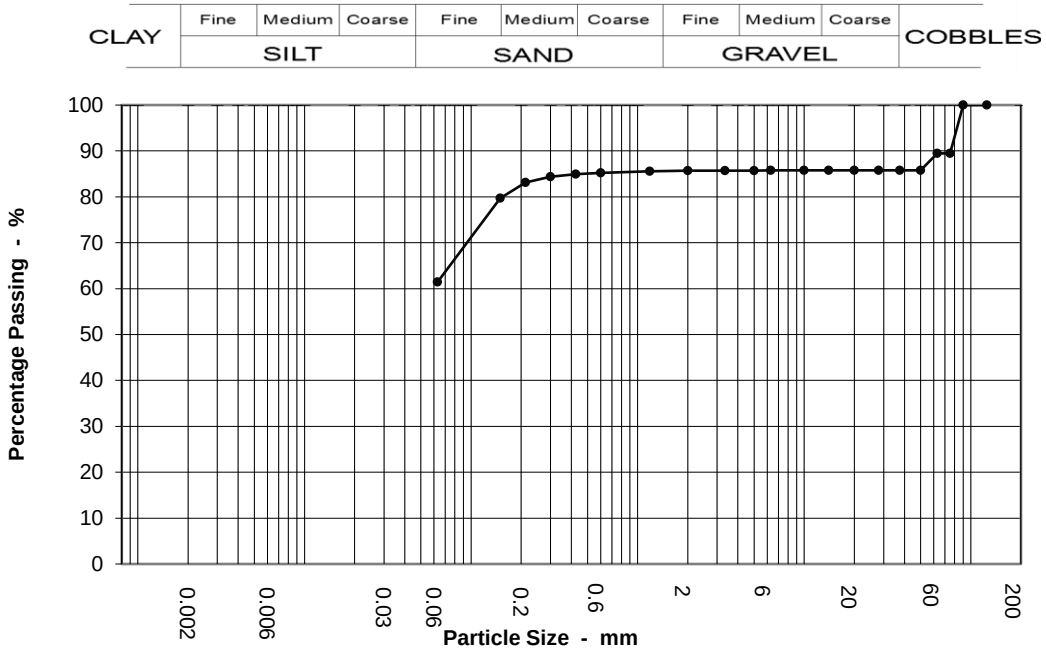
Sample Proportions	
Cobbles	26.0
Gravel	41.0
Sand	15.0
Silt	11.0
Clay	7.0

Grading Analysis	
D100	
D60	19.90
D10	0.01
Uniformity Coefficient	3700.00

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	TP26
Location	**N52 Grange to Clontail**	Sample No	5
		Depth	2.50 m
Soil Description	Slightly gravelly slightly sandy CLAY with medium cobble content	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	89		
63	89		
50	86		
37.5	86		
28	86		
20	86		
14	86		
10	86		
6.3	86		
5	86		
3.35	86		
2	86		
1.18	86		
0.6	85		
0.425	85		
0.3	84		
0.212	83		
0.15	80		
0.063	61		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

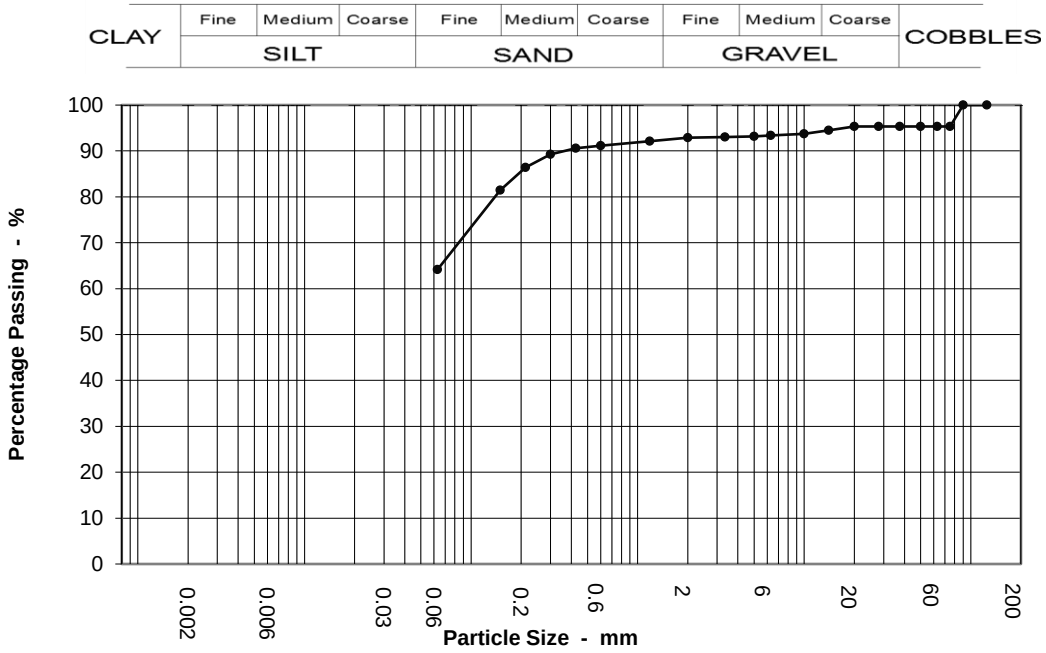
Sample Proportions	
Cobbles	11.0
Gravel	4.0
Sand	24.0
Silt & Clay	61.0

Grading Analysis	
D100	90.00
D60	
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	TP27
Location	**N52 Grange to Clontail**	Sample No	3
		Depth	0.50 m
Soil Description	Slightly gravelly slightly sandy CLAY with low cobble content	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	95		
63	95		
50	95		
37.5	95		
28	95		
20	95		
14	94		
10	94		
6.3	93		
5	93		
3.35	93		
2	93		
1.18	92		
0.6	91		
0.425	91		
0.3	89		
0.212	86		
0.15	81		
0.063	64		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

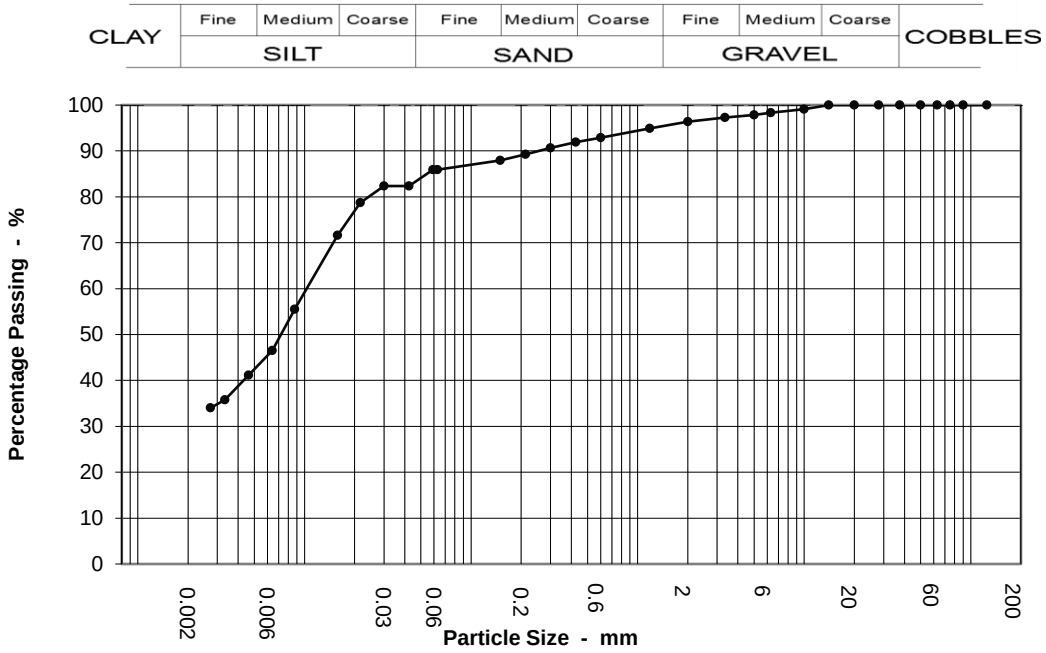
Sample Proportions	
Cobbles	5.0
Gravel	2.0
Sand	29.0
Silt & Clay	64.0

Grading Analysis	
D100	90.00
D60	
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	TP31
Location	**N52 Grange to Clontail**	Sample No	3
		Depth	1.50 m
Soil Description	Slightly gravelly slightly sandy CLAY	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.059	86
90	100	0.042	82
75	100	0.030	82
63	100	0.022	79
50	100	0.016	72
37.5	100	0.009	55
28	100	0.006	47
20	100	0.005	41
14	100	0.003	36
10	99	0.003	34
6.3	98	0.001	29
5	98		
3.35	97		
2	96		
1.18	95		
0.6	93		
0.425	92		
0.3	91		
0.212	89		
0.15	88		
0.063	86		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

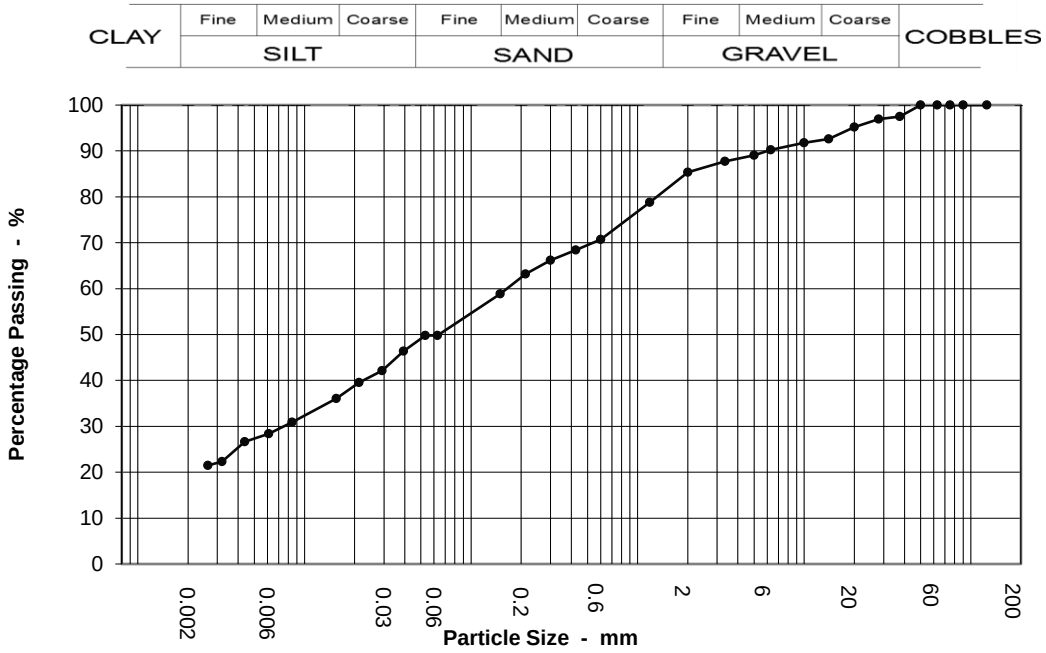
Sample Proportions	
Cobbles	0.0
Gravel	4.0
Sand	10.0
Silt	55.0
Clay	31.0

Grading Analysis	
D100	14.00
D60	0.01
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	TP32
Location	**N52 Grange to Clontail**	Sample No	1
		Depth	0.20 m
Soil Description	Slightly gravelly sandy SILT	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.053	50
90	100	0.039	46
75	100	0.029	42
63	100	0.021	40
50	100	0.016	36
37.5	97	0.008	31
28	97	0.006	28
20	95	0.004	27
14	93	0.003	22
10	92	0.003	21
6.3	90	0.001	15
5	89		
3.35	88		
2	85		
1.18	79		
0.6	71		
0.425	68		
0.3	66		
0.212	63		
0.15	59		
0.063	50		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

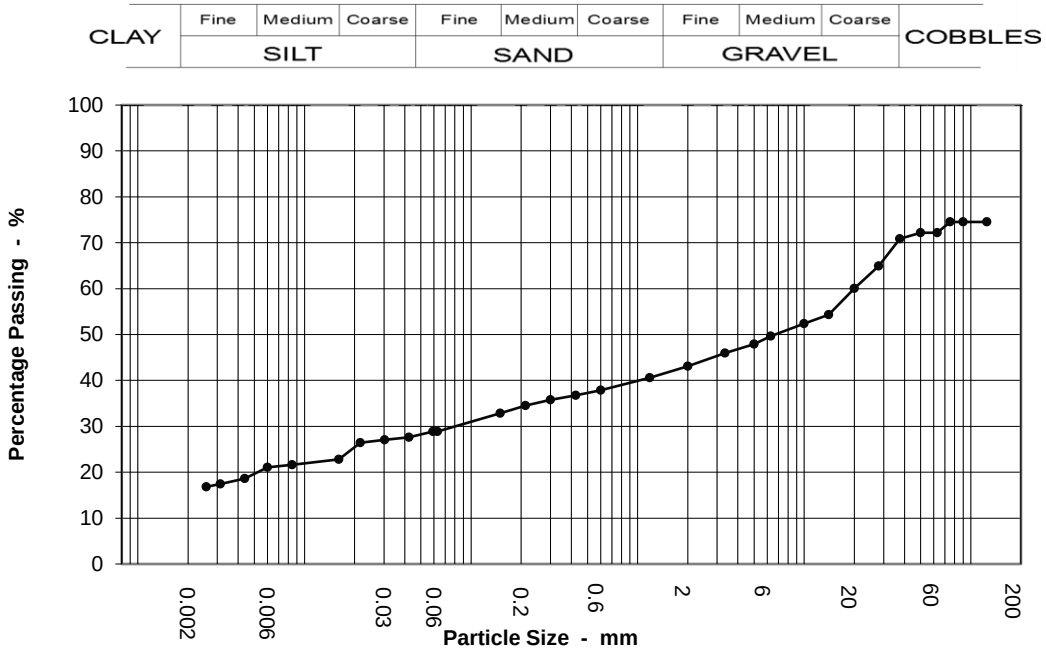
Sample Proportions	
Cobbles	0.0
Gravel	15.0
Sand	36.0
Silt	31.0
Clay	19.0

Grading Analysis	
D100	50.00
D60	0.16
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	TP33
Location	**N52 Grange to Clontail**	Sample No	3
		Depth	1.00 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	75	0.059	29
90	75	0.042	28
75	75	0.030	27
63	72	0.022	26
50	72	0.016	23
37.5	71	0.008	22
28	65	0.006	21
20	60	0.004	19
14	54	0.003	17
10	52	0.003	17
6.3	50	0.001	13
5	48		
3.35	46		
2	43		
1.18	41		
0.6	38		
0.425	37		
0.3	36		
0.212	34		
0.15	33		
0.063	29		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

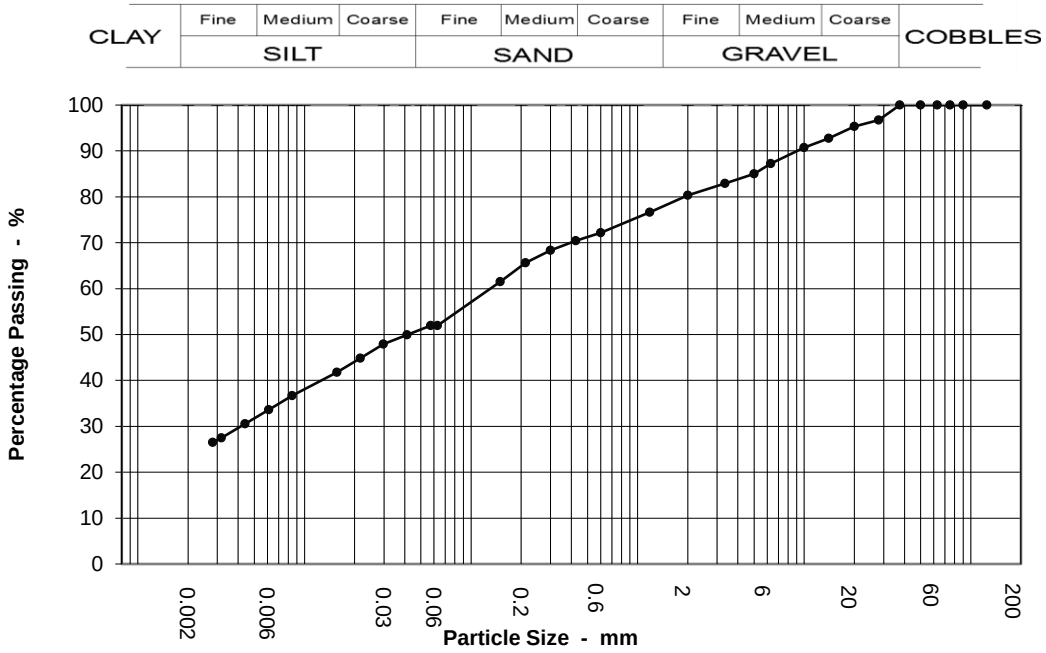
Sample Proportions	
Cobbles	28.0
Gravel	29.0
Sand	14.0
Silt	14.0
Clay	15.0

Grading Analysis	
D100	
D60	20.00
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P19026**
		Borehole / Pit No	TP35
Location	**N52 Grange to Clontail**	Sample No	1
		Depth	0.50 m
Soil Description	Slightly gravelly slightly sandy SILT	Sample type	B



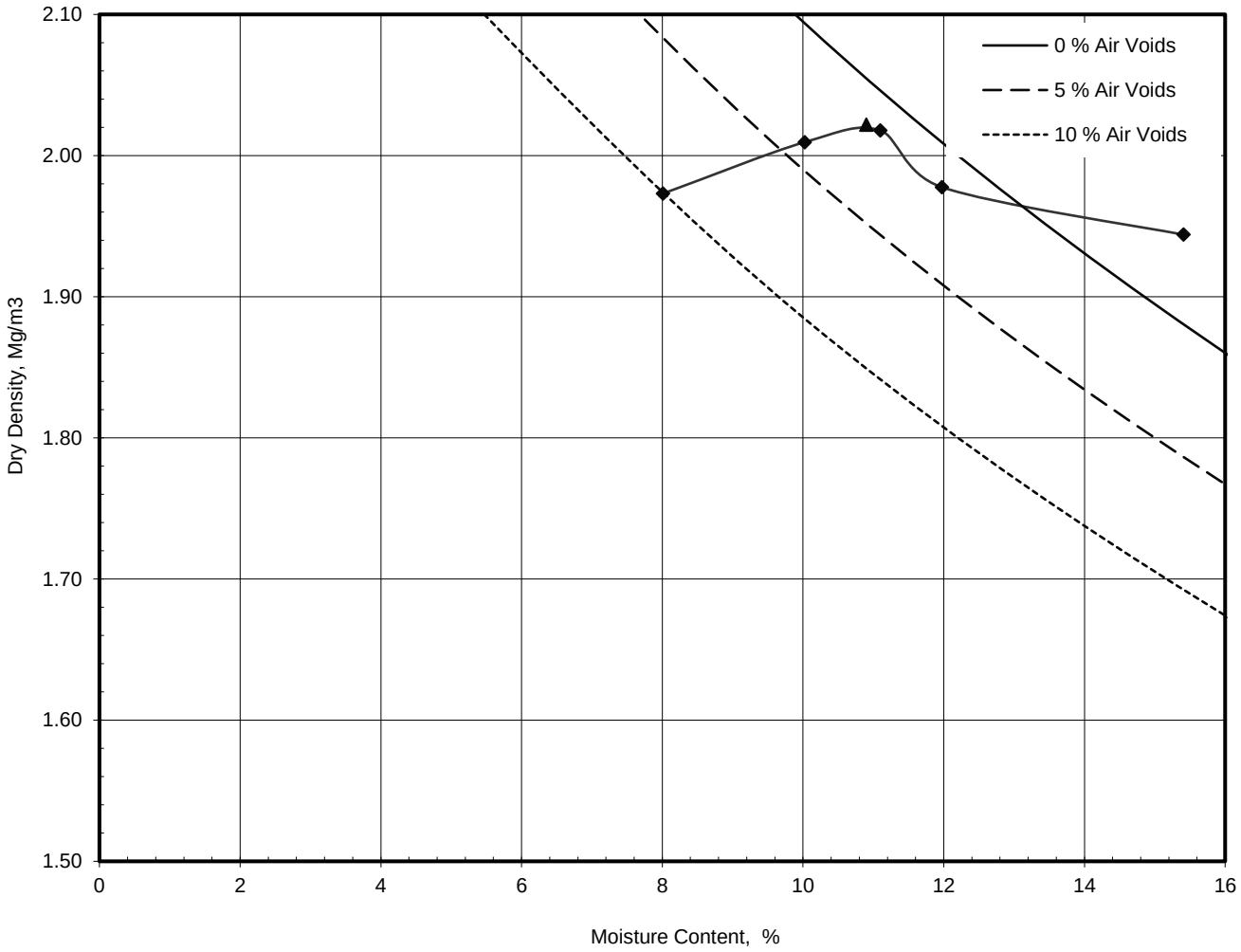
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.057	52
90	100	0.041	50
75	100	0.030	48
63	100	0.022	45
50	100	0.016	42
37.5	100	0.008	37
28	97	0.006	34
20	95	0.004	31
14	93	0.003	28
10	91	0.003	26
6.3	87	0.001	14
5	85		
3.35	83		
2	80		
1.18	77		
0.6	72		
0.425	70		
0.3	68		
0.212	66		
0.15	62		
0.063	52		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

Sample Proportions	
Cobbles	0.0
Gravel	20.0
Sand	28.0
Silt	29.0
Clay	23.0

Grading Analysis	
D100	37.50
D60	0.13
D10	
Uniformity Coefficient	

	Dry Density / Moisture Content Relationship Light Compaction			Job Ref	P19026
				Borehole / Pit No	BH08
Location	N52 Grange to Clontail			Sample No	1
Soil Description	Slightly sandy slightly gravelly CLAY with medium cobble content			Depth	0.50 m
				Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.4, 2.5kg rammer			Keylab ID	PGL12019080752
				Compaction Test Reference/No.	



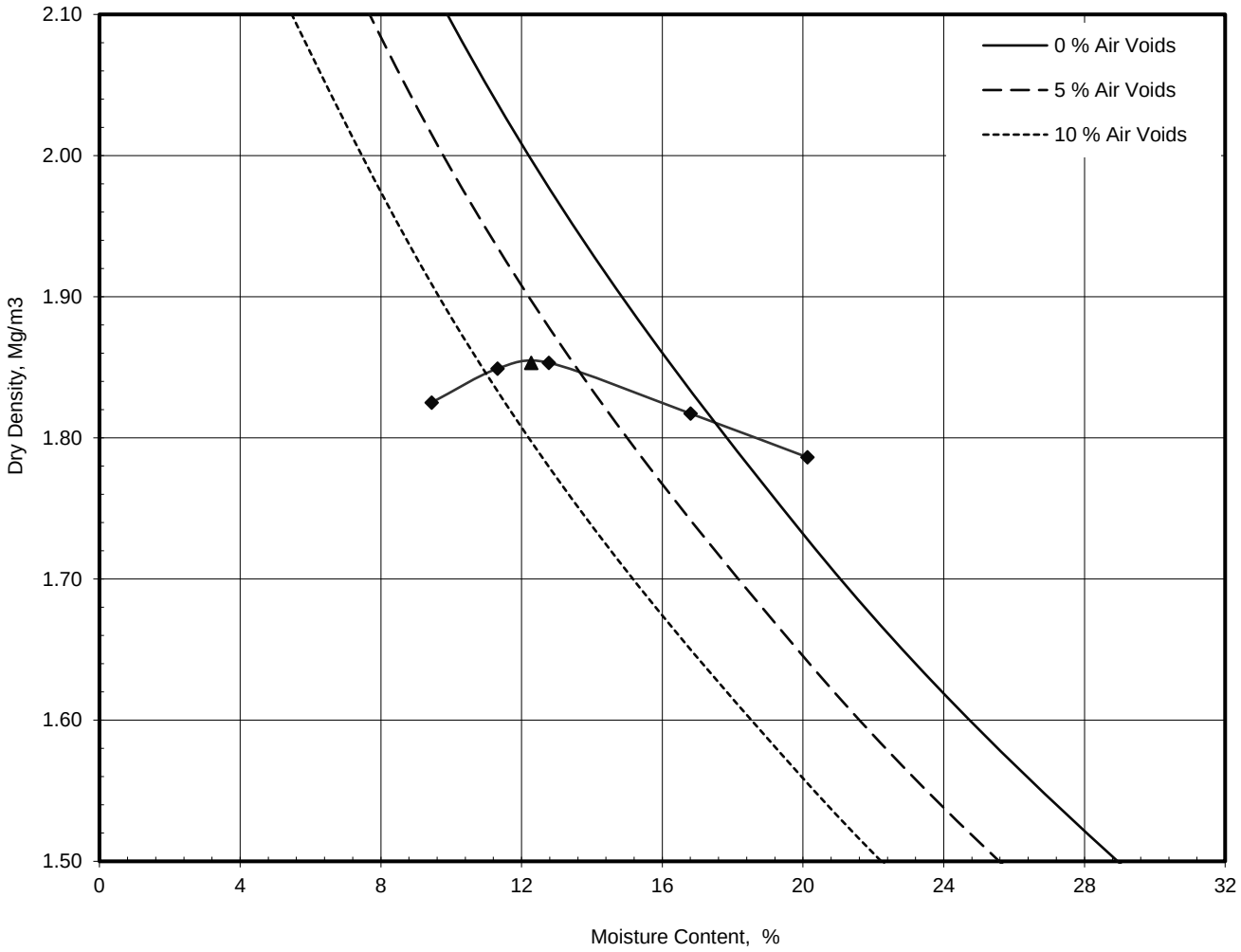
Preparation		Material used was natural
Mould Type		CBR
Samples Used		Single sample tested
Material Retained on 37.5 mm Sieve	%	36
Material Retained on 20.0 mm Sieve	%	45
Particle Density - Assumed	Mg/m³	2.65

Maximum Dry Density	Mg/m³	**2.00**

Optimum Moisture Content	%	**10.9**
Natural Mositure Content	**%**	**15.41**

Operator	Checked	Approved	Remarks	Fig
		Cilla		Sheet 1 of 1

	Dry Density / Moisture Content Relationship Light Compaction	Job Ref	P19026
		Borehole / Pit No	TP19
Location	N52 Grange to Clontail	Sample No	3
Soil Description	Slightly sandy gravelly CLAY with high cobble content	Depth	1.50 m
		Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.4, 2.5kg rammer	Keylab ID	PGL12019061165
		Compaction Test Reference/No.	



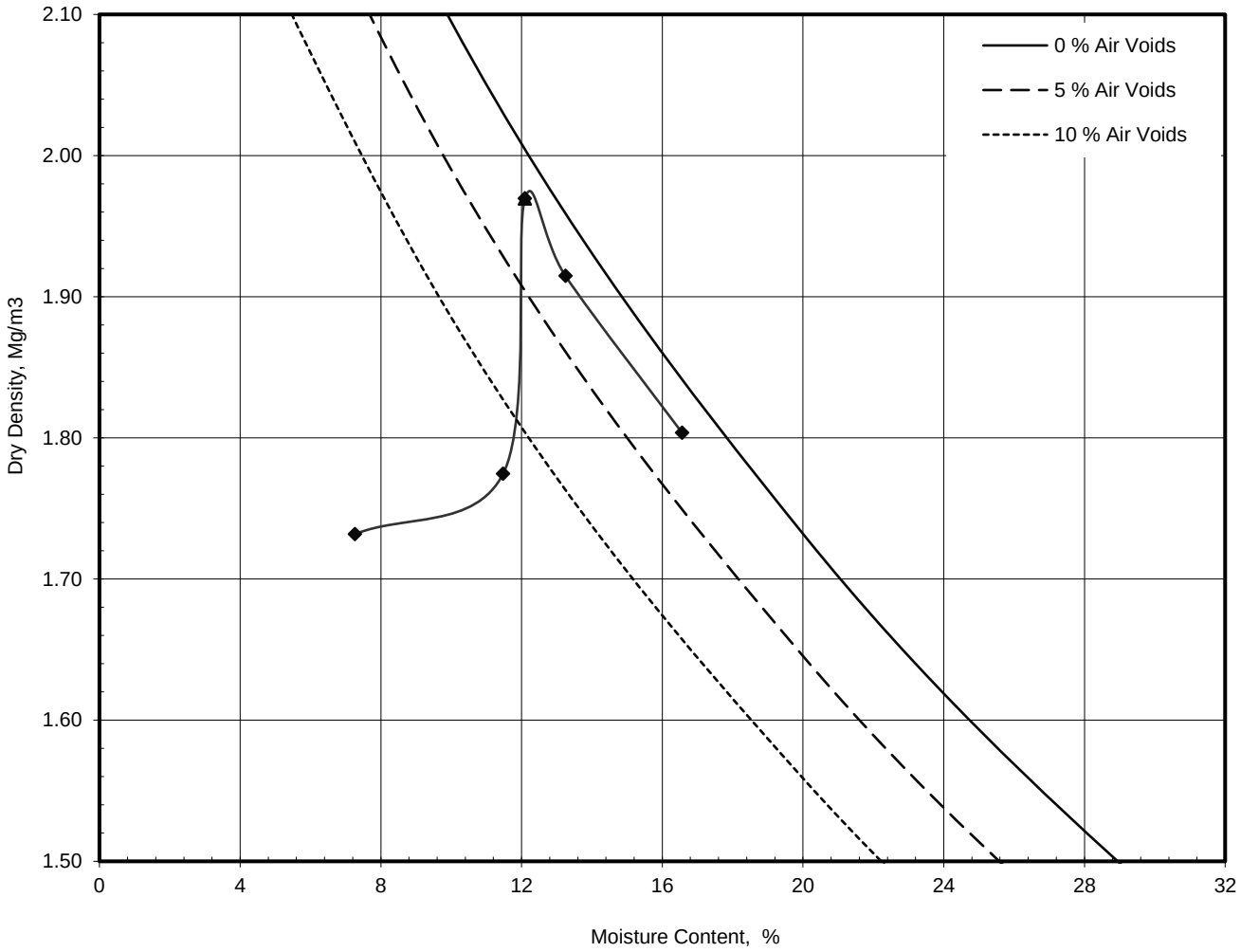
Preparation		-2146826273
Mould Type		CBR
Samples Used		
Material Retained on 37.5 mm Sieve	%	27
Material Retained on 20.0 mm Sieve	%	33
Particle Density - Assumed	Mg/m³	2.65

Maximum Dry Density	Mg/m³	**1.90**

Optimum Moisture Content	%	**12.3**
Natural Mositure Content	**%**	**20.12**

Operator	Checked	Approved	Remarks	Fig
		Cilla		Sheet 1 of 1

	Dry Density / Moisture Content Relationship Light Compaction			Job Ref	P19026
				Borehole / Pit No	TP20
Location	N52 Grange to Clontail			Sample No	3
Soil Description	Slightly sandy slightly gravelly CLAY with medium cobble content			Depth	0.80 m
				Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.4, 2.5kg rammer			Keylab ID	PGL12019061169
				Compaction Test Reference/No.	



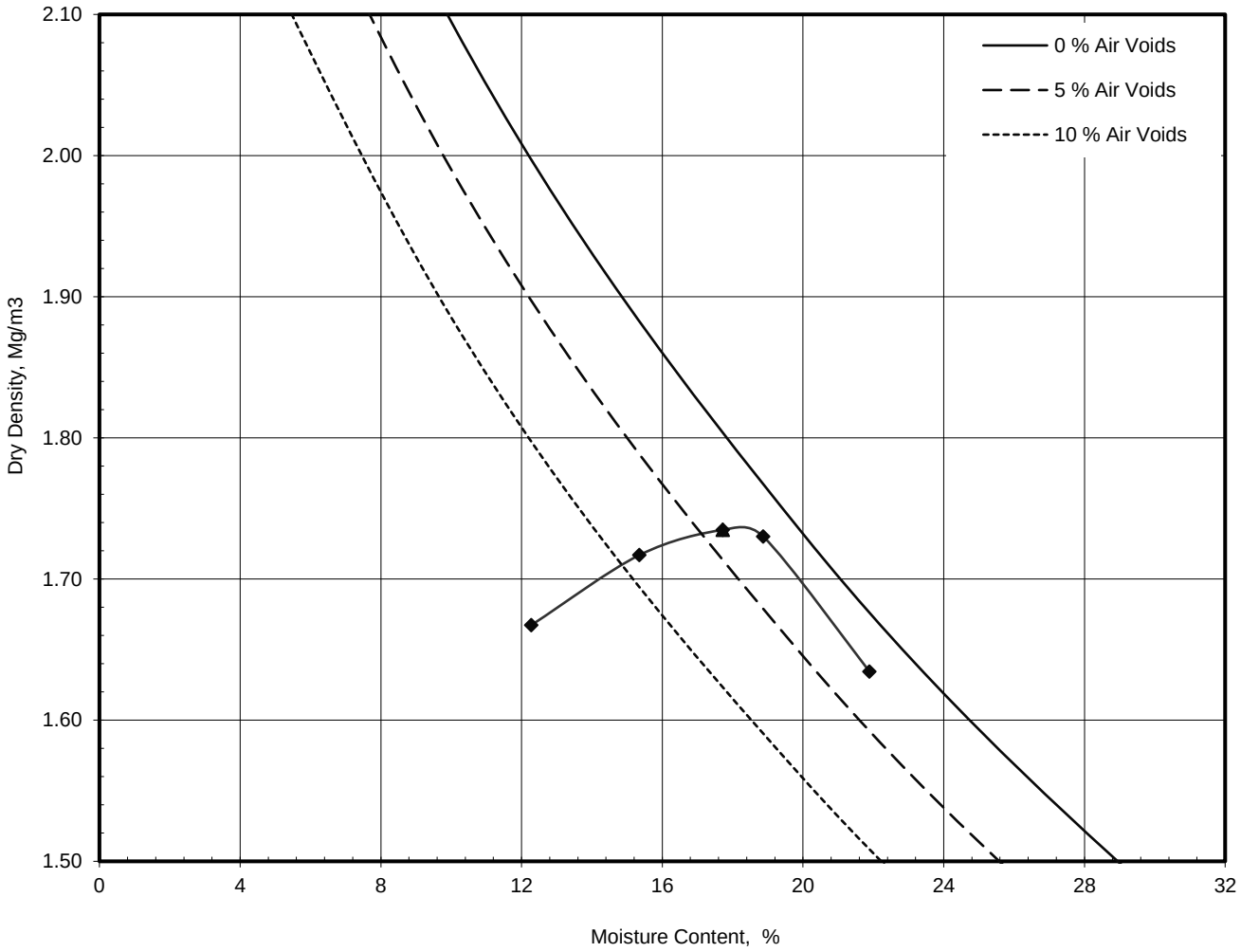
Preparation		Material used was natural
Mould Type		CBR
Samples Used		Single sample tested
Material Retained on 37.5 mm Sieve	%	31
Material Retained on 20.0 mm Sieve	%	33
Particle Density - Assumed	Mg/m³	2.65

Maximum Dry Density	Mg/m³	**2.00**

Optimum Moisture Content	%	**12.1**
Natural Mositure Content	**%**	**16.56**

Operator	Checked	Approved	Remarks	Fig
		Cilla		Sheet 1 of 1

	Dry Density / Moisture Content Relationship Light Compaction			Job Ref	P19026
				Borehole / Pit No	TP24
Location	N52 Grange to Clontail			Sample No	1
Soil Description	Slightly gravelly CLAY with medium cobble content			Depth	0.50 m
				Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.4, 2.5kg rammer			Keylab ID	PGL12019061186
				Compaction Test Reference/No.	



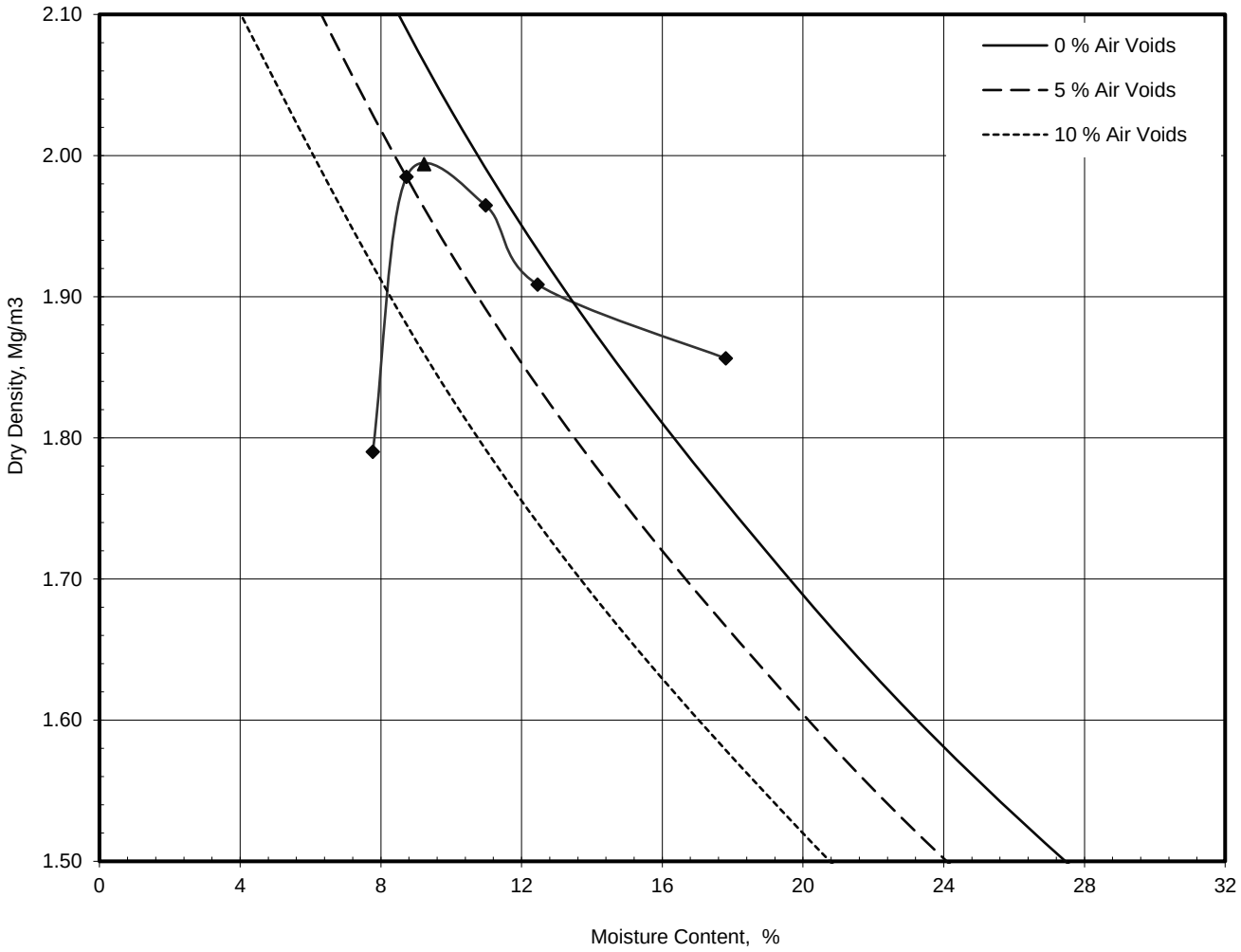
Preparation		Material used was natural
Mould Type		CBR
Samples Used		Single sample tested
Material Retained on 37.5 mm Sieve	%	22
Material Retained on 20.0 mm Sieve	%	26
Particle Density - Assumed	Mg/m³	2.65

Maximum Dry Density	Mg/m³	**1.70**

Optimum Moisture Content	%	**17.7**
Natural Mositure Content	**%**	**21.89**

Operator	Checked	Approved	Remarks	Fig
		Cilla		Sheet 1 of 1

	Dry Density / Moisture Content Relationship Light Compaction			Job Ref	P19026
				Borehole / Pit No	TP25
Location	N52 Grange to Clontail			Sample No	3
Soil Description	Very sandy very clayey GRAVEL with high cobble content			Depth	1.50 m
				Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.3, 2.5kg rammer			Keylab ID	PGL12019061191
				Compaction Test Reference/No.	



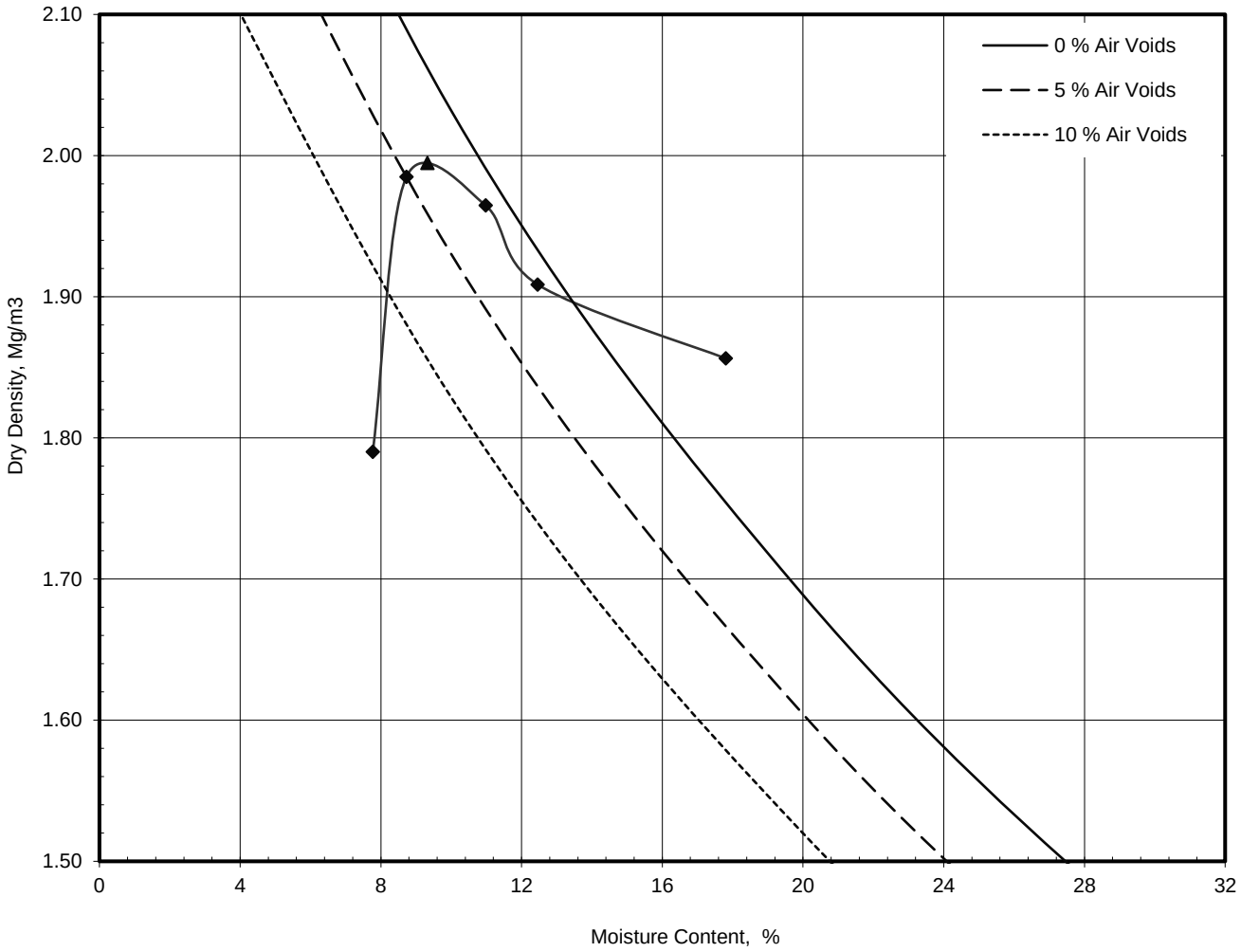
Preparation		Material used was natural
Mould Type		
Samples Used		Single sample tested
Material Retained on 37.5 mm Sieve	%	27
Material Retained on 20.0 mm Sieve	%	39
Particle Density - Assumed	Mg/m³	2.55

Maximum Dry Density	Mg/m³	**2.00**

Optimum Moisture Content	%	**9.2**
Natural Mositure Content	**%**	**17.8**

Operator	Checked	Approved	Remarks	Fig
		Cilla		Sheet 1 of 1

	Dry Density / Moisture Content Relationship Light Compaction	Job Ref	P19026
		Borehole / Pit No	TP25
Location	N52 Grange to Clontail	Sample No	3
Soil Description	Very sandy very clayey GRAVEL with high cobble content	Depth	1.50 m
		Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.4, 2.5kg rammer	Keylab ID	PGL12019061191
		Compaction Test Reference/No.	



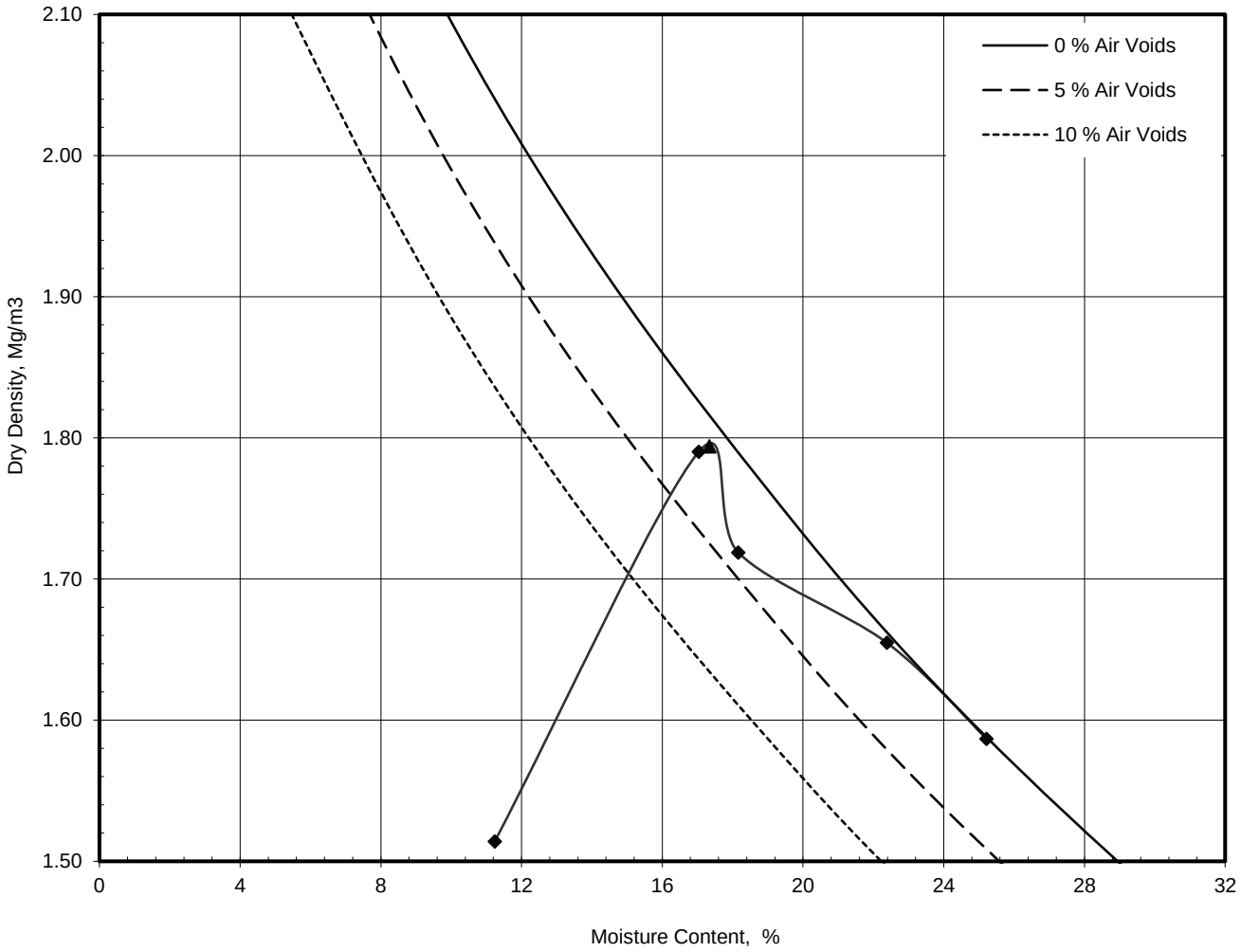
Preparation		Material used was natural
Mould Type		CBR
Samples Used		Single sample tested
Material Retained on 37.5 mm Sieve	%	27
Material Retained on 20.0 mm Sieve	%	39
Particle Density - Assumed	Mg/m³	2.55

Maximum Dry Density	Mg/m³	**2.00**

Optimum Moisture Content	%	**9.3**
Natural Mositure Content	**%**	**17.8**

Operator	Checked	Approved	Remarks	Fig
		Cilla		Sheet 1 of 1

	Dry Density / Moisture Content Relationship Light Compaction			Job Ref	P19026
				Borehole / Pit No	TP35
Location	N52 Grange to Clontail			Sample No	3
Soil Description	Slightly sandy gravelly CLAY			Depth	1.50 m
				Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.4, 2.5kg rammer			Keylab ID	PGL120190611135
				Compaction Test Reference/No.	



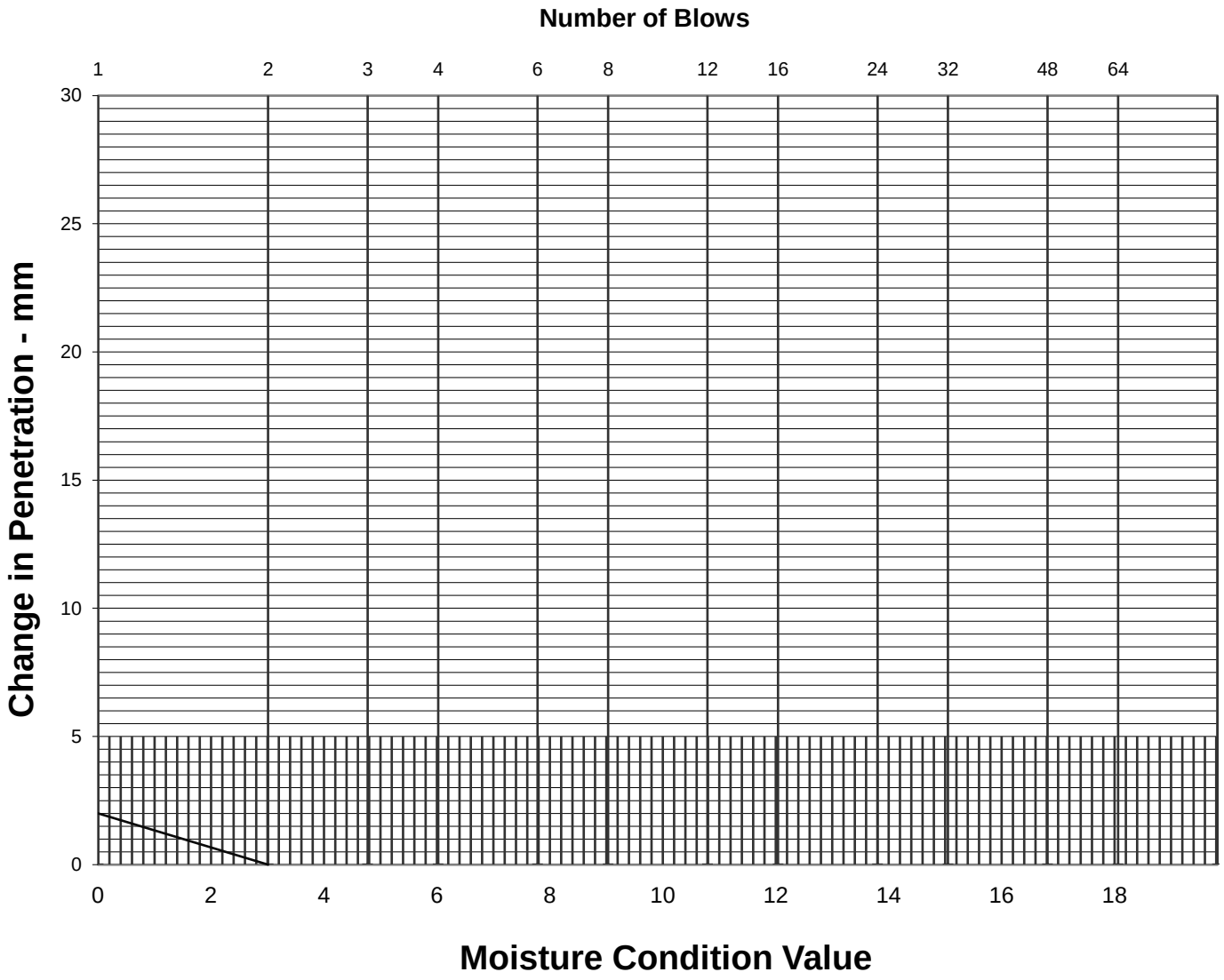
Preparation		Material used was natural
Mould Type		CBR
Samples Used		Single sample tested
Material Retained on 37.5 mm Sieve	%	38
Material Retained on 20.0 mm Sieve	%	46
Particle Density - Assumed	Mg/m³	2.65

Maximum Dry Density	Mg/m³	**1.80**

Optimum Moisture Content	%	**17.3**
Natural Mositure Content	**%**	**25.22**

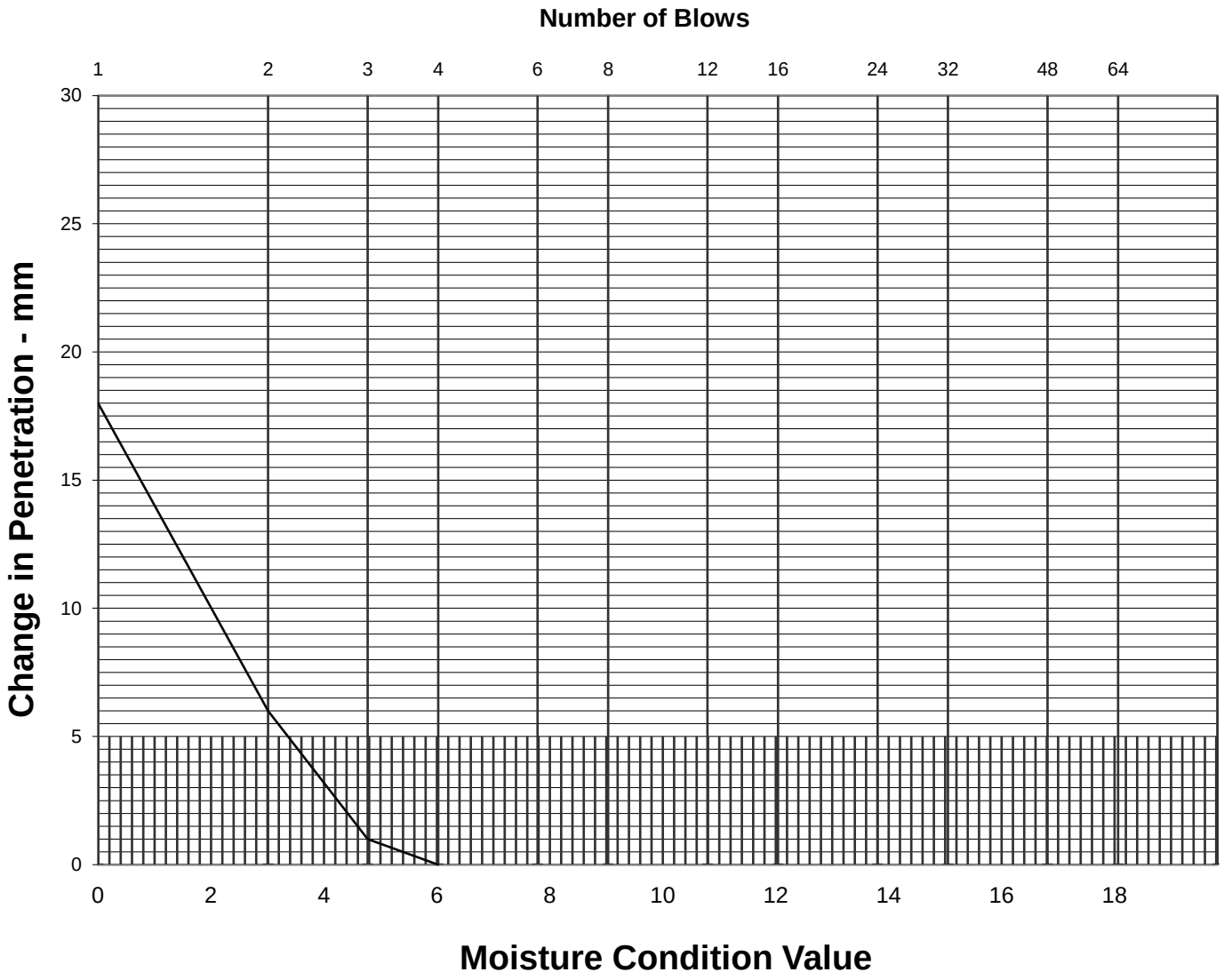
Operator	Checked	Approved	Remarks	Fig
		Cilla		Sheet 1 of 1

pgl priority geotechnical	**Moisture Condition Value** **BS 1377 : Part 4 : 1990 Clause 5**	**Job Ref**	**P19026**
		Borehole / Pit No	BH13
Location	N52 Grange to Clontail	Sample No	2
Soil Description	Slightly silty slightly sandy GRAVEL and COBBLES	Sample Type	B
		Depth	1.50 m



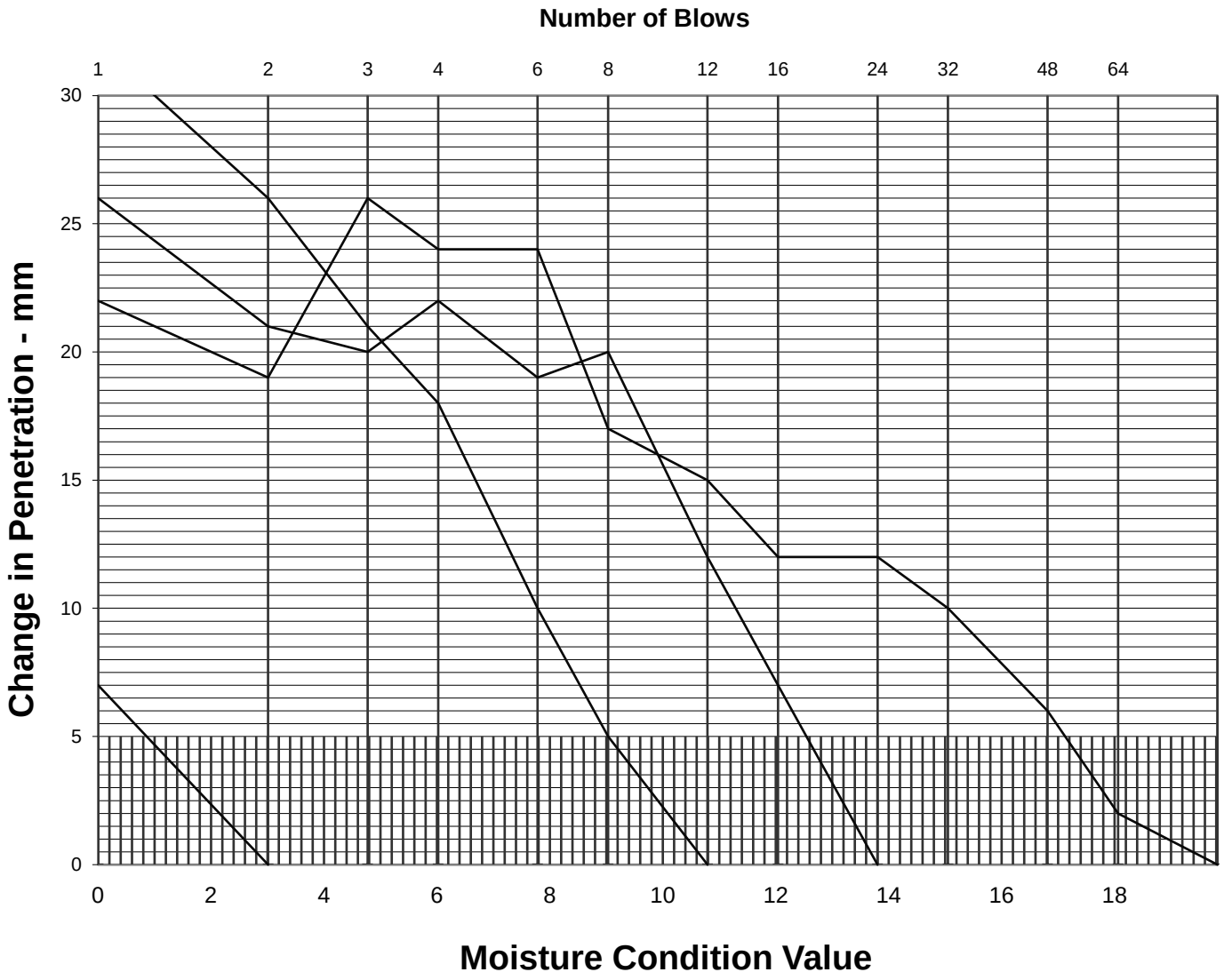
Specimen No		1	2	3	4	5	6
Moisture Condition Value		0.0					
Moisture Content	%	19.86					
Bulk density after compaction	Mg/m³	2.10					
Dry density after compaction	Mg/m³	1.75					
Hand vane strength	kPa						
Method of determining MCV		Steeptest fit line	Steeptest fit line	Steeptest fit line	Steeptest fit line	Steeptest fit line	
Mass retained on 20mm sieve	%	28.0					

pgl priority geotechnical	**Moisture Condition Value** **BS 1377 : Part 4 : 1990 Clause 5**	**Job Ref**	**P19026**
		Borehole / Pit No	TP14
Location	N52 Grange to Clontail	Sample No	1
Soil Description	Very sandy very silty GRAVEL with high cobble content	Sample Type	B
		Depth	0.50 m



Specimen No		1	2	3	4	5	6
Moisture Condition Value		3.3					
Moisture Content	%	17.61					
Bulk density after compaction	Mg/m³	2.10					
Dry density after compaction	Mg/m³	1.79					
Hand vane strength	kPa						
Method of determining MCV		Steeptest fit line	Steeptest fit line	Steeptest fit line	Steeptest fit line	Steeptest fit line	
Mass retained on 20mm sieve	%	41.8					

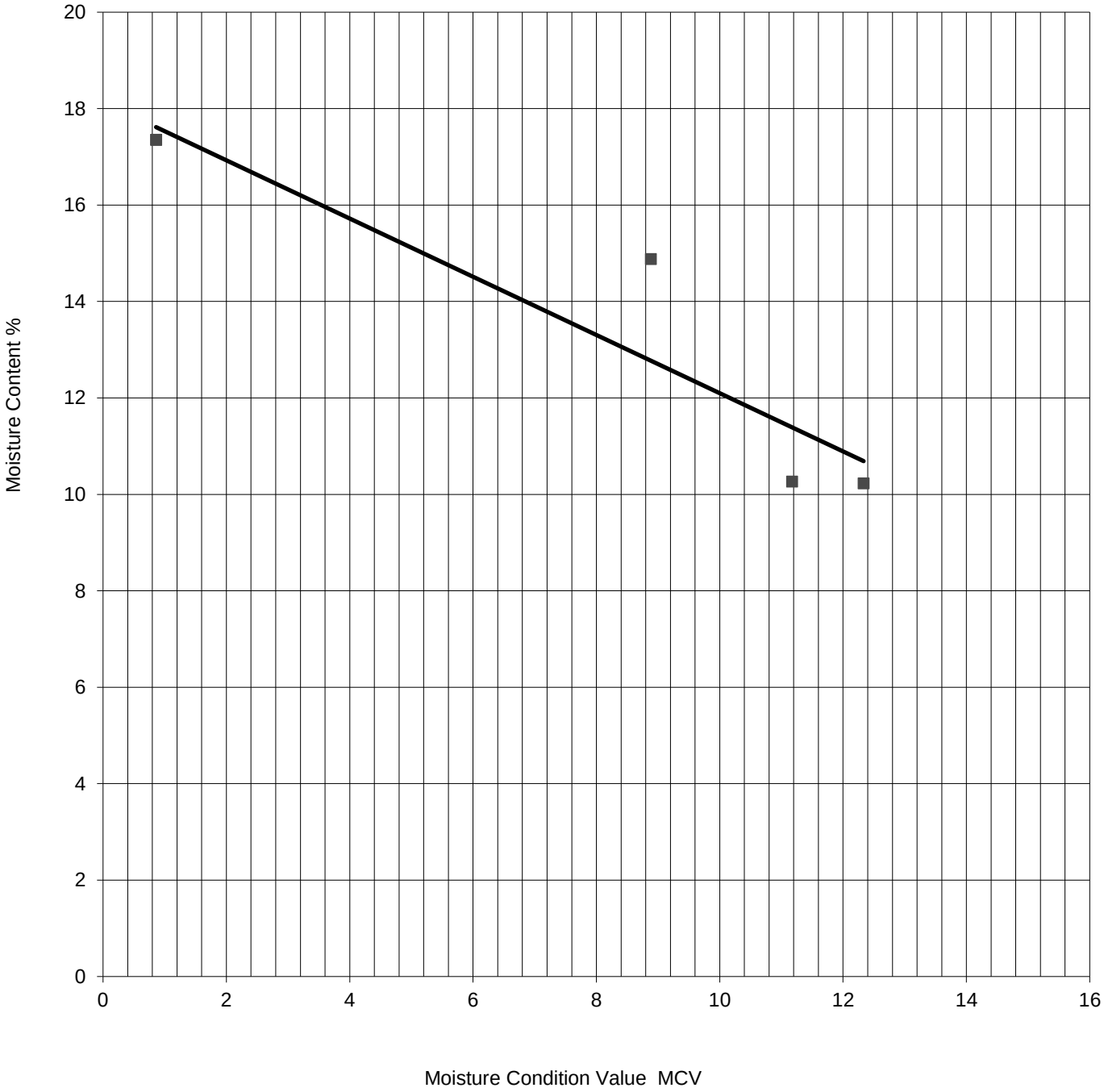
pgl priority geotechnical	**Moisture Condition Value** **BS 1377 : Part 4 : 1990 Clause 5**	**Job Ref**	**P19026**
		Borehole / Pit No	TP18
Location	N52 Grange to Clontail	Sample No	3
Soil Description	Slightly sandy slightly gravelly CLAY with high cobble content	Sample Type	B
		Depth	1.50 m



Specimen No		1	2	3	4	5	6
Moisture Condition Value		8.9	11.2	12.3	0.9		
Moisture Content	%	14.88	10.26	10.23	17.36		
Bulk density after compaction	Mg/m³						
Dry density after compaction	Mg/m³	0.00	0.00	0.00	0.00		
Hand vane strength	kPa						
Method of determining MCV		Steeptest fit line	Steeptest fit line	Steeptest fit line	Steeptest fit line	Steeptest fit line	
Mass retained on 20mm sieve	%	37.7					

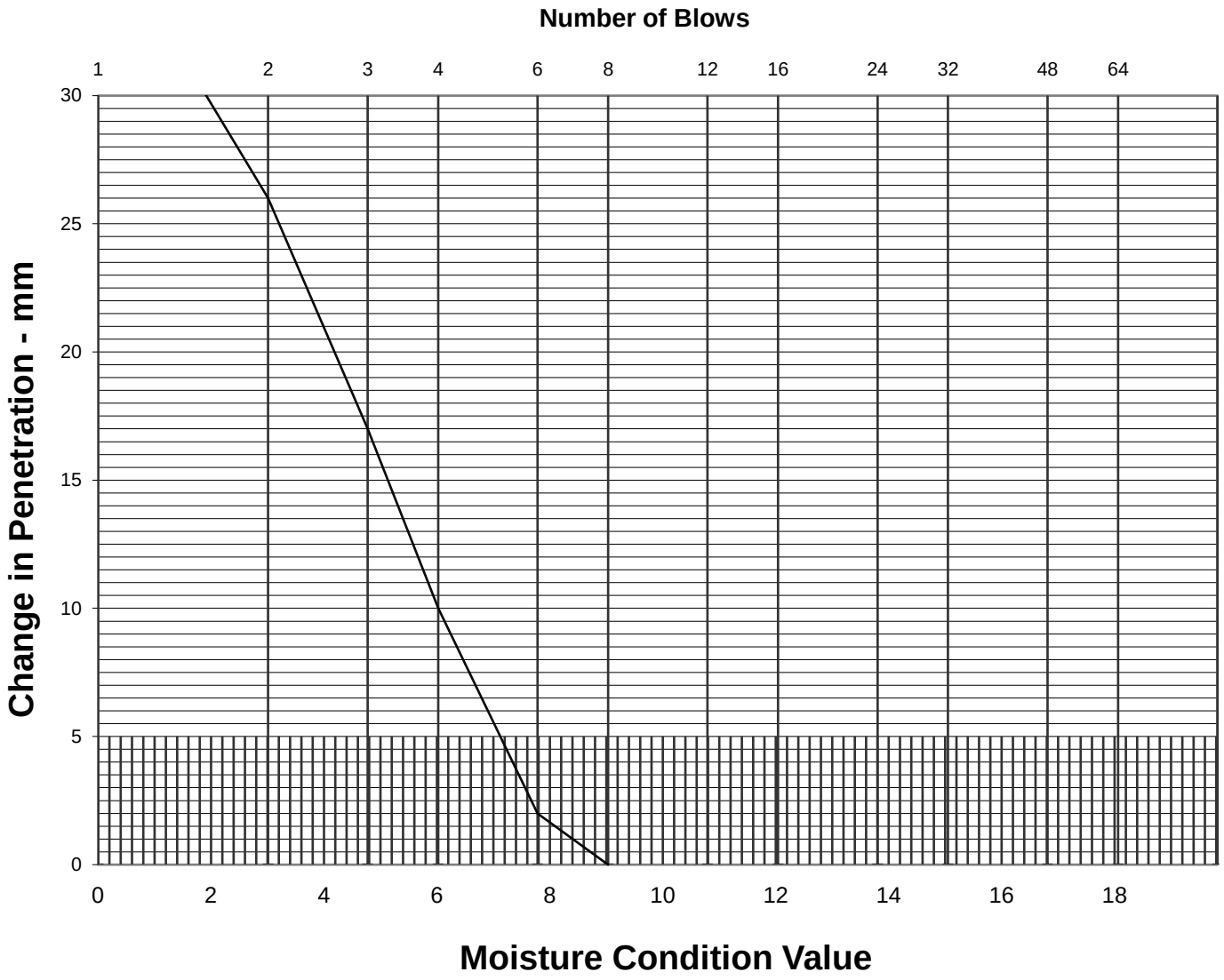
PRIORITY GEOTECHNICAL	**Moisture Condition Value** **BS 1377 : Part 4 : 1990 Clause 5**	**Job Ref**	
		Borehole / Pit No	
Location		Sample No	
Soil Description		Sample No	
		Depth	m

MCV calibration line



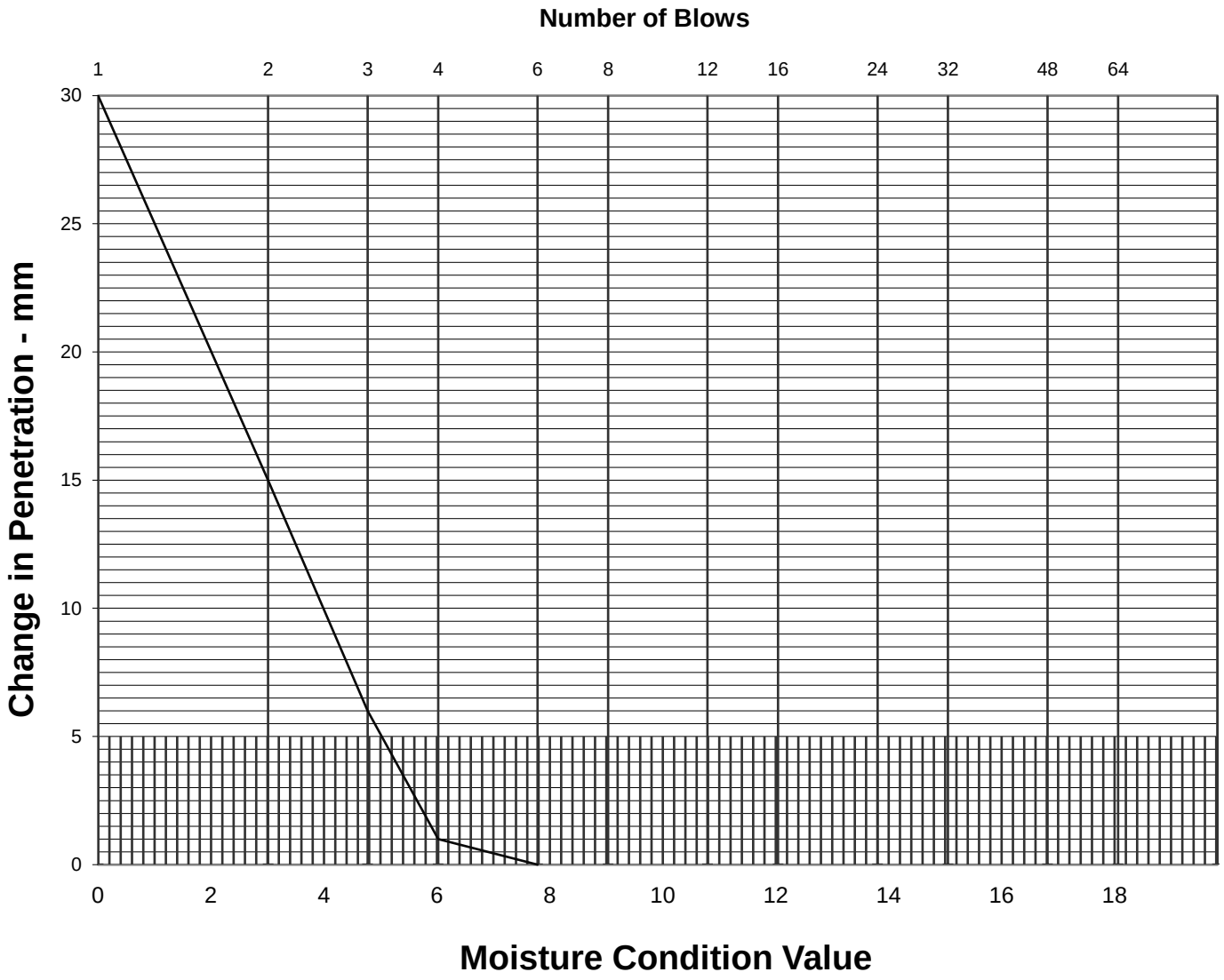
Operator	Checked	Approved	Remarks -2146826265 -2146826265

pgl priority geotechnical	**Moisture Condition Value** **BS 1377 : Part 4 : 1990 Clause 5**	**Job Ref**	**P19026**
		Borehole / Pit No	TP19
Location	N52 Grange to Clontail	Sample No	3
Soil Description	Slightly sandy gravelly CLAY with high cobble content	Sample Type	B
		Depth	1.50 m



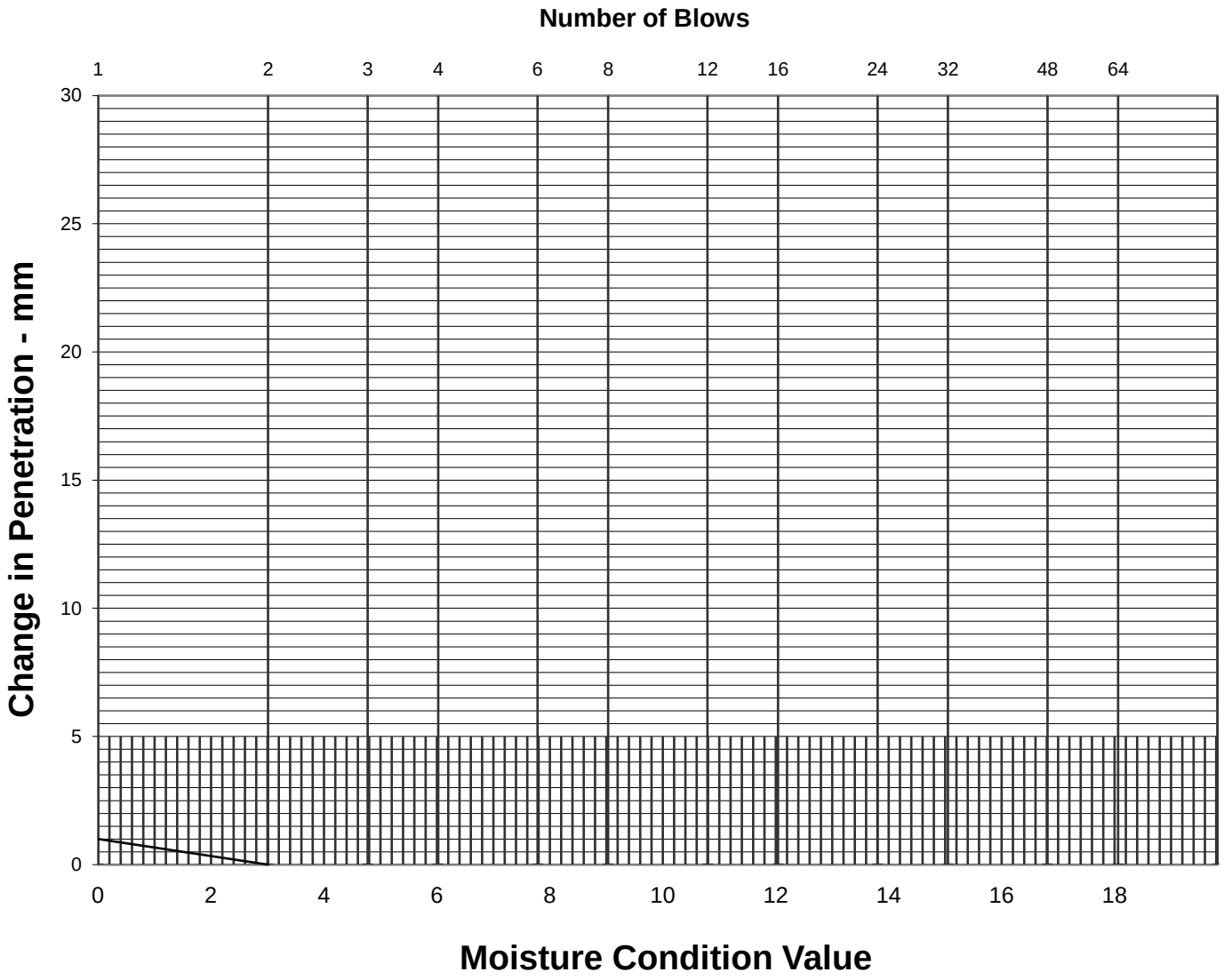
Specimen No		1	2	3	4	5	6
Moisture Condition Value		6.9					
Moisture Content	%	20.12					
Bulk density after compaction	Mg/m³						
Dry density after compaction	Mg/m³	0.00					
Hand vane strength	kPa						
Method of determining MCV		Steeptest fit line	Steeptest fit line	Steeptest fit line	Steeptest fit line	Steeptest fit line	
Mass retained on 20mm sieve	%	32.6					

pgl priority geotechnical	**Moisture Condition Value** **BS 1377 : Part 4 : 1990 Clause 5**	**Job Ref**	**P19026**
		Borehole / Pit No	TP20
Location	N52 Grange to Clontail	Sample No	3
Soil Description	Slightly sandy slightly gravelly CLAY with medium cobble content	Sample Type	B
		Depth	0.80 m



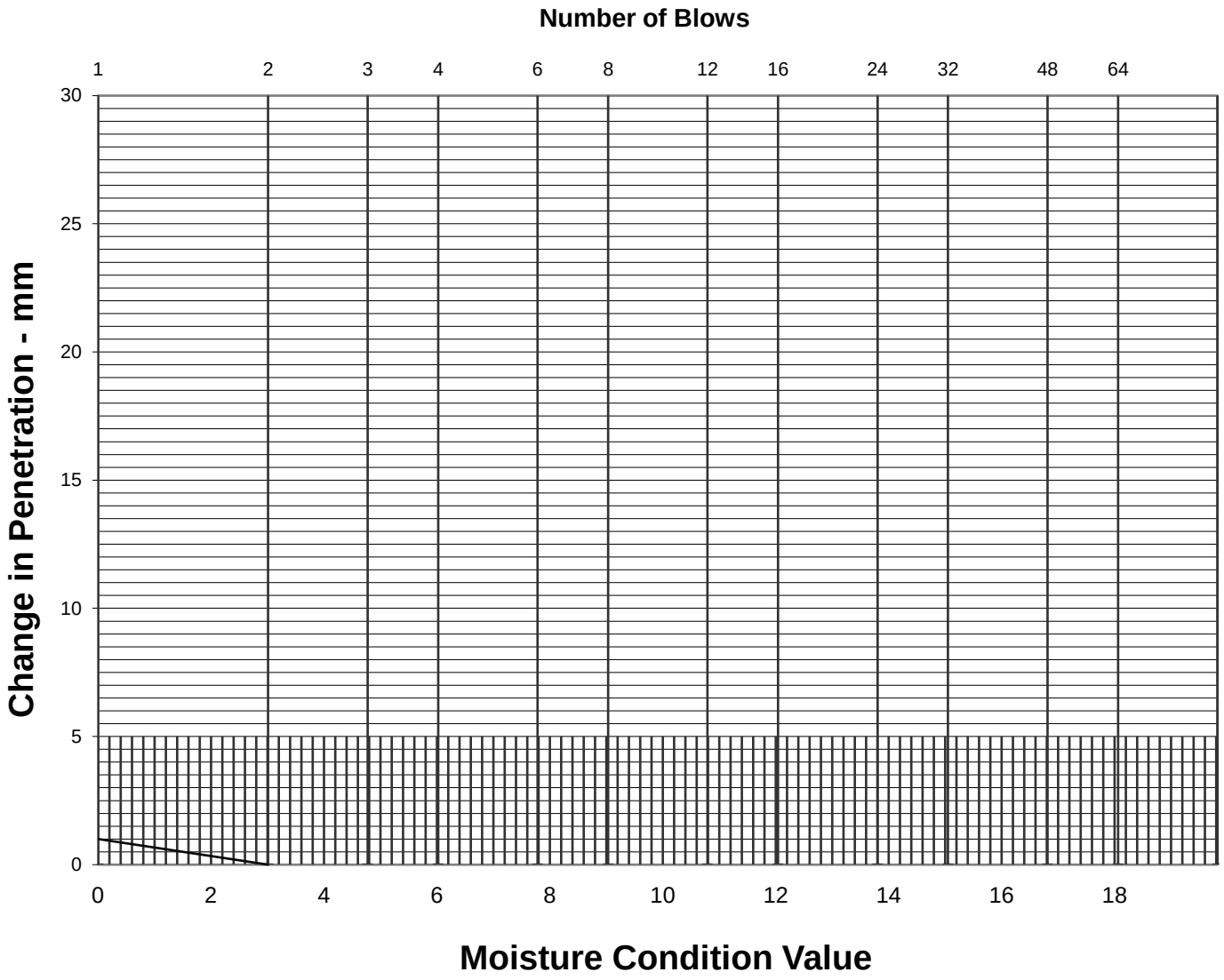
Specimen No		1	2	3	4	5	6
Moisture Condition Value		5.0					
Moisture Content	%	16.56					
Bulk density after compaction	Mg/m³	2.12					
Dry density after compaction	Mg/m³	1.82					
Hand vane strength	kPa						
Method of determining MCV		Steeptest fit line	Steeptest fit line	Steeptest fit line	Steeptest fit line	Steeptest fit line	
Mass retained on 20mm sieve	%	33.2					

pgl priority geotechnical	**Moisture Condition Value** **BS 1377 : Part 4 : 1990 Clause 5**	**Job Ref**	**P19026**
		Borehole / Pit No	TP22
Location	N52 Grange to Clontail	Sample No	1
Soil Description	Slightly sandy gravelly SILT with medium cobble content	Sample Type	B
		Depth	0.50 m



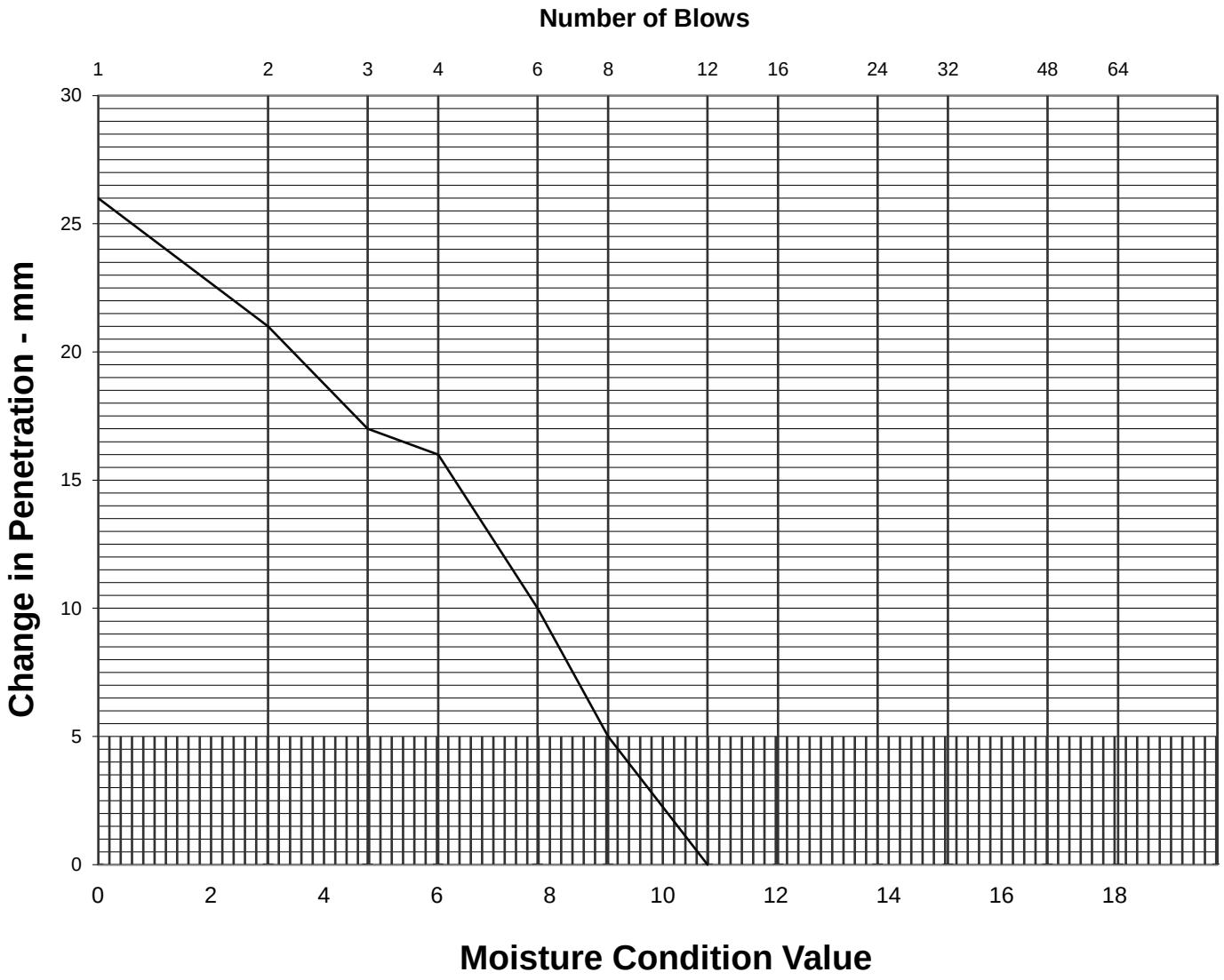
Specimen No		1	2	3	4	5	6
Moisture Condition Value		0.0					
Moisture Content	%	31.91					
Bulk density after compaction	Mg/m³	1.93					
Dry density after compaction	Mg/m³	1.46					
Hand vane strength	kPa						
Method of determining MCV		Steeptest fit line	Steeptest fit line	Steeptest fit line	Steeptest fit line	Steeptest fit line	
Mass retained on 20mm sieve	%	16.5					

pgl priority geotechnical	**Moisture Condition Value** **BS 1377 : Part 4 : 1990 Clause 5**	**Job Ref**	**P19026**
		Borehole / Pit No	TP25
Location	N52 Grange to Clontail	Sample No	1
Soil Description	Very sandy very clayey GRAVEL with low cobble content	Sample Type	B
		Depth	0.50 m



Specimen No		1	2	3	4	5	6
Moisture Condition Value		0.0					
Moisture Content	%	22.50					
Bulk density after compaction	Mg/m³	1.97					
Dry density after compaction	Mg/m³	1.61					
Hand vane strength	kPa						
Method of determining MCV		Steeptest fit line	Steeptest fit line	Steeptest fit line	Steeptest fit line	Steeptest fit line	
Mass retained on 20mm sieve	%	12.7					

pgl priority geotechnical	**Moisture Condition Value** **BS 1377 : Part 4 : 1990 Clause 5**	**Job Ref**	**P19026**
		Borehole / Pit No	TP32
Location	N52 Grange to Clontail	Sample No	1
Soil Description	Slightly gravelly sandy SILT	Sample Type	B
		Depth	0.20 m



Specimen No		1	2	3	4	5	6
Moisture Condition Value		9.0					
Moisture Content	%	23.61					
Bulk density after compaction	Mg/m³	1.93					
Dry density after compaction	Mg/m³	1.56					
Hand vane strength	kPa						
Method of determining MCV		Steeptest fit line	Steeptest fit line	Steeptest fit line	Steeptest fit line	Steeptest fit line	
Mass retained on 20mm sieve	%	4.1					

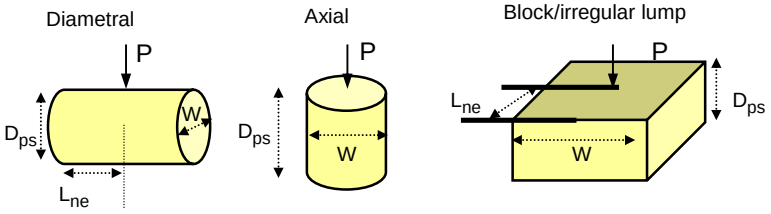
Point Load Strength Index Tests
Summary of Results

Project No.: P19026

Project Name: N52 Grange to Clontail

Borehole No.	Sample			Specimen		Rock Type and Test condition	Test Type see ISRM		Failure Valid (Y/N)	Dimensions				Force P	Equivalent diameter, De	Point Load Strength Index		Remarks (including water content if measured)
	Depth m	Ref.	Type	Ref.	Depth m		Type (D, A, I, B)	Direction (L, P or U)		Lne mm	W mm	Dps mm	Dps' mm	kN	mm	I_s MPa	$I_{s(50)}$ MPa	
RC04	7.60	RC	C			LIMESTONE	D	U	YES	50.0	76.0	76.0	64.0	16.4	69.7	3.4	3.9	Planar Undulating
RC07	6.45	RC	C			LIMESTONE	D	U	YES	60.0	76.0	76.0	66.0	20.0	70.8	4.0	4.7	Planar Smooth
RC08	7.00	RC	C			SILTSTONE	I	P	YES	40.0	76.0	40.0	9.0	1.6	29.5	1.8	1.5	Planar Smooth
RC14	4.40	RC	C			LIMESTONE	D	U	YES	80.0	76.0	76.0	66.0	19.4	70.8	3.9	4.5	Rough Planar
RC14	5.15	RC	C			LIMESTONE	D	U	YES	52.0	76.0	76.0	64.0	20.4	69.7	4.2	4.9	Planar Smooth
RC14	8.20	RC	C			LIMESTONE	D	U	YES	50.0	76.0	76.0	68.0	18.6	71.9	3.6	4.2	Planar Smooth
RC14	8.76	RC	C			LIMESTONE	D	U	YES	60.0	76.0	76.0	65.0	19.3	70.3	3.9	4.6	Planar Smooth

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block
Direction
L - parallel to planes of weakness
P - perpendicular to planes of weakness
U - unknown or random
Dimensions
Dps - Distance between platens (platen separation)
Dps' - at failure (see ISRM note 6)
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P



Test performed in accordance with ISRM Suggested Methods : 2007, unless noted otherwise
Detailed legend for test and dimensions, based on ISRM, is shown above.
Size factor, F = $(De/50)^{0.45}$ for all tests.

Date Printed: 14/11/2019

Approved By: Cilla

Table 1

sheet 1

Unconfined Compressive Strength, UCS

Job Name	**N52 Grange to Clontail**	
Job Number	**P19026**	
Borehole:	**BH07**	
Depth:	**6.15**	**m**
Rock Type	**SANDSTONE**	
Bulk Density	**2.56**	**Mg/m3**
Load at Failure, P	**147.7**	**kN**
Stress at Failure	**32.57**	**MPa**

Failure mode

Unconfined Compressive Strength, UCS

Job Name	**N52 Grange to Clontail**	
Job Number	**P19026**	
Borehole:	**BH14**	
Depth:	**5.55**	**m**
Rock Type	**SANDSTONE**	
Bulk Density	**2.69**	**Mg/m3**
Load at Failure, P	**568.5**	**kN**
Stress at Failure	**125.37**	**MPa**

Failure mode

Unconfined Compressive Strength, UCS

Job Name	**N52 Grange to Clontail**	
Job Number	**P19026**	
Borehole:	**BH14**	
Depth:	**7.9**	**m**
Rock Type	**SANDSTONE**	
Bulk Density	**2.64**	**Mg/m3**
Load at Failure, P	**319.4**	**kN**
Stress at Failure	**70.47**	**MPa**

Failure mode

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Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

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Final Report

Report No.:	19-24191-1
Initial Date of Issue:	22-Jul-2019
Client	Priority Geotechnical Ltd
Client Address:	Unit 12 Owenacurra Business Park Midleton County Cork Ireland
Contact(s):	Colette Kelly
Project	P19026 N52

Quotation No.:		**Date Received:**	18-Jul-2019
Order No.:	11653	**Date Instructed:**	18-Jul-2019
No. of Samples:	3		
Turnaround (Wkdays):	7	**Results Due:**	26-Jul-2019
Date Approved:	22-Jul-2019		

Approved By:

Details: Robert Monk, Technical Manager

Results - Soil

Project: P19026 N52

Client: Priority Geotechnical Ltd					**Chemtest Job No.:**	19-24191	19-24191	19-24191
Quotation No.:					**Chemtest Sample ID.:**	860063	860064	860065
					Sample Location:	TP27	TP26	TP34
					Sample Type:	SOIL	SOIL	SOIL
					Top Depth (m):	0.20	0.50	0.50
					Date Sampled:	16-Jul-2019	16-Jul-2019	16-Jul-2019
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
Moisture	N	2030	%	0.020		28	29	25
Organic Matter	U	2625	%	0.40		4.3	3.3	3.6

Test Methods

SOP	Title	Parameters included	Method summary
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.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.

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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

Chemtest
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Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

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Final Report

Report No.:	19-18882-1
Initial Date of Issue:	14-Jun-2019
Client	Priority Geotechnical Ltd
Client Address:	Unit 12 Owenacurra Business Park Midleton County Cork Ireland
Contact(s):	Colette Kelly
Project	P19026 N52

Quotation No.:	Q17-09116	**Date Received:**	05-Jun-2019
Order No.:	11653	**Date Instructed:**	05-Jun-2019
No. of Samples:	2		
Turnaround (Wkdays):	7	**Results Due:**	13-Jun-2019
Date Approved:	14-Jun-2019		

Approved By:

Details: Martin Dyer, Laboratory Manager

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Results - Soil

Project: P19026_N52

Client: Priority Geotechnical Ltd		**Chemtest Job No.:**			19-18882	19-18882
Quotation No.: Q17-09116		**Chemtest Sample ID.:**			837692	837693
			Sample Location:		TP02	TP03
			Sample Type:		SOIL	SOIL
			Top Depth (m):		0.60	0.50
			Date Sampled:		28-May-2019	28-May-2019
			Asbestos Lab:		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
ACM Detection Stage	U	2192		N/A	-	-
Moisture	N	2030	%	0.020	18	25
pH	U	2010		N/A	7.8	5.7
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010	< 0.010
Cyanide (Total)	U	2300	mg/kg	0.50	0.60	1.0
Arsenic	U	2450	mg/kg	1.0	14	7.5
Boron	N	2450	mg/kg	0.40	1.1	1.0
Barium	U	2450	mg/kg	10	120	180
Cadmium	U	2450	mg/kg	0.10	1.4	1.0
Chromium	U	2450	mg/kg	1.0	62	54
Molybdenum	U	2450	mg/kg	2.0	8.5	2.5
Copper	U	2450	mg/kg	0.50	41	21
Mercury	U	2450	mg/kg	0.10	< 0.10	< 0.10
Nickel	U	2450	mg/kg	0.50	66	53
Lead	U	2450	mg/kg	0.50	33	19
Selenium	U	2450	mg/kg	0.20	1.1	1.7
Zinc	U	2450	mg/kg	0.50	110	70
Chromium (Trivalent)	N	2490	mg/kg	1.0	62	54
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50
Organic Matter	U	2625	%	0.40	14	1.9
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0

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Results - Soil

Project: P19026_N52

Client: Priority Geotechnical Ltd		**Chemtest Job No.:**			19-18882	19-18882
Quotation No.: Q17-09116		**Chemtest Sample ID.:**			837692	837693
			Sample Location:		TP02	TP03
			Sample Type:		SOIL	SOIL
			Top Depth (m):		0.60	0.50
			Date Sampled:		28-May-2019	28-May-2019
			Asbestos Lab:		DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10
Benzene	U	2760	µg/kg	1.0	< 1.0	< 1.0
Toluene	U	2760	µg/kg	1.0	< 1.0	< 1.0
Ethylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0
m & p-Xylene	U	2760	µg/kg	1.0	1.4	< 1.0
o-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0
Methyl Tert-Butyl Ether	U	2760	µg/kg	1.0	< 1.0	< 1.0
Naphthalene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10
Acenaphthene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Fluorene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Phenanthrene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Anthracene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Fluoranthene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Pyrene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Chrysene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Coronene	N	2800	mg/kg	0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2800	mg/kg	2.0	< 2.0	< 2.0
PCB 28	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 52	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 90+101	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 118	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 153	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 138	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 180	U	2815	mg/kg	0.010	< 0.010	< 0.010
Total PCBs (7 Congeners)	N	2815	mg/kg	0.10	< 0.10	< 0.10
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30

Results - Single Stage WAC

Project: P19026_N52

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	19-18882						
Chemtest Sample ID:	837692						
Sample Ref:							
Sample ID:							
Sample Location:	TP02						
Top Depth(m):	0.60						
Bottom Depth(m):							
Sampling Date:	28-May-2019						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%	8.1	3	5	6
Loss On Ignition	2610	U	%	5.0	--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	U		7.8	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.0020	--	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	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.0049	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0076	0.076	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	< 0.0010	< 0.50	4	50	200
Chloride	1220	U	1.5	15	800	15000	25000
Fluoride	1220	U	0.38	3.8	10	150	500
Sulphate	1220	U	12	120	1000	20000	50000
Total Dissolved Solids	1020	N	98	970	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	7.6	76	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	18

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: P19026_N52

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	19-18882						
Chemtest Sample ID:	837693						
Sample Ref:							
Sample ID:							
Sample Location:	TP03						
Top Depth(m):	0.50						
Bottom Depth(m):							
Sampling Date:	28-May-2019						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%	1.1	3	5	6
Loss On Ignition	2610	U	%	7.1	--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	U		5.7	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.036	--	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	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.0023	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	< 0.0010	< 0.050	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	< 0.0010	< 0.50	4	50	200
Chloride	1220	U	2.3	23	800	15000	25000
Fluoride	1220	U	0.13	1.3	10	150	500
Sulphate	1220	U	4.3	43	1000	20000	50000
Total Dissolved Solids	1020	N	20	200	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	16	160	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	25

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.

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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
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.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
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.
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
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)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

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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
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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 Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

UKAS TESTING
2183

Final Report

Report No.:	19-11950-1
Initial Date of Issue:	16-Apr-2019
Client	Priority Geotechnical Ltd
Client Address:	Unit 12 Owenacurra Business Park Midleton County Cork Ireland
Contact(s):	Colette Kelly
Project	P19026 N52

Quotation No.:	Q17-09116	**Date Received:**	05-Apr-2019
Order No.:	11653	**Date Instructed:**	05-Apr-2019
No. of Samples:	2		
Turnaround (Wkdays):	7	**Results Due:**	15-Apr-2019
Date Approved:	16-Apr-2019		

Approved By:

Details: Martin Dyer, Laboratory Manager

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Results - Soil

Project: P19026 N52

Client: Priority Geotechnical Ltd			**Chemtest Job No.:**		19-11950	19-11950
Quotation No.: Q17-09116			**Chemtest Sample ID.:**		806259	806260
			Client Sample ID.:		TP35	TP36
			Sample Type:		SOIL	SOIL
			Top Depth (m):		0.8	0.7
			Date Sampled:		29-Mar-2019	29-Mar-2019
			Asbestos Lab:		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
ACM Detection Stage	U	2192		N/A	-	-
Moisture	N	2030	%	0.020	16	47
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010	< 0.010
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50	0.70
Arsenic	U	2450	mg/kg	1.0	9.7	12
Barium	U	2450	mg/kg	10	110	480
Cadmium	U	2450	mg/kg	0.10	0.68	1.4
Chromium	U	2450	mg/kg	1.0	38	27
Molybdenum	U	2450	mg/kg	2.0	< 2.0	< 2.0
Copper	U	2450	mg/kg	0.50	21	32
Mercury	U	2450	mg/kg	0.10	< 0.10	0.13
Nickel	U	2450	mg/kg	0.50	52	36
Lead	U	2450	mg/kg	0.50	45	24
Selenium	U	2450	mg/kg	0.20	0.62	5.9
Zinc	U	2450	mg/kg	0.50	100	55
Chromium (Trivalent)	N	2490	mg/kg	1.0	38	27
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10

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Results - Soil

Project: P19026 N52

Client: Priority Geotechnical Ltd			**Chemtest Job No.:**		19-11950	19-11950
Quotation No.: Q17-09116			**Chemtest Sample ID.:**		806259	806260
			Client Sample ID.:		TP35	TP36
			Sample Type:		SOIL	SOIL
			Top Depth (m):		0.8	0.7
			Date Sampled:		29-Mar-2019	29-Mar-2019
			Asbestos Lab:		LIVERPOOL	LIVERPOOL
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Benzene	U	2760	µg/kg	1.0	< 1.0	< 1.0
Toluene	U	2760	µg/kg	1.0	< 1.0	< 1.0
Ethylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0
m & p-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0
o-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0
Methyl Tert-Butyl Ether	U	2760	µg/kg	1.0	< 1.0	< 1.0
Naphthalene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10
Acenaphthene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Fluorene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Phenanthrene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Anthracene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Fluoranthene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Pyrene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Chrysene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2800	mg/kg	0.10	< 0.10	< 0.10
Coronene	N	2800	mg/kg	0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2800	mg/kg	2.0	< 2.0	< 2.0
PCB 28	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 52	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 90+101	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 118	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 153	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 138	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 180	U	2815	mg/kg	0.010	< 0.010	< 0.010
Total PCBs (7 Congeners)	N	2815	mg/kg	0.10	< 0.10	< 0.10
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30

Results - Single Stage WAC

Project: P19026 N52

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	19-11950						
Chemtest Sample ID:	806259						
Sample Ref:							
Sample ID:	TP35						
Sample Location:							
Top Depth(m):	0.8						
Bottom Depth(m):							
Sampling Date:	29-Mar-2019						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%	0.85	3	5	6
Loss On Ignition	2610	U	%	3.7	--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	U		6.2	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	< 0.0020	--	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	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.0023	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	< 0.0010	< 0.050	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	< 0.0010	< 0.50	4	50	200
Chloride	1220	U	3.1	31	800	15000	25000
Fluoride	1220	U	0.11	1.1	10	150	500
Sulphate	1220	U	2.7	27	1000	20000	50000
Total Dissolved Solids	1020	N	7.8	78	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	16	160	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	16

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: P19026 N52

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	19-11950						
Chemtest Sample ID:	806260						
Sample Ref:							
Sample ID:	TP36						
Sample Location:							
Top Depth(m):	0.7						
Bottom Depth(m):							
Sampling Date:	29-Mar-2019						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%	15	3	5	6
Loss On Ignition	2610	U	%	73	--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	U		6.7	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.0050	--	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	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.0094	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	0.0022	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	< 0.0010	< 0.050	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	< 0.0010	< 0.50	4	50	200
Chloride	1220	U	3.4	34	800	15000	25000
Fluoride	1220	U	0.19	1.9	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	35	340	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	20	200	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	47

Waste Acceptance Criteria

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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
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.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
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.
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
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)	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
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U/S	Unsuitable Sample
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>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
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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

APPENDIX C

EXPLORATION LOCATION LAYOUT AND PLANS

Exploration location layout P19026 -SI-A

Exploration location plans P19026-SI-01 to P19026-SI-07

Location	Easting	Northing	Ground Level (mOD)	Final Depth (m bgl)	Date Start (dd/mm/yyyy)
BH01	683638.8	782758.8	68.41	3.7	31/05/2019
BH02	683673.2	782779.8	67.3	4.6	30/05/2019
BH03	683693.1	782779.7	68.51	3.3	30/05/2019
BH04	684096.9	782959.7	59.85	0.6	29/05/2019
BH04A	684095.9	782959.7	59.85	1.4	29/05/2019
BH07	684693.4	783232.2	51.37	3.6	28/05/2019
BH08	684900.7	783353.0	51.1	3.4	29/05/2019
BH10	685390.1	783473.6	52.63	3.5	28/05/2019
BH11	685378.2	783503.4	50.76	4.5	30/05/2019
BH12	685785.1	783585.3	75.68	1.4	27/05/2019
BH13	685925.4	783659.5	74.83	2.5	27/05/2019
BH14	686542.3	783881.7	65.65	1.9	24/05/2019
RC01	683638.8	782758.8	68.41	12.0	19/08/2019
RC02	683673.2	782779.8	67.3	12.0	16/08/2019
RC03	683693.1	782779.7	68.51	12.0	12/08/2019
RC04	684096.9	782959.7	59.85	11.9	26/08/2019
RC07	684693.4	783232.2	51.37	9.4	23/08/2019
RC08	684900.7	783353.0	51.1	12.0	22/08/2019
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RC10	685390.1	783473.6	52.63	10.0	20/08/2019
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RC12	685785.1	783585.3	75.68	12.2	14/08/2019
RC13	685925.4	783659.5	74.83	12.1	14/08/2019
RC14	686542.3	783881.7	65.65	8.9	12/08/2019
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TP02	683473.1	782703.6	75.42	3.7	28/05/2019
TP02A	685347.9	783517.5	50.42	3.4	27/05/2019
TP03	683566.9	782740.8	71.11	2.0	28/05/2019
TP04	683756.5	782809.4	71.31	2.4	29/03/2019
TP05	683791.6	782826.3	69.02	2.2	29/03/2019
TP06	683947.2	782913.3	69.67	1.4	29/03/2019
TP07	687242.9	784396.6	46.58	2.9	28/03/2019
TP08	684044.5	782968.9	63.2	1.0	29/03/2019
TP13	684685.1	783292.5	49.92	2.8	26/03/2019
TP14	684827.2	783286.8	54.46	2.9	26/03/2019

DRAFT

Location	Easting	Northing	Ground Level (mOD)	Final Depth (m bgl)	Date Start (dd/mm/yyyy)
TP15	685315.3	783459.4	52.69	2.7	26/03/2019
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TP17	685562.0	783530.0	-	1.7	27/03/2019
TP18	685674.0	783576.0	-	2.0	27/03/2019
TP19	685846.0	783609.4	73.28	2.8	26/03/2019
TP20	686007.5	783686.6	70.67	2.0	26/03/2019
TP21	686090.2	783712.1	68.16	2.5	26/03/2019
TP22	686236.8	783785.5	69.32	2.1	27/03/2019
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TP24	686436.6	783837.3	68.99	2.4	27/03/2019
TP25	686545.7	783883.1	65.19	2.3	27/03/2019
TP26	686585.3	783888.3	62.87	3.1	28/03/2019
TP27	686758.6	783954.1	61.73	2.5	28/03/2019
TP28	686844.1	783997.2	65.22	1.9	27/05/2019
TP29	686951.6	784048.7	63.73	2.1	27/05/2019
TP30	687032.9	784127.6	59.33	1.5	27/05/2019
TP31	687107.1	784178.9	55.27	2.0	27/05/2019
TP32	687222.9	784259.6	53.98	1.7	28/03/2019
TP33	687291.9	784336.9	53.86	1.3	26/03/2019
TP34	687364.7	784431.2	44.54	2.4	28/03/2019
TP35	687461.7	784572.4	42.64	2.8	28/03/2019
TP36	687570.6	784697.2	37.85	3.4	29/03/2019

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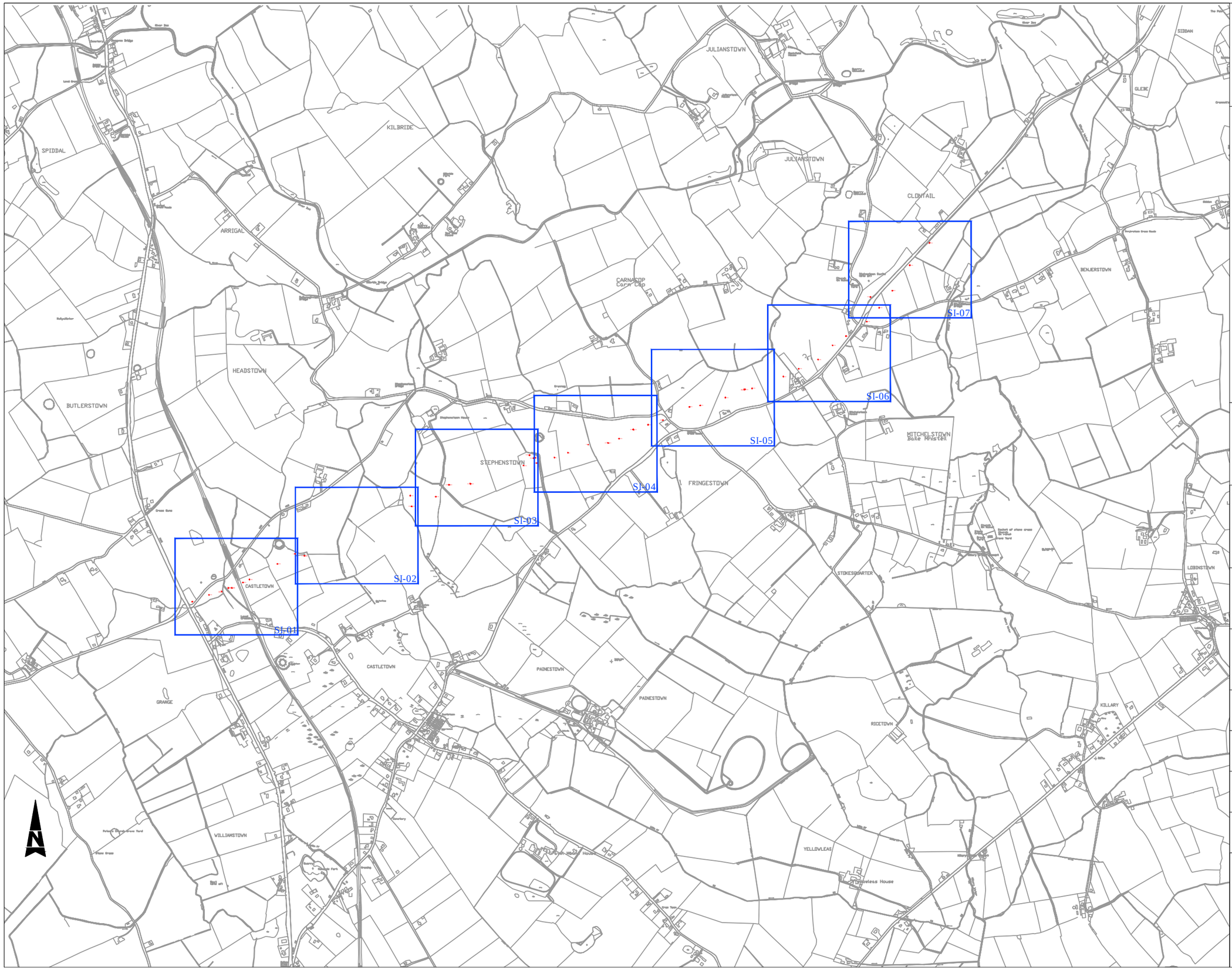

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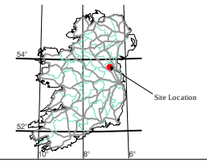

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N52 Grange to Clontail Scheme

Sheet Title:

EXPLORATORY LOCATION LAYOUT

JOB NUMBER:

P19026

DRAWING NUMBER:

P19026-SI-A

DRAWN BY:

Gary Curtin

DATE:

26/09/2019

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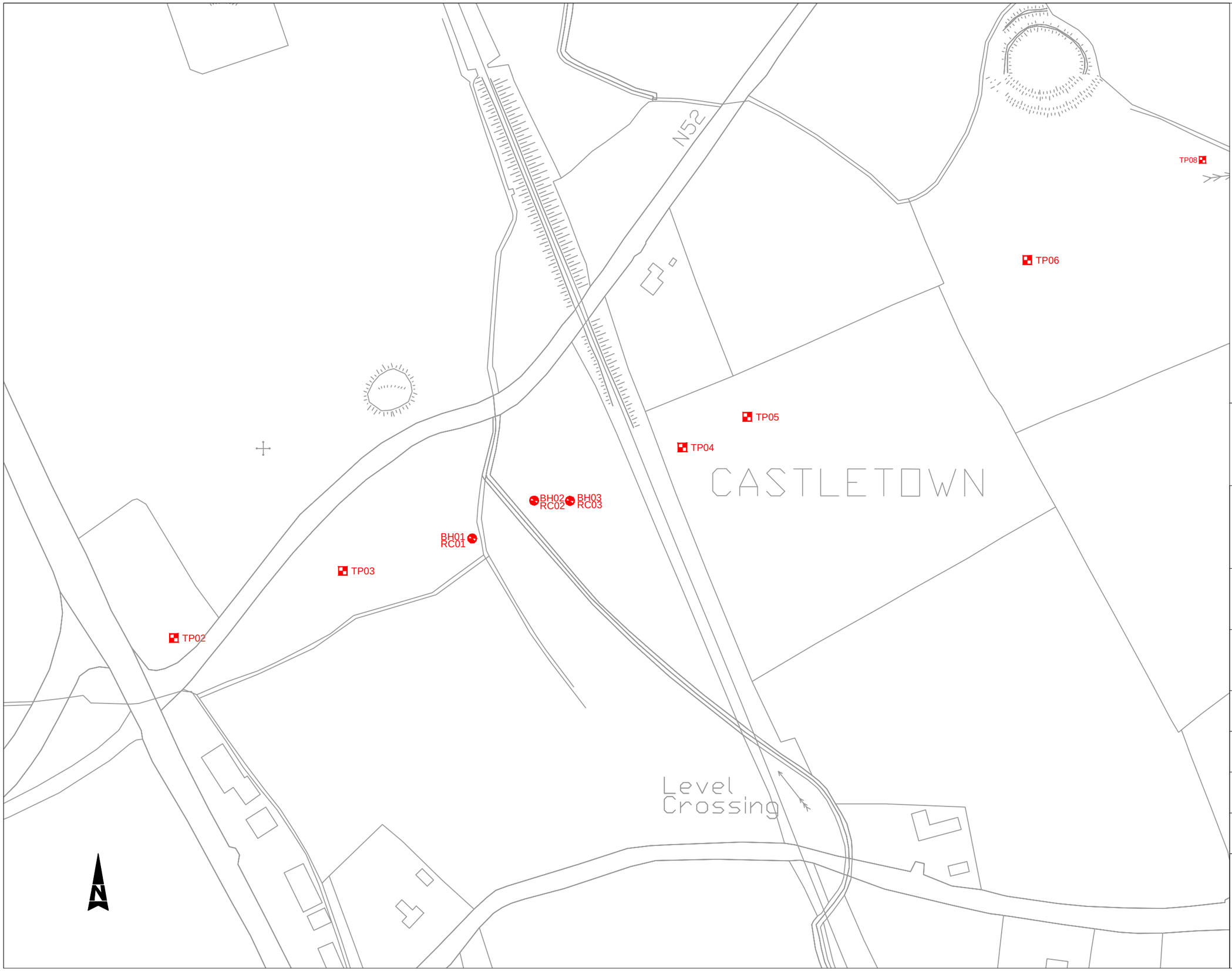

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BH00 Denotes Borehole location

RC00 Denotes Rotary Core location

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N52 Grange to Clontail Scheme

Sheet Title:

EXPLORATION LOCATION PLAN

JOB NUMBER:

P19026

DRAWING NUMBER:

P19026-SI-01

DRAWN BY:

Gary Curtin

DATE:

26/09/2019

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TP00 Denotes Trial Pit location

BH00 Denotes Borehole location

RC00 Denotes Rotary Core location

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N52 Grange to Clontail Scheme

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EXPLORATION LOCATION PLAN

JOB NUMBER:

P19026

DRAWING NUMBER:

P19026-SI-02

DRAWN BY:

Gary Curtin

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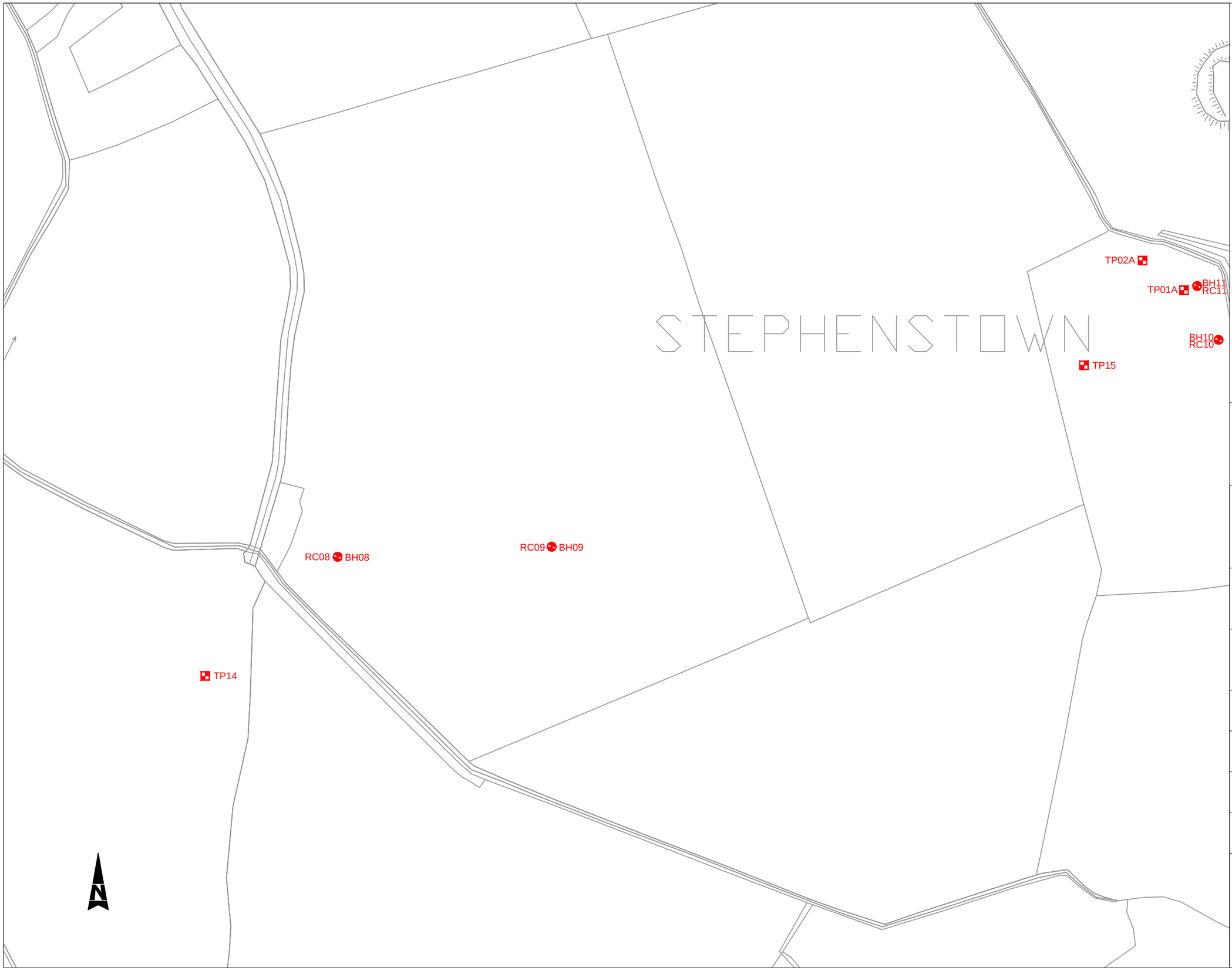

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TP21

TP22

TP23

TP24

BH14
RC14
TP25

TP26

Stokes
Cross Roads

N

KEY:

TP00 Denotes Trial Pit location

BH00 Denotes Borehole location

RC00 Denotes Rotary Core location

JOB NAME:

N52 Grange to Clontail Scheme

Sheet Title:

EXPLORATION LOCATION PLAN

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pgl priority geotechnical

TP33

TP32

TP31

TP30

TP29

TP28

TP27

N

KEY:

TP00 Denotes Trial Pit location

BH00 Denotes Borehole location

RC00 Denotes Rotary Core location

JOB NAME:

N52 Grange to Clontail Scheme

Sheet Title:

EXPLORATION LOCATION PLAN

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DRAWING NUMBER:

P19026-SI-06

DRAWN BY:

Gary Curtin

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26/09/2019

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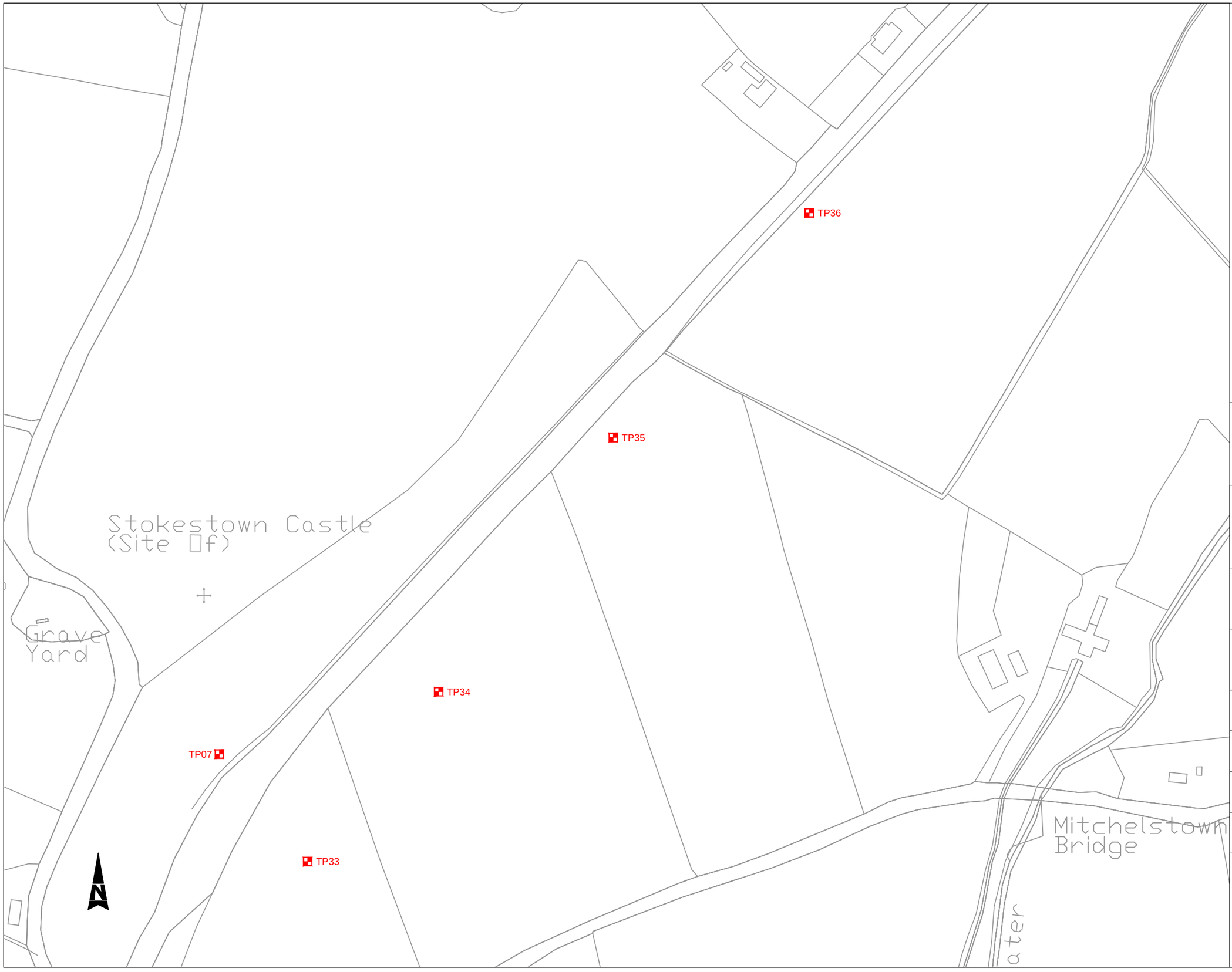

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BH00 Denotes Borehole location

RC00 Denotes Rotary Core location

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DRAWN BY:

Gary Curtin

DATE:

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APPROVED:

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REVISION:

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pgl priority geotechnical

Appendix D. Cultural Heritage Report

Cultural Heritage Impact Assessment for N52 Realignment, Grange to Clontail, County Meath

Prepared for Atkins on behalf of Meath County Council

By William Anderson, Billy Quinn, Declan Moore and Nigel Malcolm

November 2019

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Revision History

Revision Reference	Date Issued	Issued To
N52 Grange to Clontail Assessment	05/11/2019	Draft to client
N52 Grange to Clontail Assessment RevD	27/11/2019	Draft to client for revision
N52 Grange to Clontail Assessment RevE	21/11/2020	Draft to client for review

Contract

This report was commissioned by Atkins on behalf of Meath County Council

Report prepared by **William Anderson, Billy Quinn, Declan Moore and Nigel Malcolm (Archaeological Consultants, Moore Group)**

Report reviewed by **Declan Moore Archaeological Consultant**

Purpose

This report describes the results of a cultural heritage desktop assessment, field survey and archaeological testing of the proposed realignment of the N52 road between Grange and Clontail in County Meath. The results, conclusions and recommendations contained within this report are based on information available at the time of its preparation. Whilst every effort has been made to ensure that all relevant data has been collated, the author and Moore Group accept no responsibility for omissions and/or inconsistencies that may result from information becoming available subsequent to the reports completion. Moore Group accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

Filename: N52 Grange to Clontail Assessment RevE.docx

Non Technical Summary

MOORE GROUP was commissioned to complete a cultural heritage impact assessment of the potential impact of the proposed realignment of the N52 between Grange and Clontail in County Meath. The proposed scheme comprises of a new single carriageway road extending SW-NE from the N52 intersection with the R162 in Grange townland and terminating in Clontail townland to the north of Mitchelstown Bridge. The preferred route for the realignment has a length (maximum west/east along the centre line) of 4.9km and covers a surface area of approximately 28.85 hectares.

This study aims to assess the baseline archaeological, architectural and cultural heritage environment to evaluate the potential or likely impacts that the proposed development will have on this environment and, where appropriate, to suggest mitigation measures to ameliorate potential impacts. Following on from this, the residual impact that the proposed scheme will have on the baseline cultural heritage resource is identified and evaluated. The area examined for this study includes the full extent of the proposed road development as well as the wider area.

The assessment found that the proposed development intersects the Zones of Notification of three archaeological sites recorded in the RMP (ME012-007----, ME012-012---- and ME012-013----). The works will not directly impact on the sites themselves. One of these (ME012-013----), a ringfort/rath in Castletown, is the subject of a Preservation Order (PO no. 11/1970). There is a total of 22 RMP sites located within 1km of the preferred route. Geophysical survey detected a number of potential archaeological features including three subcircular features which were interpreted to be ditched enclosures, an identification confirmed by subsequent archaeological test excavations. Two of these enclosures are entirely within the preferred route, while the most westerly enclosure is just outside, with the nearest verified features located roughly 5m from the boundary of the route.

The assessment found that the proposed development will not directly impact any sites of architectural heritage value which are Protected Structures. There are five Protected Structures within 1km of the preferred route option: the closest is Stephenstown House (RPS No. MH012-110), which stands at 350m distance from the preferred route option). Several local built features will be impacted, including townland/field boundaries, farm tracks and the embankment of the disused Navan and Kingscourt railway.

Geophysical and ground survey identified additional areas of archaeological potential. Three clearly defined subcircular features identified by geophysical survey were investigated using test excavations, which confirmed the presence of archaeological features and deposits at all three locations. A total of 52 recorded sites, anomalies or areas of archaeological potential are identified within and close to the proposed road alignment. Six of these are recorded archaeological monuments which are close to the alignment and will not be directly physically impacted by the development, five others are geophysical anomalies also located outside the alignment; the remaining 41 anomalies or areas of archaeological potential are within the preferred route alignment.

Measures recommended to mitigate the impacts on archaeological sites include excavation, targeted and general test excavation and survey recording. These mitigation measures are summarised in Table 7 and detailed in Section 3 of this report.

Locational information within this report was also organised using the system of field numbering employed for the geophysical survey report (Nicholls 2019). This divides the preferred route option into 21 areas, corresponding with fields, running from west to east (Figure 17).

For ease of reference the locations of all cultural heritage sites noted in this report are depicted in Appendix 5 – A3 Figures.

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Abbreviations

AAP	Area of Archaeological Potential
ACA	Architectural Conservation Areas

ASI	Archaeological Survey of Ireland
DCHG	Department of Culture, Heritage and the Gaeltacht
DLHG	Demesne Landscapes and Historic Gardens
NIAH	National Inventory of Architectural Heritage
NMI	National Museum of Ireland
OSI	Ordnance Survey Ireland
RMP	Record of Monuments and Places
RPS	Record of Protected Structures
SMR	Sites and Monuments Record

Coordinate System

All GPS coordinates given in this report are in Irish Transverse Mercator (ITM).

1 Introduction

MOORE GROUP was commissioned by Atkins on behalf of Meath County Council to complete a cultural heritage impact assessment of the potential impact of the proposed realignment of the N52 between Grange and Clontail in County Meath.

The preferred route option is located on land situated in County Meath approximately halfway between Kells and Ardee, and it is formed by a corridor that runs parallel to the existing N52 national secondary road (Figure 1). The proposed scheme comprises of a new single carriageway road extending SW-NE from the N52 intersection with the R162 in Grange townland and terminating in Clontail townland to the north of Mitchelstown Bridge. The preferred route option has a length (maximum west/east along the centre line) of 4.9km and covers a surface area of approximately 28.85 hectares.

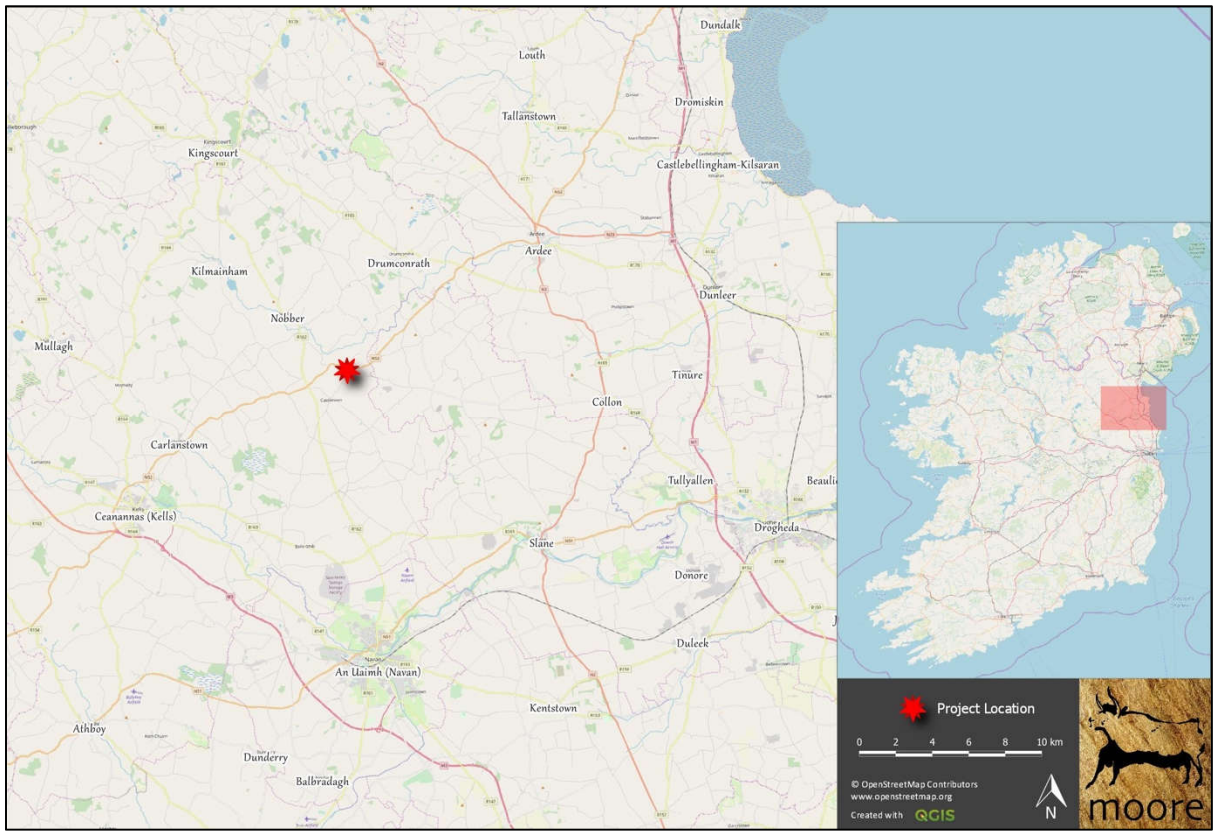

Figure 1: Location of the Proposed Development Area (preferred route option)

1.1 Scope of Work

This study aims to assess the baseline archaeological, architectural and cultural heritage environment (hereafter referred to as cultural heritage environment or cultural heritage resource), to evaluate the potential or likely impacts that the proposed development will have on this environment and, where appropriate, to suggest mitigation measures to ameliorate potential impacts, in accordance with the policies of:

- Department of Culture, Heritage and the Gaeltacht;
- The National Monuments Acts (1930-2014);
- Meath County Development Plan; and

- Best practice guidelines.

Following on from this, the residual impact that the proposed scheme will have on the baseline environment is identified and evaluated.

For the purposes of this report the definition of "cultural heritage" is taken broadly from the UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage, 1972, which considers the following to be "cultural heritage":

- Tangible cultural heritage;
- movable cultural heritage (artefacts);
- immovable cultural heritage (monuments, archaeological sites, etc);
- underwater cultural heritage (shipwrecks, underwater ruins and cities); and
- Intangible cultural heritage (oral traditions, folklore etc).

This impact assessment addresses Cultural Heritage under the two headings of Archaeological Heritage and Architectural Heritage.

1.2 Methodology

The methodology used in the preparation of this assessment is broadly based on guidance provided in the National Roads Authority's (NRA) *Guidelines for the Assessment of Archaeological Heritage Impacts on National Road Schemes* (NRA 2005a), and *Guidelines for the Assessment of Architectural Heritage Impacts on National Road Schemes* (NRA 2005b) (the 'NRA Guidelines'). The specific methodology used for the field survey walkover is detailed below, in section 2.5.

1.2.1 Desktop Assessment

The desktop assessment was undertaken by Will Anderson, updating research by Billy Quinn and Nigel Malcolm for an earlier route selection report which considered four options for the road realignment (Moore Group 2018), and was also informed by the results of geophysical surveys carried out within the preferred route option (Nicholls 2015; Nicholls 2019) as well as a targeted programme of archaeological testing (Excavation Licence Ref. 19E0565 and Detection Licence 19R0198) carried out by Declan Moore in October 2019 (Moore Group 2019).

A buffer zone of 1km, centred on the Route Selection Study Area, was used for the initial mapping and assessment exercise. This was carried out in order to gain a greater understanding of the archaeological and architectural landscape through which the proposed road realignment will traverse, and to highlight concentrations of known archaeological sites and past settlement patterns in order to identify areas of potential archaeological sensitivity. This zone was later redefined in width once the final corridor design had been decided to allow for a detailed and focussed assessment of the potential impacts arising from the construction and operation of the proposed road realignment.

All known cultural heritage sites were reviewed on the Archaeological Survey of Ireland (ASI) along with aerial photography and Ordnance Survey Ireland (OSI) mapping. Sites mapped included the following:

- UNESCO World Heritage Sites including the tentative list of candidate sites;
- National Monuments, be they in the ownership or guardianship of the State, in the ownership of a local authority or monuments under Preservation Orders;

- Record of Monuments & Places (RMP) and Sites and Monuments Record (SMR) from www.archaeology.ie;
- Records of Protected Structures from Meath County Council;
- National Inventory of Architectural Heritage (NIAH) for Co. Meath; and
- Demesnes Landscapes and Historic Gardens indicated on the OSI First Edition Mapping.

All townlands located within or in the immediate vicinity of the preferred route option were listed and crossed referenced with:

- National Monuments in State Care, a list for Co. Meath available from www.archaeology.ie; and
- Preservation Orders, a list available from the National Monuments Service.

The baseline historical research included a search of the British and Irish Archaeological Bibliography (www.biab.ac.uk). The National Library of Irelands catalogue (http://catalogue.nli.ie/) was also consulted. Other sources consulted include the Ordnance Survey Records for the area, www.duchas.ie, www.heritagemaps.ie and a number of local history publications (see References).

The Meath County Development Plan (2013-2019) was also reviewed. The development plan contains lists of cultural heritage sites including national monuments, recorded monuments, architectural conservation areas and protected structures. The plans also outline the county's heritage policies and objectives that aim to protect and promote the archaeological, architectural and cultural heritage of the region. This evaluation was carried out with due regard to these policies and other relevant information contained within the plans.

To assess the potential impact of the proposal the following sources were also consulted or reviewed:

- Excavations Bulletin;
- Topographical files of the National Museum of Ireland;
- Cartographic Sources;
- Toponyms;
- Aerial photographs;
- Published archaeological inventories;
- Data contained in previous assessments undertaken for the proposed road realignment; and including constraints study, route option assessments and geophysical surveys.

1.3 Terms and Definitions

Cultural Heritage

The phrase 'cultural heritage' is a generic term used to identify a multitude of cultural, archaeological and architectural sites and monuments. The term 'cultural heritage' is used throughout this report in relation to archaeological objects, features, monuments and landscapes as well as all structures and buildings which are considered to have historical, archaeological, artistic, engineering, scientific, social or technical significance/merit.

Record of Monuments and Places

A feature recorded in the 'Record of Monuments and Places' (RMP) refers to a recorded archaeological site that is granted statutory protection under the National Monuments Act 1930-2014. The RMP is the

most widely applying provision of the National Monuments Act, as amended. It comprises a list of recorded monuments and places (resulting from the Archaeological Survey of Ireland [ASI]) and accompanying maps on which such monuments and places are shown for each county. The information contained within the RMP is derived from the earlier non-statutory Sites and Monuments Record (SMR). However, some entries were not transferred to the statutory record as they refer to features that, on inspection by the Archaeological Survey, were found not to merit inclusion in that record or could not be located with sufficient accuracy to be included. Such sites however remain part of the SMR. The Record of Monuments and Places is a static record which has not been updated since its initial mapping and inventories were completed.

Sites and Monuments Record

The Sites and Monuments Record (SMR) is an inventory of the known archaeological monuments in the State. There are more than 150,800 records in the database and over 138,800 of these relate to archaeological monuments. The SMR is a dynamic record which is regularly updated with more up-to-date information and is made available by the National Monuments Service as the Archaeological Survey Database (ASD) on their website www.archaeology.ie. Paper and digital files relating to each site are held by the SMR Archive Unit in Dublin.

The latest mapping made available on the National Monument Service website (www.archaeology.ie) includes zones of notification which may be different than those contained in the RMP, for the purposes of this report these are referred to as SMR zones of notification. The zones do not define the exact extent of the monuments but rather are intended to identify them for the purposes of notification under Section 12 of the National Monuments Act (1930-2004): each is referred to as a "zone of notification".

Archaeological monuments are registered by the National Monuments Service (NMS) using a unique Sites and Monuments Record (SMR) number which is used to reference these sites in this report.

Register of Historic Monuments

Section 5 of the 1987 National Monuments Act states that the Minister is required to establish and maintain a Register of Historic Monuments. Historic monuments and archaeological areas present on the register are afforded statutory protection under the 1987 Act. Any interference with sites recorded in the Register without the permission of the Minister is illegal, and two months' notice in writing is required prior to any work being undertaken on or in the vicinity of a registered monument. This list was largely replaced by the Record of Monuments and Places following the 1994 Amendment Act.

Preservation Order

A Preservation Order is made by the Minister when a monument meets the definition of 'national monument' and when that monument is under threat; a preservation order means that any interference must have the consent of the Minister (Kirwan 2003, 7-8). Section 8 of the 1930 National Monuments Act states that 'Where it appears to the Minister, on a report made by the Advisory Council or otherwise, that a monument which in his opinion is a national monument is in danger of being or is actually being destroyed, injured, or removed, or is falling into decay through neglect, the Minister may by order […] entrust the preservation of such monument to the Commissioners'.

1.4 Meath County Development Plan 2013-2019

The relevant policies and objectives for Archaeological, Architectural and Cultural Heritage management for Meath were reviewed.

These policies and objectives are outlined in Chapter 9, Section 9.6 of the County Development Plan.

The relevant policies are appended herein in section Appendix 3.d of this report.

1.5 Description of Project

The proposed development is for the construction of a road to realign the current N52 national secondary road between Grange and Clontail in County Meath. The proposed scheme comprises of a new single carriageway road extending SW-NE from the N52 intersection with the R162 in Grange townland and terminating in Clontail townland to the north of Mitchelstown Bridge (Figure 1, Figure 2).

Figure 2: Extent of the preferred route option

2 Existing Environment

2.1 Location Details

The N52 Grange to Clontail Realignment scheme is situated approximately halfway between Kells and Ardee in the north of County Meath (see Table 1 for details on the location). The proposed corridor of land, with junction off-shoots, runs parallel to the existing N52. Its western end is at Cassidy's Cross and the north/south aligned R162. From here it runs along an east-northeast alignment to the south of the present N52, across the disused Navan and Kingscourt railway line and then over open farmland to Stokes Crossroads. From here, the alignment runs north of the N52, veering to the northeast as it approaches Clontail.

Table 1: Location details

County	Meath
Barony	Morgallion (Machaire Gaileang) and Slane Lower
Parishes	Castletown and Mitchelstown
Street/Road	N52
Townlands	Grange, Castletown (Morgallion By.), Stephenstown, Fringestown, Mitchelstown (Slane Lower By.), Clontail
Locations	Parallel to the existing N52 from its junction with the R162 in the west to Clontail in the east. Crossing mainly undeveloped land (greenfield), including a mixture of arable and pastoral farmland.
OS Sheet number (s)	12
Archaeological Monuments	None yet recorded within the preferred route option; the preferred route option intersects the Zone of Notification for three sites (ME012-007----, ME012-012---- and ME012-013----).
Architectural Sites	None as listed by the National Inventory of Architectural Heritage (NIAH) within the preferred route option. Four Protected Structures are within 1km of the preferred route option. The nearest is Stephenstown House (RPS No. MH012-110--), 350m to the north. Local, built features likely to be impacted include townland and field boundaries, trackways and a section of the embankment of the Navan and Kingscourt railway line.
ITM	Centred on E 685342, N 783453

2.2 Archaeological, Architectural and Historical Background

2.2.1 General Introduction

The subject area is located approximately halfway between Kells and Ardee centred on Stokes Crossroads either side of the existing N52 in County Meath. Topographically the area is characterised by low drumlins ranging from elevations of 50m to 80m with stream corridors draining into the River Dee to the north and the Killary Water to the east. The landscape is a mixture of arable and pastoral fields bounded by mature hedgerows and drainage ditches. Many of the fields have been enlarged by the removal of traditional boundaries and replaced with post and wire fences. The land is interspersed with small patches of woodland and areas of scrubby fen on low lying, more marginal ground. Due to the undulating terrain the agricultural landscape is characterised by an irregular patchwork of fields of varying sizes scattered with farmsteads, some 18/19th century in origin, located along a complex of roads including national, regional and local access routes. There is also evidence of small-scale quarrying on gravel ridges.

The route alignment from west to east crosses six townlands: Grange, Castletown Stephenstown, Fringestown, Mitchelstown and Clontail, within two civil parishes – Castletown and Mitchelstown – and two baronies: Morgallion and Slane Lower. The name Morgallian is an ancient one and refers to a tribe called the Gaileanga Mora meaning "the plain of the Gailenga". The Gailenga kingdom in Brega was concentrated north of the Blackwater and Boyne Rivers. Following the Cambro Norman invasion, Henry II granted the Lordship of Meath to Hugh de Lacy. To effectively control his newly acquired property, de Lacy gave land grants to his chief followers, and the territory of the Gaileanga-Mora went to Gilbert de Angulo. The caput of the barony was at Nobber where a borough was established, and a motte built (ME005-070---). In later years the d'Angellos fell out of favour with Prince John and the manor of Nobber was returned to the younger Hugh de Lacy in c. 1200. Slane is long associated with the Fleming family. Archembald Fleming arrived in Ireland with Henry II in 1171 and participated in Hugh de Lacy's plantation of the Kingdom of Mide. The Flemings later took from their principal seat the name Lords of Slane. On a local level Stephenstown, site of a long since removed castle, was according to the Calendar to Fiants of the reign of Henry VIII in the ownership of the Thomas Flemyng.

Based on historic mapping, more recent aerial imagery and existing inventories, the archaeology of the area is most prominently represented by early medieval remains, with several earthen ringforts/raths occupying drumlin slopes. These sites functioned as enclosed farmsteads and their presence in the area indicates a well settled agricultural community based on cereal growing and animal husbandry. Many of these sites were indicated by circular, hachured enclosures marked as 'forts' on the first edition Ordnance Survey maps drawn up between 1829 and 1842. These forts include examples at Castletown (ME012-013---, ME012-014---) and Stephenstown (ME012-004---).

Notable Medieval sites include a motte and bailey at Castletown (ME012-015---) and the former site of Stokestown Castle in Clontail (ME012-008---). Motte and baileys were an early type of castle consisting of a flat-topped, steep-sided, earthen mound enclosed by a bank and fosse. They were constructed by the Anglo-Normans in the late 12th and early 13th century AD. The castle of Stokestown was originally recorded in the Down Survey (1654-6) and was named after the local landowner John Stokes. The Down Survey also indicates the presence of a castle in Stephenstown of which no trace survives

The area's ecclesiastical heritage is represented by the remains of two Medieval churches, one known originally as Kilpatrick (SMR No's ME012-016---, ME012-016004---, RPS No. MH012-107) in Castletown (rebuilt in 1820) and the 14th century parish church of Mitchelstown in Clontail (ME012-007-& ME012-007001-). The present Saint Patrick's Church of Ireland (RPS No. MH012-107), in ruins, is of standard Board of First Fruits form with bell tower and nave. Evidence of its earlier past can be seen in an incised Latin cross-slab in the graveyard and 15th century fabric including a female effigy incorporated into the existing structure. The Parish Church of St. Nicholas at Clontail is first recorded in the early 14th century in ecclesiastical taxation rolls of Pope Nicholas IV. The church is later recorded as a roofless ruin in the Down Survey.

Following the wars of the 17th century, resulting in the large-scale dispossession of Catholic holdings the Protestant ascendancy class started to consolidate their estates by building country houses in stone walled demesnes. These properties characteristically had gate lodges, out buildings, stables, tree-lined avenues, formal ornamental woods, walled gardens and terraces. Within the vicinity of the proposed scheme is a typical example of a country house and estate – Stephenstown House (NIAH Reg. No. 1440120) dated 1780 – 1820. This house with adjoining stables survives as a ruined three-bay three-storey house, within the demesne is a designed tree ring, a garden and a bridal path leading to single story cottages and a voussoired bridge. Other named houses recorded on historic mapping include the former Glebe House (Castletown since demolished) and the associated cottage and schoolhouse (NIAH- Reg. No. 14310006).

Unrecorded sites of heritage value in the immediate surroundings of the corridor are St Patrick's well in Castletown and Tobarnaveenoy in Stephenstown. In addition, Niall Roycroft (TII Archaeologist) identified a hollow at Stephenstown, 65m to the south west of a high status raised ringfort (ME012-004—) in a field known as Moat/Fort Field in the Meath Field names Project. This hollow was investigated during geotechnical testing in May 2019 (discussed below, in section 2.3.11.4).

In more modern times folkloric sources identified by Roycroft record 'Croppy Burials' associated with the 1798 rebellion in a field in Headstown north of the route corridor and in Raffin to the west of the scheme.

Farming continued to determine the general appearance of the area's-built environment into the 19th century. The dominant system of enclosure encountered along the proposed road development consists of 18th and 19th century rectilinear field and hedgerow. Sections of dry-stone walls were also noted and revetting ditches and drains, particularly in Stephenstown and Castletown.

One of the most important infrastructural developments to impact the subject area was the coming of the Navan and Kingscourt Railway developed in 1865 and opened on 1st November, 1875. The line was bought out in 1888 by the Midland and Great Western Railway. Passenger services were suspended in 1947 but the railway continued to operate largely transporting gypsum until its closure in 2002. The track survives as an embankment with a bridge (dismantled) and limestone abutments along the N52 and at the remains of a level crossing in Castletown. The PDA intersects an approximately 40m width section of the embankment to the south of the former bridge. Cavan County Council published a planning notice in 2013 proposing to construct a shared pedestrian and cycle greenway along the disused railway.

As detailed in the following sections, a number of potential archaeological sites have been detected in the more recent geophysical survey and subsequent testing.

2.3 Archaeological Heritage

2.3.1 World Heritage Sites

Although not formally recognised in Irish legislation, impacts on World Heritage Sites will nonetheless be a material consideration for developments in their wider vicinity.

There are no World Heritage Sites within 10km of the study area; The nearest UNESCO World Heritage Site is Brú na Bóinne located approximately 17km to the south east. The nearest candidate site that appears on the Tentative List is the Early Medieval Monastic site of Kells, 10.7km to the south west.

2.3.2 National Monuments in State Care, Guardianship or under Protection Order

On a national level, the highest degree of protection granted to archaeological monuments are those afforded National Monument status, which are protected under the National Monuments Act of 1930 and its various amendments. These sites fall into several categories and many are the pre-eminent sites in Ireland. These sites include:

- Sites that are in the ownership or guardianship of the State;
- Monuments that are the subject of Preservation Orders;
- Monuments in the ownership of a local authority that are of National Importance; and
- Walled towns.

Generally National Monuments in state care are numbered amongst the best preserved and most impressive monuments in the country.

There are no National Monuments in State Care within or in the vicinity of the proposed road realignment. The nearest is Cruicetown Church and Cross (National Monument No. 264; RMP no's ME011-004---- and ME011-094004---), which is located on a hill approximately 3.9km to the north west of the study area, where it is has commanding views to the north and west, away from the project.

2.3.3 Other National Monuments

Afforded the same level of protection as National Monuments in State care are archaeological monuments that are the subject of Preservation Orders, Walled Towns and archaeological monuments that are in the ownership of a local authority that are of National Importance.

There are two sites in the vicinity of the route alignment that are the subject of Preservation Orders. One is a rath in Castletown (PO no. 11/1970, ME012-013----) located to the immediate north of and adjacent to the existing N52 and is 38m from the road corridor. The other is Raffin Enclosure (ME011-040----) approximately 1km to the west of the scheme.

There are two churches with associated graveyards that are located near the scheme: the now derelict Saint Patrick's Church of Ireland Church, (ME012-016 and ME012-016001-) perched on a hill in Castletown 520m south of the route. Closer to the scheme (40m from a side road tie-in and 100m from the mainline) near its eastern end are the ruins of Clontail Church and graveyard (ME012-007 and ME012-007001-); this was the former medieval parish church of Mitchelstown Parish. A review of the Meath Graveyard survey indicates that St. Patrick's Church is in the ownership of the Church Representative Body and the Clontail Church is the ownership of Meath County Council.

2.3.4 Archaeological Monuments

The legislation that affords protection to the archaeology of Ireland has seen several amendments since the first National Monuments Act of 1930 and there is a legacy of several different registers and associated terminology. The following sections contain information relating to the Register of Historic Monuments (RHM), the Record of Monuments and Places (RMP) and the Archaeological Survey Database (ASD).

2.3.5 Register of Historic Monuments

The Register of Historic Monuments was created in response to the 1987 amendment to the National Monuments Act. The Register consists of a list of archaeological monuments where, as part of the registration process, the owner of the monument must be notified in writing by registered post or by hand.

There is a single site listed in the Register of Historic Monuments located within the wider area, classified as an earthwork and souterrain (RHM No. MG1705, RMP No. ME012-006----), located approximately 570m to the north of Stokes Cross.

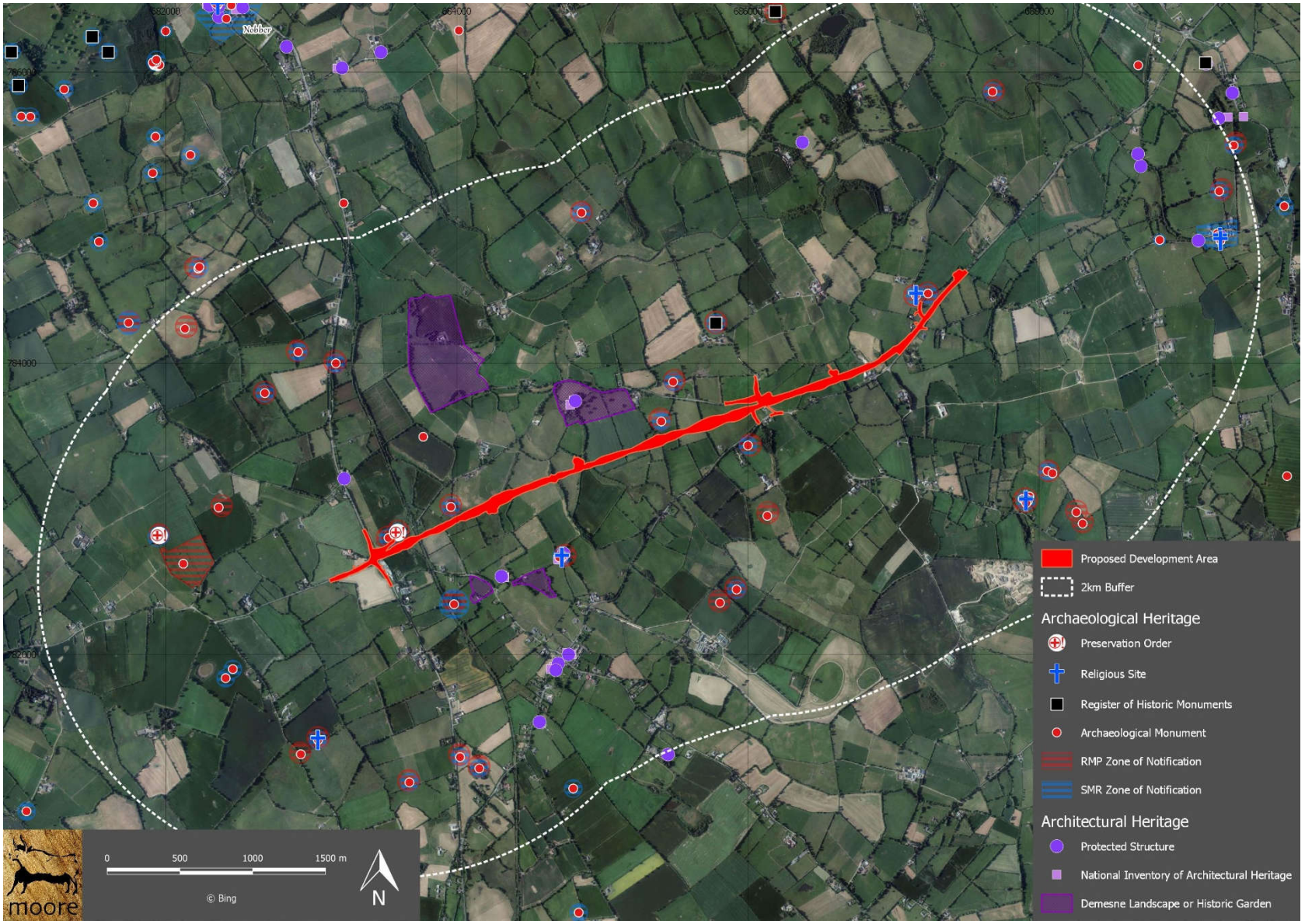

Figure 3: Archaeological and architectural heritage recorded in the surroundings of the preferred route option

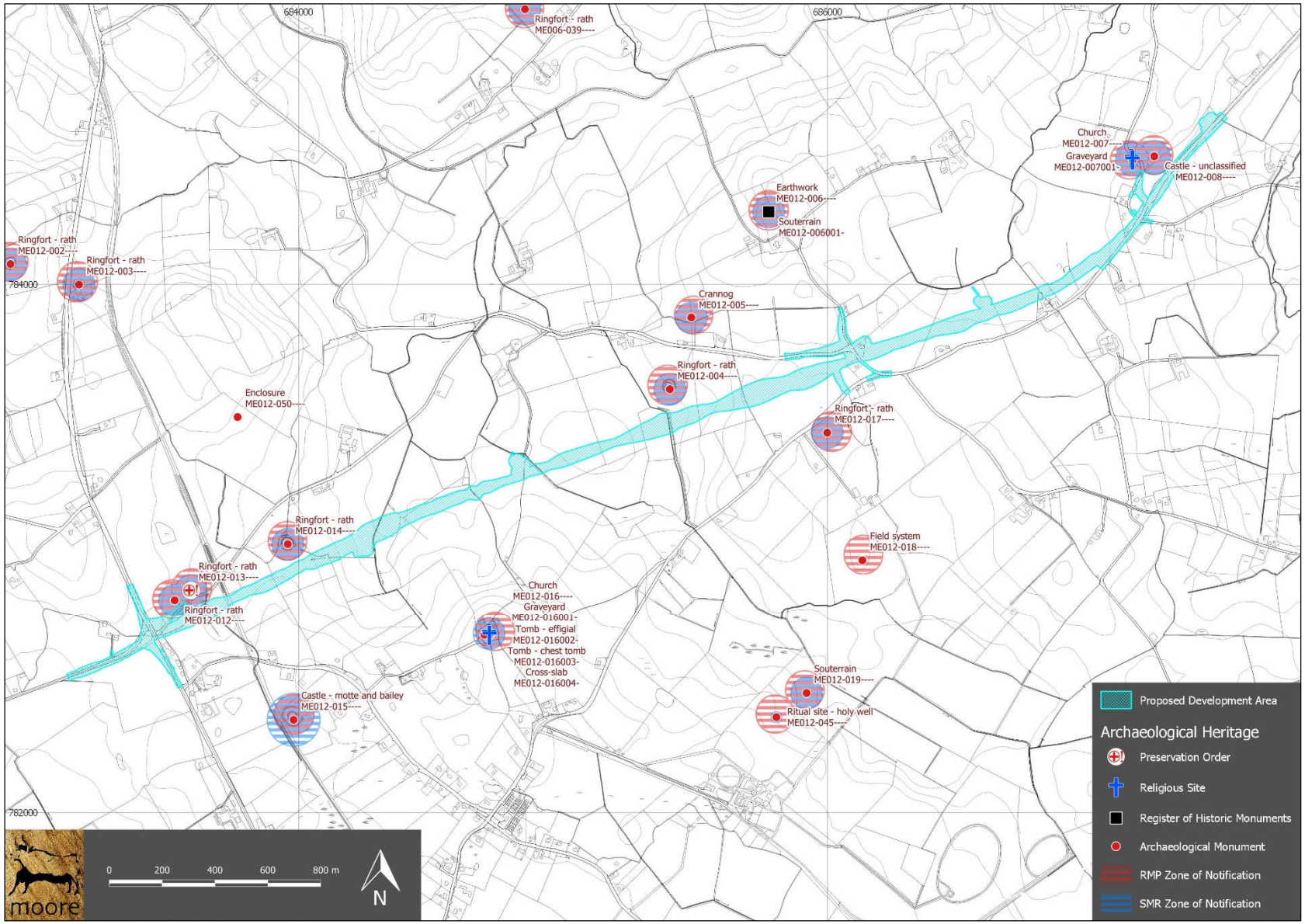

Figure 4: Archaeological sites recorded in the surroundings of the preferred route option

2.3.6 Record of Monuments and Places (RMP)

The Record of Monuments and Places (RMP) comprises a list of recorded monuments and places and accompanying maps on which such monuments and places are shown for each county. The most up-to-date record of archaeological monuments, the Archaeological Survey Database (ASD), is available for viewing and download on the www.archaeology.ie website (see also section 2.3.7. below).

2.3.7 Archaeological Survey Database

The Archaeological Survey Database (ASD) is available for viewing and download on the www.archaeology.ie website. The National Monuments Service also makes available SMR Zones of Notification on the website.

There are 22 archaeological monuments listed in the ASD that are located within 1km of the proposed development (Table 2); six of these monuments are within 100m. Several of these monuments are components of the same site (e.g. churches with associated graveyards and monuments), the number of sites within 1km of the PDA is 16, three of which comprise more than one monument.

There are no recorded archaeological monuments located within the preferred route option, however, the preferred route option boundary crosses into the Zone of Notification (ZoN) of three RMP sites. Distances were calculated between the preferred route option boundary and recorded RMP sites: distances indicated in the right-hand column of Table 2 are from the point data, made available in the ASD except in cases where the boundary of the site is well defined on maps or plans (e.g. the boundary of a graveyard or edge of earthworks), where the measurement is made from there rather than the point.

Table 2: SMRs within 1km of the Proposed Development Area

SMR No	Class	Townland	ITM (E)	ITM (N)	Distance/direction from preferred route option
ME011-041----	Ringfort - rath	Raffin	682364	783013	900m NW
ME011-042----	Field system	Raffin	682121	782628	800m W
ME011-052001-	Enclosure	Clooney	682461	781901	900m SW
ME011-052002-	Enclosure	Clooney	682412	781839	975m SW
ME012-004----	Ringfort - rath	Stephenstown	685404	783602	89m N
ME012-005----	Crannog	Carnacop	685485	783873	320m N
ME012-006----	Earthwork	Carnacop	685778	784274	446m N
ME012-006001-	Souterrain	Carnacop	685778	784274	446m N
ME012-007----	Church	Clontail	687150	784475	53m N
ME012-007001-	Graveyard	Clontail	687154	784469	31m N
ME012-008----	Castle - unclassified	Clontail	687236	784483	69m
ME012-012----	Ringfort - rath	Castletown (Morgallion By.)	683531	782805	28m N
ME012-013----	Ringfort - rath	Castletown (Morgallion By.)	683599	782837	38m N

SMR No	Class	Townland	ITM (E)	ITM (N)	Distance/direction from preferred route option
ME012-014----	Ringfort - rath	Castletown (Morgallion By.)	683959	783017	51m N
ME012-015----	Castle - motte and bailey	Castletown (Morgallion By.)	683981	782351	390m SE
ME012-016----	Church	Castletown (Morgallion By.)	684720	782677	520m S
ME012-016001-	Graveyard	Castletown (Morgallion By.)	684722	782670	498m S
ME012-016002-	Tomb - effigial	Castletown (Morgallion By.)	684726	782679	500m S
ME012-016003-	Tomb - chest tomb	Castletown (Morgallion By.)	684711	782674	520m S
ME012-016004-	Cross-slab	Castletown (Morgallion By.)	684703	782672	496m SE
ME012-017----	Ringfort - rath	Fringestown	685999	783438	160m S
ME012-018----	Field system	Fringestown	686132	782956	628m S

The 22 RMP entries for sites located within 1km of the PDA consist of six ringforts/raths (ME011-041----, ME012-004----, ME012-012----, ME012-013----, ME012-014---- and ME012-017----), two enclosures (ME011-052001- and ME011-052002-) (Figure 5), two field systems (ME011-042---- and ME012-018----), a crannog (ME012-005----) and earthwork (ME012-006----) with associated souterrain (ME012-006001-) at Carnacop, the church (ME012-007----) and graveyard (ME012-007001-) at Clontail, a castle (ME012-008----) at Clontail which is labelled 'Stokestown Castle' on historic maps, a motte and bailey castle (ME012-015----) at Castletown and the medieval parish church of Kilpatrick (ME012-016----), now called Castletown Kilpatrick, with associated graveyard (ME012-016001-), as well as an effegial tomb (ME012-016002-) (Figure 6), a chest tomb (ME012-016003-) (Figure 7) and a cross slab (ME012-016004-) (Figure 8).

Overall, the nature of these sites indicate the area as supporting substantial early medieval and medieval occupation. This is reflected in the concentration of raths, which fieldwork for the present development has supported through the identification, through geophysics and test excavation, of another three circular enclosures that do not have any above-ground expression. Fewer pre-medieval monuments have been recorded, but evidence of long-term, prehistoric occupation in the wider area is found further to the west, at Raffin Fort (discussed below, Section 2.3.11).

Figure 5: Google Earth image of cropmarks indicating two enclosures - ME011-052001--- and ME011-052002--- (National Monuments Service)

Figure 6: Tomb - effigial ME012-016002---

Figure 7: Tomb - chest tomb ME012-016003---

Figure 8: Cross slab ME012-016004---

2.3.8 Cartographic Research

Analysis of historic mapping shows how the landscape has changed over time. The comparison of subsequent versions of historic maps can show how some landscape features have been created, altered or removed over a period of time. Sometimes features that appear on these early maps are found to be of potential archaeological significance during fieldwork. For this study the following historic maps were consulted:

- Down Survey 1654 -1656
- Taylor and Skinner maps 1777
- A map of the County of Meath, by William Larkin 1812
- First edition Ordnance Survey 6" Maps circa 1830; and
- Third edition Ordnance Survey 25" Maps circa 1900

Down Survey Map (c. 1656)

A review of the available cartographic sources for the subject area, begins with the Petty's Down Survey, so called because a chain was laid down and a scale made. The survey was undertaken from 1656-8 under the direction of William Petty. Using the earlier Civil Survey as a guide, teams of surveyors, mainly former soldiers, were sent out to measure every townland to be forfeited to soldiers and adventurers post the Cromwellian Wars. The resulting maps, made at a scale of 40 perches to one inch (the modern equivalent of 1:50,000) were the first systematic mapping of a large area on such a scale attempted anywhere. The primary purpose of these was to record the boundaries of each townland and to calculate their areas with great precision. The maps are also rich in other detail showing churches, roads, rivers, castles, houses and fortifications.

Note: There are no Parish Scale Maps for the subject area.

The road realignment lies largely in Morgallion Barony, with the two of the easternmost townlands in Slane Lower. Notable features depicted include a castle (ME012-015---) and church (ME012-016---) in Castletownkilpatrick, a fortified house in Stephenstown, probably on the site of the existing house, and the Church and Castle in Clontail (ME012-007--- & ME012-008---) (Figure 10).

Figure 9: Down Survey County map showing area of proposed road realignment

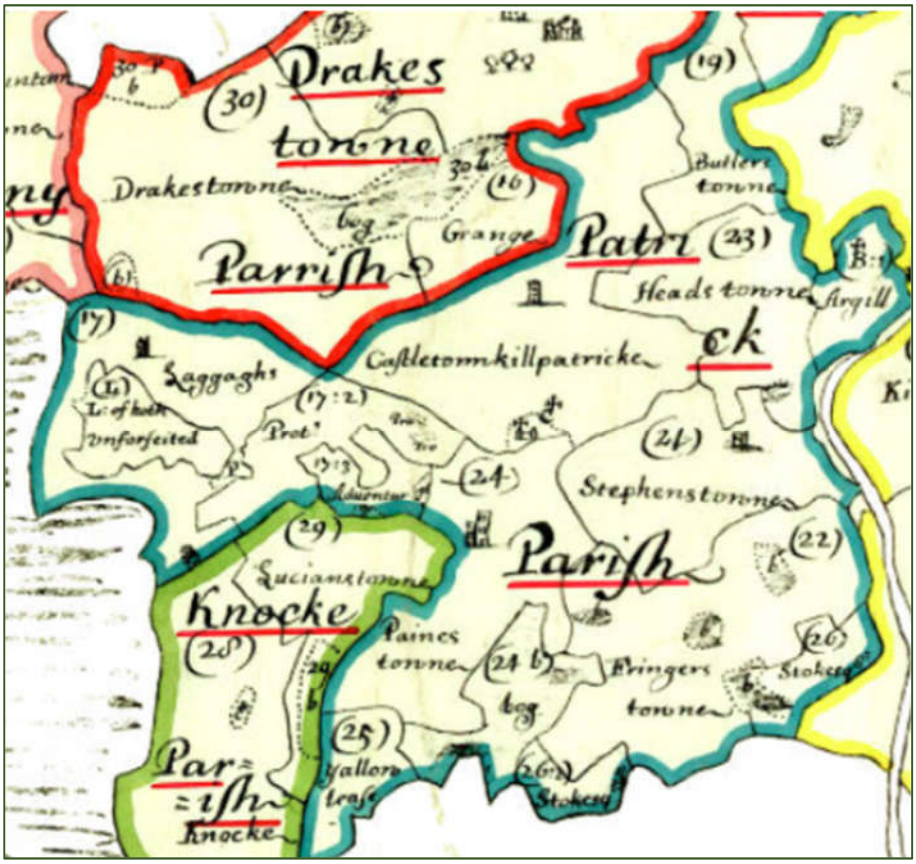

Figure 10: Barony Map of Morgallion showing from top to bottom, Grange, Castletown, Stephenstown and Fringestown.

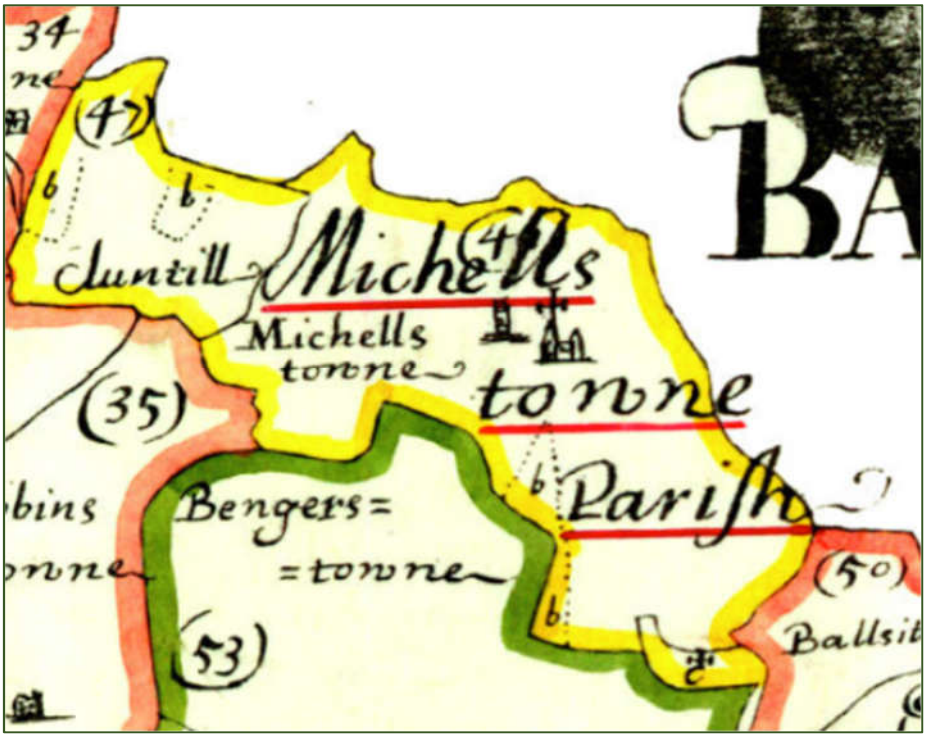

Figure 11: Mitchelstown and Clontail showing Church and Stokestown castle.

Taylor and Skinner's Maps of the Roads of Ireland surveyed 1777 and published 1778

George Taylor and Andrew Skinner were surveyors who received funding from Ireland's noblemen and gentlemen in order to map the roads of Ireland. They began their survey in February 1777 and completed it by the end of the year. This book of maps shows the 18th century road network and major houses and places of interest.

Map 260 in the original folio (Figure 12) shows the route from Dundalk to Kells showing Benjerstown, Stephenstown and Castletown. The inclusion of Stephenstown House on this map reflects its importance as a principal seat in the local area. No additional unrecorded features were noted.

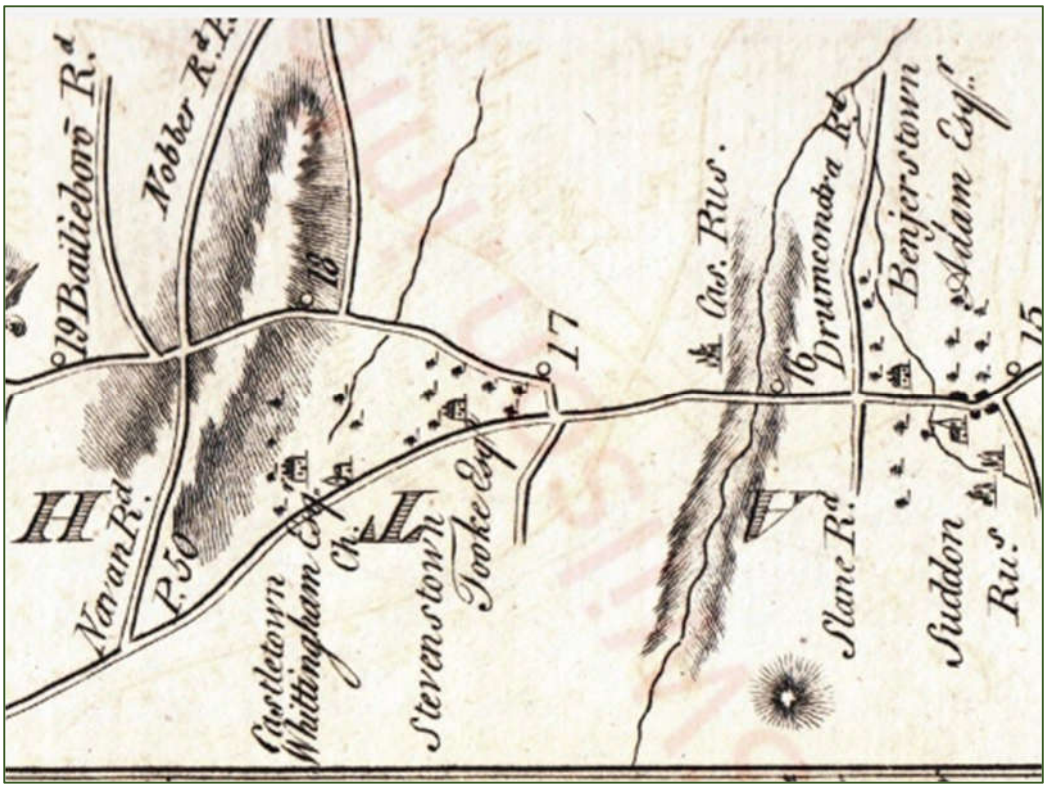

Figure 12: Extract from Map 260 showing 'Stevenstown' and Castletown.

A map of the County of Meath, by William Larkin 1812

Grand Juries were established in the eighteenth century to determine whether there was a good case for a criminal prosecution to take place. Later they took over many of the functions now carried out by local authorities. The panel for the Grand Jury was selected by the sheriff from the major ratepayers and numbered between twelve and twenty-three men with twelve men having to reach agreement.

Bridge building, road maintenance, and the building of fever hospitals were some of the duties carried out by Grand Juries. The poor law unions took over most of these functions in 1840 and county councils took over any remaining fiscal and administrative functions after the Local Government Act of 1898. Responsibilities included the maintenance of militia lists, shire courts, provision and upkeep of roads and bridges, asylums, building and maintaining public buildings, infirmaries and hospitals, industrial schools, famine relief works and much more. A number of county maps were commissioned by Grand Juries between 1760-1820; the Meath maps Surveyed by William Larkin were published in June 4th, 1817 on a scale of two inches to one mile.

The subject area is featured in Sheet 1 (mid north) and notated features are Headstown, Castletown, Stephanstown, Stokes Cross, Mitchelstown and Benjerstown (Figure 13). The road west of Stephanstown house is shown in its original alignment running towards Cross Guns. Dots, indicating houses are dispersed along the route. The undulating topography of the area is shown in hachures. There are no additional features noted.

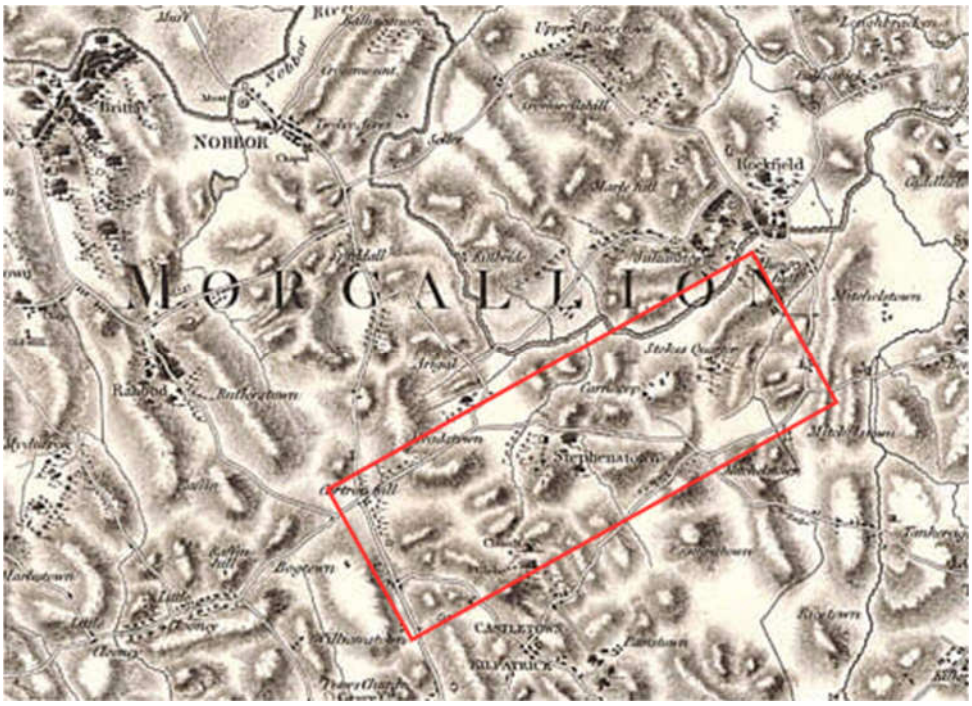

Figure 13: Extract from Larkin's map showing general area.

1st edition six-inch Ordnance Survey (OS) 1837-1838 and later editions

As shown on the first edition 6" map, the western end of the roadway now called the N52 did not follow the same alignment as exists at present. The original road ran in an arc from Cross Guns some 500m to the north, through Headstown townland connecting with the N52 road at Stephenstown Bridge. The present alignment is shown on later editions and was probably built as a civil scheme during/post the famine to provide relief and employment to the local community. From Stevenstown through Stokes Cross to Clontail the N52 follows the 1830s route.

Within the study area there are a number of features indicated on the historical OS maps of archaeological significance. Several raths shown as circular, hachured enclosures labelled 'Forts' are now recorded on the RMP (Figure 14). These sites include the pair directly north of the scheme at its western end (ME012-012--- and ME012-013---), the bi-vallate example in Castletown (ME012-014---) and the raised ringfort in Stephenstown (ME012-004---).

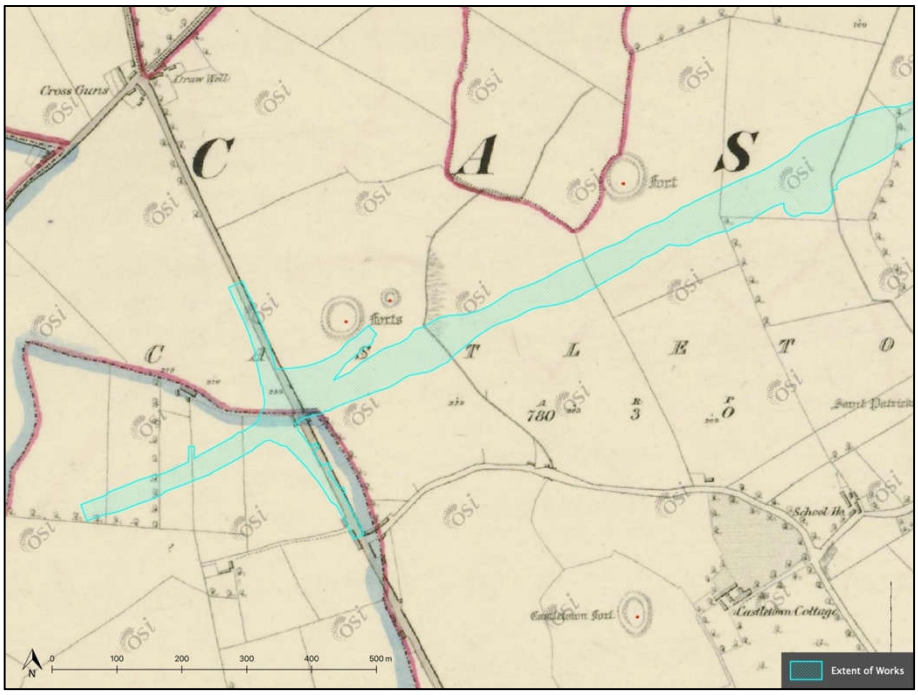

Figure 14: Detail from OS 6" first edition map showing 'forts' (ME012-012--- and ME012-013---) north of the preferred route option

Other significant features include Stephenstown House and Demesne and the Medieval parish church and graveyard in Clontail (ME012-007--- & ME012-007001--- and the nearby Castle (ME012-008---). On the first edition map, the graveyard, church and 'Stokestown Castle' are shown and labelled (Figure 15); on the third edition map, these labels are given qualifiers: the church is now labelled '(in ruins)' and the castle as '(site of)' (Figure 16).

Topographic and cultural features of interest also include the location of springs (especially shown on the third edition map), place names (such as Stokes Cross Roads, labelled on both historic maps) and the position of field boundaries. Interestingly, there has been very little alteration to the divisions of fields since those shown in the 1830s map into the modern day. Some subdivision is evident from the c.1900 map and recent aerial photographs, but on the whole the large, rectilinear field divisions are unchanged over the last two centuries.

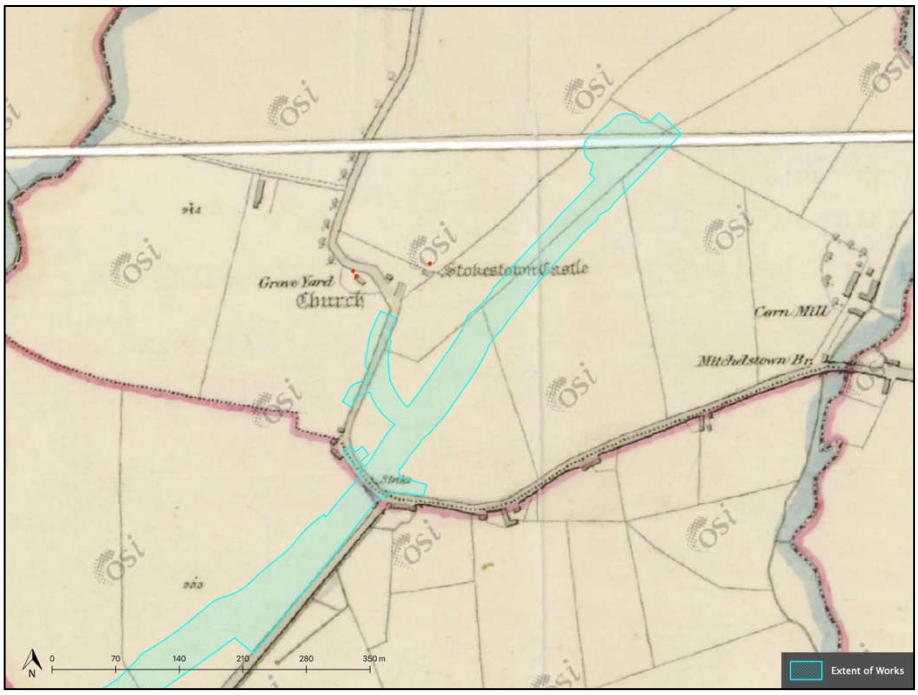

Figure 15: Detail from OS 6" fist edition map showing sites in Clontail townland, north of the preferred route option

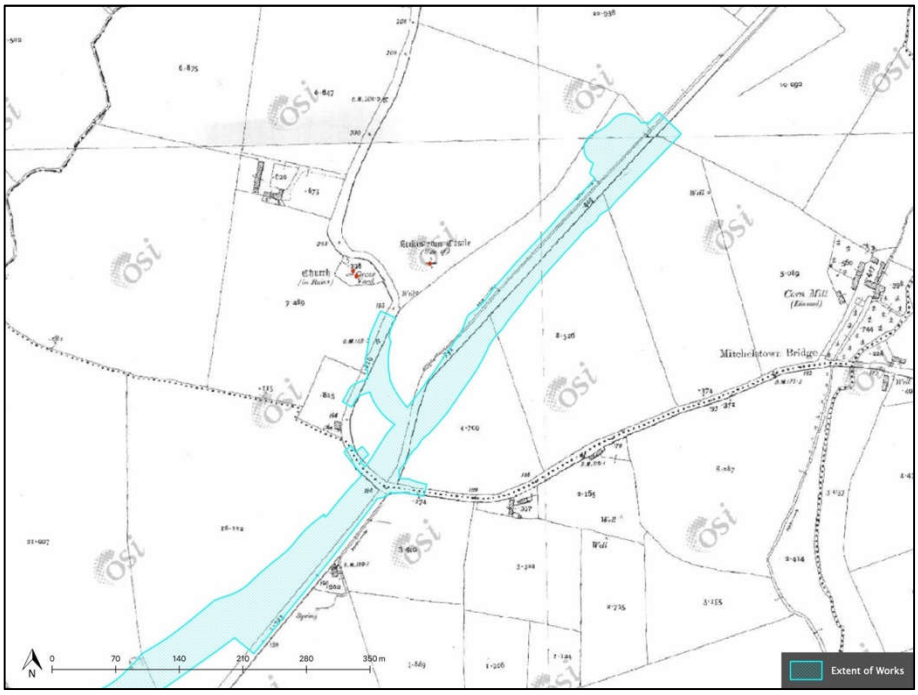

Figure 16: Detail from OS 25" third edition map showing sites in Clontail townland, north of the preferred route option

2.3.9 Aerial Photography

The usefulness of aerial photography is that it allows for a different perspective - 'the distant view'. Archaeological sites may show up on the ground surface, depending on their state of preservation, by light and shadow contrasts (shadow marks), tonal differences in the soil (soil marks) or differences in

height and colour of the cultivated cereal (crop marks). It is also a useful aid in pinpointing existing features and can assist in ascertaining their extent and degree of preservation.

The utility of aerial photography for archaeological 'remote sensing' is demonstrated in the general area, where two enclosures were recently registered with the RMP on the basis of aerial photographs taken during a dry period in the summer of 2018 (see above records for ME011-052001--- and ME011-052002---, and Figure 5). Weather and light conditions can influence the visibility of features from aerial photography, and so much can depend upon when available photographs have been taken.

Bing satellite as well as Google Earth imagery (Google Earth Pro Historical Imagery) were reviewed to check for any visible anomalies within the preferred route option, but nothing of cultural heritage significance not already recorded was noted. The locations where geophysical survey had detected likely features such as enclosures were checked, but there were no visible signs of these from available aerial or satellite photography.

2.3.10 Topographical Files of the National Museum of Ireland

The topographical files of the NMI identify all recorded finds held in the NMI archive that have been donated to the state in accordance with national monuments legislation. The files sometimes include reports on excavations undertaken by NMI archaeologists in the early 20th century. Valuable information that can be gleaned might include the exact location, ground type, depth below ground level and condition when found, of each find. However, the amount and the usefulness of the information available on each find can vary considerably. The topographical files are listed by county and townland and/or street name.

A review of the NMI Topographical Files notes that there are no finds recorded within the environs of the alignment. The closest find is plotted approximately 2.2km south of the western terminal along the R162, as '1935:157-165. 6 Fragments Animal Bone (1935:160-165)'.

2.3.11 Previous Archaeological Fieldwork

To review previous archaeological fieldwork in the preferred route option and its locality, the database for the Excavations Bulletin was searched. The Excavation Bulletin is both a published annual directory and an online database that provides summary accounts of all the excavations carried out in Ireland and Northern Ireland from 1970 to 2012. The database gives access to over 15,000 reports and can be browsed or searched using multiple fields, including Year, County, Site Name, Site Type, Grid Reference, Licence No., Sites and Monuments Record No. and Author.

The National Roads Authority (NRA) archaeological database (http://archaelogy.nra.ie) contains a description of the results of excavations carried out in advance of various road schemes. In general, the database contains information on sites for which final excavation reports have been received.

A search of the excavations database on www.excavations.ie was undertaken based on the townlands which the preferred route option crosses and adjacent townlands: no results were returned for townlands crossed by the preferred route option. However, there has been archaeological fieldwork slightly beyond the immediate surroundings of the preferred route option, as well as investigations undertaken in advance of the present project.

Approximately 1km to the west of the preferred route option is an enclosure (ME011-040----) that is the subject of a preservation order (PO No. 4/1988). This site – known as Raffin Fort – was bulldozed in 1988, hence the preservation order, and was subsequently the subject of salvage excavations in 1989-1993, led by Conor Newman. Raffin Fort has a long and complex sequence of occupation spanning from the Neolithic to the later medieval period; excavated features at the site include a Neolithic enclosure and house, a multi-ringed timber structure dating from the Early Bronze Age, a Late Bronze Age palisaded enclosure and a later, Iron Age henge structure (Newman 1995). Excavations at Raffin Fort account for all five of the summary reports for Raffin townland on the Excavations database.

2.3.11.1 Archaeological Fieldwork for the N52 Scheme

A number of archaeological background and fieldwork studies have been completed which relate to the proposed scheme. Of particular importance are geophysical surveys which identified potential archaeological sites (Nicholls 2015, 2019); these surveys are referred to herein in more detail in the ground survey section of this report (section 2.5), and the reports are reproduced in full as appendices.

Initial archaeological investigation for the N52 project took place in 2008, addressing a smaller area for what was called the Fringestown N52 improvement scheme. This involved an archaeological constraints study (Roycroft 2008) which listed the existing heritage constraints and assessed the impact of five different route options. Subsequent investigations addressed a project area from Stephenstown to Fringestown, including geophysical survey in two areas (Nicholls 2015).

Further archaeological study for the N52 Grange to Clontail scheme consisted of the preparation of a route selection constraints report (Moore Group 2018). This involved a review of recorded archaeological sites, field survey, and an assessment of the potential impacts along four different route options. An important element of this report was to identify previously unrecorded archaeological or architectural heritage sites, structures, monuments or features, including vernacular features, using historical maps and other sources (Moore Group 2018: 11-14). Another report (Roycroft 2018) specified the status of and potential impacts upon the rath (ME012-013---) for which there is a Preservation Order in place. Once the emerging preferred route had been selected, geophysical survey was carried out across almost the whole area of the proposed development (Nicholls 2019, discussed below).

2.3.11.2 Geophysical survey

Geophysical surveys using magnetometer have been carried out across the majority of the preferred route option. The surveys were carried out in two phases – in 2015 (detection licence no. 15R0141) and 2019 (detection licence no. 19R0077) – by John Nicholls of Target for Archaeological Management Solutions Ltd. The geophysical survey refences 'Areas' which are presented in Figure 17. The results of the geophysical survey are presented in Figure 18 and Figure 19.

Two areas were surveyed with magnetometer in 2015, one of which intersects with land within the present preferred route option. In Area 1, which lies to the north of the current preferred route option, three fields were surveyed which detected the presence of a circular enclosure interpreted as a probable ringfort/rath as well as a sub-rectangular enclosure remains (Nicholls 2015: 4). In Area 2, the geophysical survey investigated three fields in Fringestown, including land within the present preferred route option. Several anomalies were detected, including a possible sub-rectangular enclosure (south of the present

preferred route option) and possible ditches and enclosure remains or early field boundaries (Nicholls 2015: 4).

Subsequent to selection of a preferred route option, more comprehensive geophysical survey was undertaken, which resulted in the identification of a number of potential archaeological features (Nicholls 2019). The geophysical survey involved high resolution magnetic gradiometer survey and was undertaken in 19 areas, covering a total of 14.36 hectares (two of the 21 areas of the project were not accessible due to high crops). The results demonstrated a variety of background magnetic response along the proposed scheme, with interpretation complicated by responses deemed to represent natural soil/geological variations and effects of recent land use (Nicholls 2019: 5). However, alongside poorly defined responses and small-scale positives, for which an archaeological interpretation should not be entirely excluded, there are several magnetic responses that suggest well-defined features: the survey report concluded that there were three concentrations of definitive archaeological remains which constitute sub-circular and oval shaped enclosures – in Area 5 (Response no. 16), Area 15 (Response no. 44) and Area 20 (Response nos. 66-67).

The geophysical survey report recommended test excavations at locations where magnetic responses were interpreted as possible or probable archaeological features. As well as the three concentrations of definite archaeological remains in Areas 5, 15 and 20, notable responses of archaeological interest were identified in Areas 2, 13, 14 and 19 – 'a possible fulacht fiadh/burnt mound and probable former building in Area 2; concentration of magnetically weak linear anomalies and associated responses in Area 13; possible pit locations and ditch remains to the W in Area 14; and a magnetically weak curvilinear anomaly, potentially part of an enclosure ditch, in Area 19' (Nicholls 2019: 13). The results of the geophysical survey form an important part of the assessment of archaeological sites that may be impacted by the proposed road development.

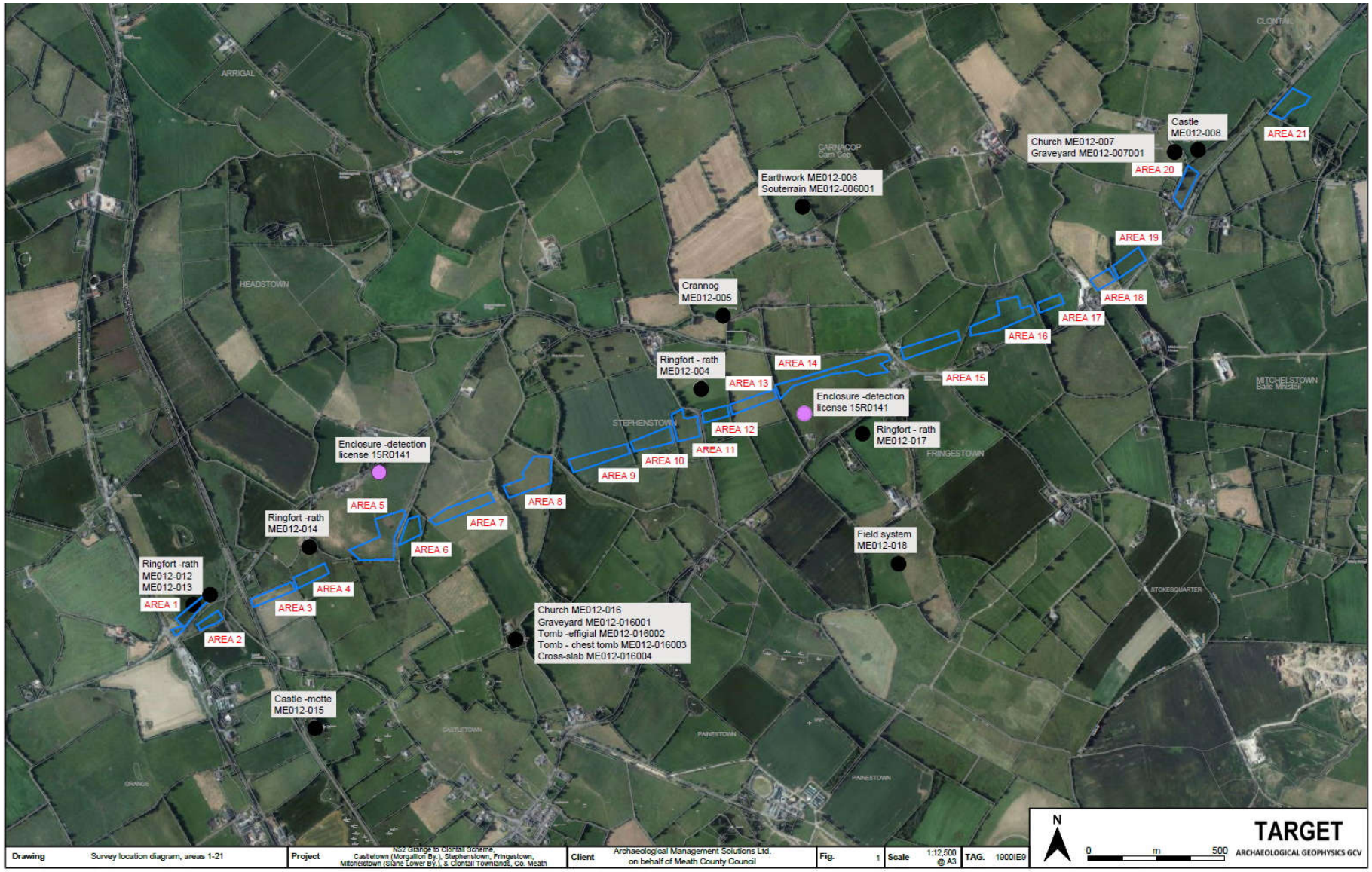

Figure 17: Map of areas of geophysics survey (Nicholls 2019)

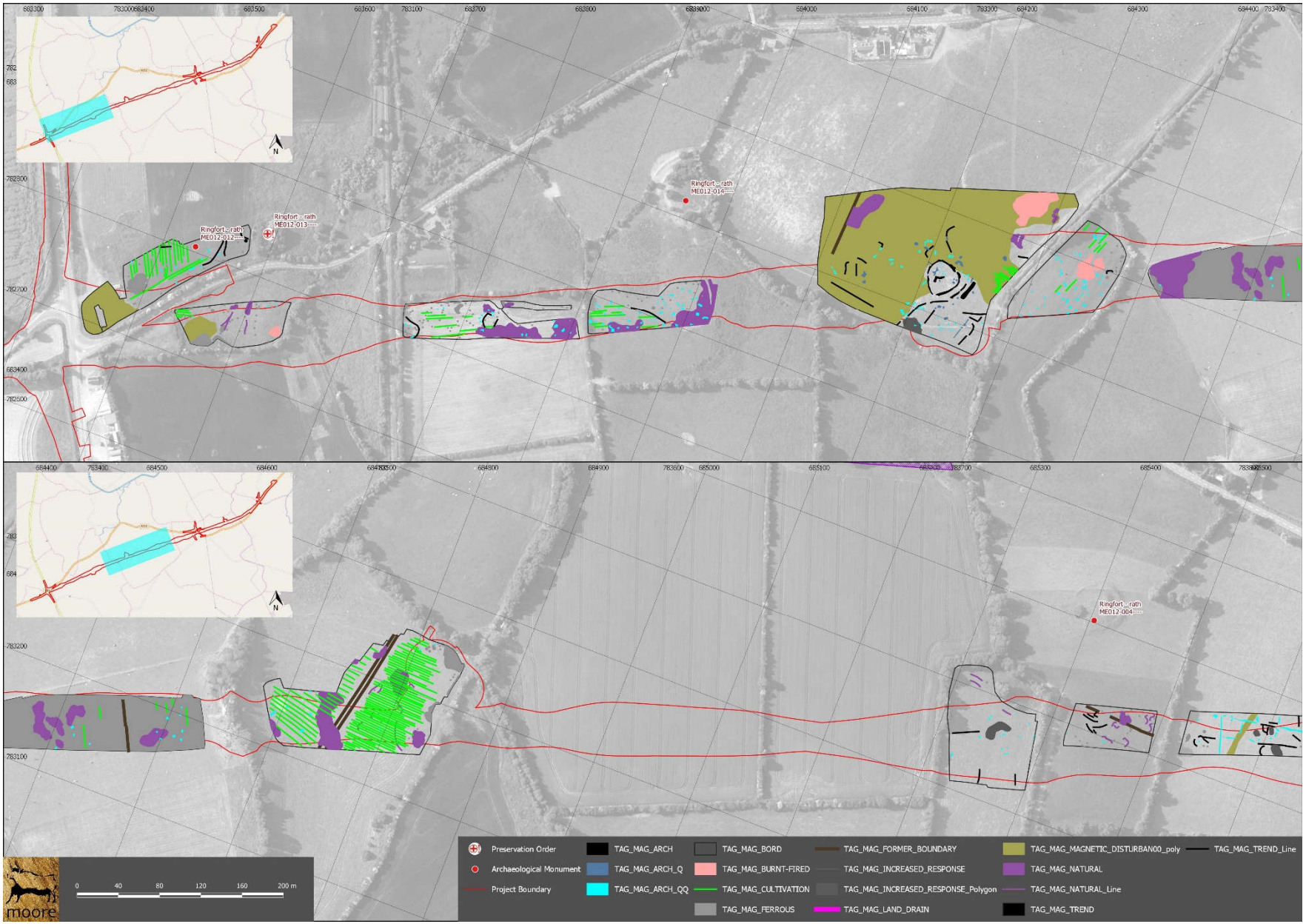

Figure 18: Results of Geophysical Survey (Nicholls 2019) 1 of 2.

Figure 19: Results of Geophysical Survey (Nicholls 2019) 2 of 2.

2.3.11.3 Test excavations

Targeted archaeological testing (excavation licence no. 19E0565, detection licence no. 19R0198) took place at three of the identified anomalies that were interpreted as enclosures – in Area 5 (Castletown), Area 15 (Fringestown) and Area 20 (Grange) (see Appendix for full report). The testing took place in October 2019. Trench locations were established using a survey grade GNSS. A 16–ton mechanical excavator equipped with a ditching bucket was used to excavate topsoil under the supervision of Senior Archaeologist. The work involved mechanically excavating 24 trenches, 10m in length by 2m wide, at each of these circular anomalies, removing topsoil by mechanical digger and investigating any potential archaeological features exposed by hand.

The presence of enclosure ditches, as detected by the geophysical survey, was verified through excavation at all three of the tested locations. By excavating a series of trenches perpendicular to the detected features, the testing located the courses of the ditched enclosures which are visible as bands of darker coloured fills contained in shallow cuts that contrast with the surrounding natural and in some areas contain charcoal and bone. Features adjacent to and within the enclosures were also located, at Areas 5 and 20. There are no above-ground archaeological features visible at any of the three sites.

The excavations informed an assessment of the sensitivity of the three sites. The sites are assessed as having 'moderate' sensitivity because, although they are confirmed archaeological sites, they are not monuments on the RMP and they do not have an above-ground element, so are unlikely to be classed as National Monuments. The magnitude of impact is judged as 'high' for the enclosures in Areas 5 and 15, which will be entirely impacted by the development, and 'medium' for the enclosure in Area 20, which on the basis of current information is just outside the PDA. There will be a significant impact on the enclosures in Areas 5 and 15 and a slight to none impact in Area 20 (see Table 8).

Full details of the test excavation results are contained in the appended report.

2.3.11.4 Other assessments

Other assessments related with the N52 realignment have also taken place. Excavation of geotechnical pits at Stephenstown on 27 May 2019 was supervised by Niall Roycroft (TII Archaeologist). The testing focused on an area of low ground which is situated directly beside a stream that runs east and south of SMR No. ME012-004---, which is recorded as a 'ringfort – rath'. The Stephenstown hollow survives as an altered and embanked sink hole and its proximity to the nearby rath suggests a ritual function beyond a simple water source. Although no finds or organic remains were retrieved, Roycroft observes that stratigraphic layers had parallels with those found in the Kings Stables, Co Armagh. Though the exact nature of what is termed 'the Stephenstown hollow' was not determined, the report on the testing summarised that 'it would be prudent to consider the Stephenstown hollow as a natural feature, but still a zone of archaeological potential, perhaps associated with Ringfort ME012-004--- as it may have been used as a 'Holy Well' in the past' (Roycroft 2019). Roycroft also carried out another site-specific investigation, to more accurately locate a crannóg (ME012-005---) whose position on maps is erroneous (Roycroft in Moore Group 2018: 32-38).

Reports of 'croppy burials' in the vicinity of the project area have been highlighted by Niall Roycroft. The term croppy refers to Irish rebels who took part in the 1798 Rebellion. Accounts of these burials are taken from the folklore pages of the Duchas.ie web page, and these contain reports of confrontations and burials that occurred in Raffin, Drakestown and Headstown.

2.3.12 Folkloric References

The Irish Folklore Commission preserves an important record of Ireland's oral tradition and material culture of 2,400 bound and paginated volumes. The bulk of the Collection was assembled by full-time collectors from verbatim transcripts of field recordings made on Ediphone (wax cylinder) recording machines. The Collection can be said to encapsulate the following 14 key subject areas of Settlement and Dwelling, Livelihood & Household Support, Communications and Trade, The Community, Human Life, Nature, Folk-Medicine, Time, Principles and Rules of Popular Belief and Practice, Mythological Tradition, Historical Tradition, Religious Tradition, Popular Oral Literature, and Sports and Pastimes.

A reference relating to the subject area from the Schools Collection (Carlanstown roll number 884) notes that during the 1798 rebellion Father Murphy and a band of Croppies fought with British Soldiers and the local Yeomanry in Raffin in the parish of Castletown 'They buried the "dirty croppies" in shallow graves and in the fall of the year the wheat which they had in their pockets and which was all they had to eat on the journey from Wexford, sprung up through the thin earth which covered them and ripened in the sun'. Father Murphy survived this encounter but was later attacked at Drakestown Bridge and 'Foully Murdered'.

A further reference from the Castletown Schools Collection records that 'there are Croppies graves in Headstown. Over one of these graves in Mr Cumiskey's land there is a stone in the shape of a cross. On the top of it is written "Remember '98" and on the bottom of it is R.I.P.'

Regarding field names, Patrick Carolan, a Collector, recorded that 'The Fear Breaga is a field at Castletown owned by Mr Ryan. There is a kind of a pond off the side of the road near the village of Castletown. It is called the Pull Buide'. 'There is a well called Thuber Veeny in Stephenstown'. The Nunan, Glochan and Bugger are fields in Mitchelstown and at Stoke's Cross there is a field called Mullathomais.

2.3.13 Meath Field Names Project

The Meath Field Names Group is a voluntary group established in May 2008 with the aim of recording the 'Field Names' of the County along with their history, features, name origin and folklore. The records are accessed via an interactive map available via www.meathfieldnames.com portal. This resource is a useful tool drawing on local knowledge to identify the history and folklore of land use. Table 3 lists the individual Areas with named fields; Figure 20 is a capture of the interactive map showing fields crossed by part of the PDA.

Table 3: Field Name project references

Area Number	Townland	Field name
Area 1	Grange	No Name
Area 2	Grange	No Name

Area 3	Castletown	No Name
Area 4	Castletown	No Name
Area 5	Castletown	No Name
Area 6	Castletown	No Name
Area 7	Castletown	No Name
Area 8	Stephenstown	Ram Field
Area 9	Stephenstown	Big Meadow
Area 10	Stephenstown	Drain Field
Area 11	Stephenstown	The bottoms (reference to it being a site of an old Monastery- Field containing Stephenstown Hollow
Area 12	Stephenstown	The Moat/Fort Field, the field contains SMR ME012-004---classified as a Rath
Area 13	Stephenstown	The Well Field
Area 14	Fringestown	Mullagh Tomais (Tom's Mill)
Area 15	Fringestown	No Name
Area 16	Fringestown	Murtagh's Field
Area 17	Fringestown	No Name
Area 18	Mitchelstown	No Name
Area 19	Mitchelstown	No Name but adjacent to the Graveyard Field to the north
Area 20	Clontail	No name but adjacent to the Castle Field to the north
Area 21	Clontail	Big Crockens

Figure 20: Screen capture from Meath Field Names Project showing fields crossed by part of the PDA

2.3.14 Toponym Analysis

Townlands are the smallest administrative land divisions used in Ireland and are in fact the only surviving administrative structure with a continuous history of development going back to medieval times if not earlier. Irish townlands generally relate not to settlements, but land units and as such they acquired legal title at an early date.

They constitute the basic divisions of the countryside and were carefully recorded in historic maps and books that accompanied the great land transfers of the seventeenth century. There are 62,000 townlands in Ireland, grouped into civil parishes, then counties and finally provinces. Townland names are a rich source of information for the land use, history, archaeology and folklore of an area. The place name can have a variety of language origins such as, Irish, Viking, Anglo-Norman and English. The names can provide information on families, topographical features, and historical incidents. In terms of the built environment many names reference churches, fords, castles, raths, graveyards, roads and passes etc. In the compilation of the Ordnance Survey scholars such as Eugene O'Curry and John O'Donovan were commissioned to provide the Survey with the anglicised forms of the Irish place-names, and it is these anglicised forms that have been in general use ever since. In compiling the following data a number of resources were consulted including the Placenames Database of Ireland www.logainm.ie and Irish Names of Places by P.W. Joyce (Joyce, 1913).

The name of the barony – Morgallion – has an identifiable historical derivation: *Machaire Gaileang*. Machaire translates as 'plain', and so the name translates as 'the plain of the Gaileanga'. The following explanatory note is given in the Placenames Database of Ireland <www.logainm.ie>:

> 'Seo cuid den chur síos a rinne Gearóid Mac Niocaill in Ireland before the Vikings ar roinnt de na treabhchais a bhí i gcríocha Uí Néill an deiscirt chomh fada siar le deireadh an 6ú haois: 'Scattered among the Uí Néill kingdoms were various subordinate peoples: on the coast, straddling the Boyne, lay the Ciannachta, and between these and the Airgialla to the north-east were the Gailenga and Luigne, peoples of which other branches were to be found in Connachta …'.
>
> Tá ainmneacha an dá phobal Luigne agus Gailenga caomhnaithe in ainmneacha na mbarúntachtaí Luíne agus Machaire Gaileang i gCo. na Mí (cé nach ionann réimse na seanchríoch agus réimse na mbarúntachtaí a chuir na Normannaigh ar bun); 'Makerigalin' a thugtar ar an logainm deireanach sin sa dán Fraincise faoi ghabháltais na nAngla-Normannach, Song of Dermot and the Earl, a cumadh i dtosach an 13ú haois. Caomhnaíodh iarsma den ainm Ciannachta in ainm na barúntachta Ferrard / Fir Arda i ndeisceart Co. Lú ar a dtugtaí Fir Ardda Ciannachta tráth. Bhí fearann ag an treabhchas sin laisteas den Bhóinn chomh maith. 'The Uí Néill kings of Knowth were also styled kings of Ciannachta from the eighth century, as they had conquered the lands of that tribe south of the lower Boyne', a scríobh Byrne in Irish Kings and High Kings'

Table 4: Toponym analysis

Townland Name/ Name	Irish Version (Genitive)	Translation	Comment
Grange	An Ghráinsigh	Church owned land	This townland was owned by the parish of Kilshine.

Townland Name/ Name	Irish Version (Genitive)	Translation	Comment
Castletown (Morgallion By.),	Baile an Chaisleáin	Townland of the castle	This reference relates to a motte and bailey (SMR ME012-015---). On the Down Survey Barony map a castle is shown in 'Castletownkillpatricke' near the boundary with Grange. The first edition map shows the motte as a sub-circular enclosure named 'Castletown Fort'.
Stephenstown	Baile Stiofáin	The town of Stiofán	Stephenstown is first referenced in 1560 in the Calendar to Fiants of Henry VIII at which time it was in the ownership of Thomas Flemyng. A castle is shown on the Down Survey, it may have been on the site of the existing Stephenstown House.
Fringestown	Baile Fringe	Fringe's homestead	Fringe, a family name. No buildings featured on the Down Survey
Mitchelstown (Slane Lower By.),	Bhaile Mhistéil	Family name – Mitchel's homestead	This was known as Mitchelstown or Stookestown, features on the Down Survey maps with a castle and Church (Clontail)
Clontail	Cluain tuill	Tuathal's lawn or meadow	Featured on the Down Survey and contains a church (SMR ME012-007---) and the former site of Stokestown Castle (SMR ME012-008---). In the 1640 Civil Survey John Stoakes owned 194 acres at Mitchelstowne and Clontoule with 'a stone house, a corn mill, a tuck mill, and some cabins'.

2.3.15 Townland Boundaries

The typology of townland boundaries can vary in different parts of the country, with some areas favouring distinctive high, wide earthen banks or just stone walling; sometimes there is a combination of earth and stone, with a stone-revetment or a facing on an earthen bank. Some boundaries are laid out along natural features including rivers, streams and high ground or manmade features such as roads and walls. Townlands boundaries that are traversed by the preferred route option are discussed in Table 5

Table 5: Townland boundary Survey

Areas	Townlands	Chainage	Boundary Type	Comment and Impact of Development
Area 2 & 3	No. 1 Grange / Castletown	0.250	This boundary at Cassidy's Cross extends to the east of the R162 road	Most of this boundary within the road take has been removed by previous works to the N52 and is now built over. A short section of approximately 10m length survives as a hedge line to the north and east of Cassidy's Garage. As most of the physical fabric of the boundary no longer

Areas	Townlands	Chainage	Boundary Type	Comment and Impact of Development
				exists, the impact will be slight/none.
Area 8 & 9	No. 2 Castletown / Stephenstown	1.330	Mature tree line on earthen bank. An esker ridge with a disused field road representing the boundary along the ridge lined with mature trees. Esker ridge subject to recent quarrying.	The townland boundary runs along the top of the esker. The PDA crosses and will remove an approximately 60m width of the boundary. Therefore, the impact will be moderate.
Area 13 & 14	No. 3 Stephenstown / Fringestown	2.420	Mature Tree line and ditch	Hedgerow and deep ditch to east of boundary. The PDA crosses and will remove an approximately 80m width of the boundary. Therefore, the impact will be moderate.
Area 17 & 18	No. 4 Fringestown / Mitchelstown	3.600	Boundary has been removed by development of outbuildings associated with farm	Boundary removed by development. As no physical fabric of the boundary remains, the impact will be none.
Area 19 & 20	No. 5 Mitchelstown / Clontail	4.070	Boundary runs to north west of Crossroads junction of N52 and Local access road L74102. Survives as a modern tree line of conifers	Boundary runs down the middle of an existing minor road. As no physical fabric of the boundary remains, the impact will be none.

2.4 Architectural Heritage

2.4.1 Architectural Conservation Areas (ACA)

The Planning and Development Act 2000, as amended, provides that all Development Plans must now include objectives for preserving the character of Architectural Conservation Areas (ACAs). An ACA is a place, area, group of structures or townscape of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest, or which contribute to the appreciation of protected structures.

In these areas, the protection of the architectural heritage is best achieved by controlling and guiding change on a wider scale than the individual structure, in order to retain the overall architectural or historic character of an area.

There are no ACAs in the vicinity of the preferred route option.

2.4.2 Record of Protected Structures (RPS)/National Inventory of Architectural Heritage (NIAH)/ Industrial/Vernacular Heritage

The importance of our built heritage is enshrined in the Planning and Development Act, 2000 (Part II, Section 10) which places a statutory obligation on local authorities to include in their Development Plans objectives for the protection of structures, or parts of structures, which are of special interest. The principal mechanism for the protection of these structures is through their inclusion on the Record of Protected Structures (RPS). This list provides recognition of the structures importance, protection from adverse impacts and potential access to grant aid for conservation works. The RPS is an ongoing process and can be reviewed and added to. In considering additions to the RPS local authorities have recourse to the National Inventory of Architectural Heritage (NIAH) which provides a source of guidance on the significance of buildings in their respective areas. The RPS for County Meath is contained in the Development Plan Appendix 8.

There are four Protected Structure located in the vicinity of the route corridor (Figure 3): none are located within the preferred route option. Two are associated with St. Patrick's Church, one relating to the Church itself (RPS No. MH012-107) and the other to a Mausoleum located within the grounds of the Church (RPS No. MH012-108). As noted above, this site is also an archaeological monument (ME012-016--- and associated listings – see Table 2). Located on the top of a small hill, the site is surrounded by mature trees and hedgerows. Immediately to the north of the site is a modern farm shed and yard, which is situated between the church and the proposed route options. To the west there are two rows of vegetation, on each side of the access to the modern farmyard. Any views to the north west, north and north east, towards the proposed route options will be partially screened by vegetation and the modern farm shed but more extensive during the winter months when the vegetation loses its foliage.

Along the access to St. Patrick's Church is a farmhouse, which is currently unoccupied and falling into a ruinous state (RPS No. MH012-103). Immediately to the north of the house, between it and the proposed route corridor, is a more recent, large farm shed, which is still in use.

Stephenstown House (RPS No. MH012-110), a three-storey country house constructed circa 1760 is currently unoccupied and falling into disrepair, with ground floor openings blocked up with stone and concrete blocks and no glass in the upstairs windows (there are restoration works currently ongoing). There are extensive associated outbuildings, cast iron gated entrance on the existing N52 to the east of the house, with iron fencing along the entrance avenue to the house. Niall Roycroft (2008) notes that the buildings associates with Stephenstown House 'are subject to a Temporary Preservation Order that includes all buildings and their 'aspects' (views to/from)'. It would appear likely that this reference concerns its inclusion in the Record of Protected Structures, as legislation relating to Preservation Orders and Temporary Preservation Orders deals with archaeological monuments.

Table 6: Record of Protected Structures near the preferred route option

RPS No	Structure name	Townland	Description	Distance/direction from preferred route option
MH012-103	Farmhouse	Castletown	Detached three-bay single-storey farm house, built c.1850, now in derelict condition. Stone and clay	420m S

RPS No	Structure name	Townland	Description	Distance/direction from preferred route option
			walls. Pitched corrugated-iron roof. Square-headed openings with stone sills.	
MH012-107	St. Patrick's Church of Ireland Church	Castletown	Board of First Fruits church, rebuilt in 1820, on the site of an earlier church, now derelict. Medieval windows of earlier church inserted to tower.	520m S
MH012-108	Mausoleum	Castletown	Coursed limestone burial vault, c.1830, with dressed limestone coping. Surrounded by two sets of cast-iron railings on limestone plinth walls with anthemion-headed corner posts. Accessed through cast-iron gate.	489m S
MH012-110	Stephenstown House	Stephenstown	Detached three-bay three-storey house, built c.1760, with central flat-roofed porch. Remains of three-bay two-storey earlier house. Cast-gates and gate piers to the site and to the entrance.	350m N

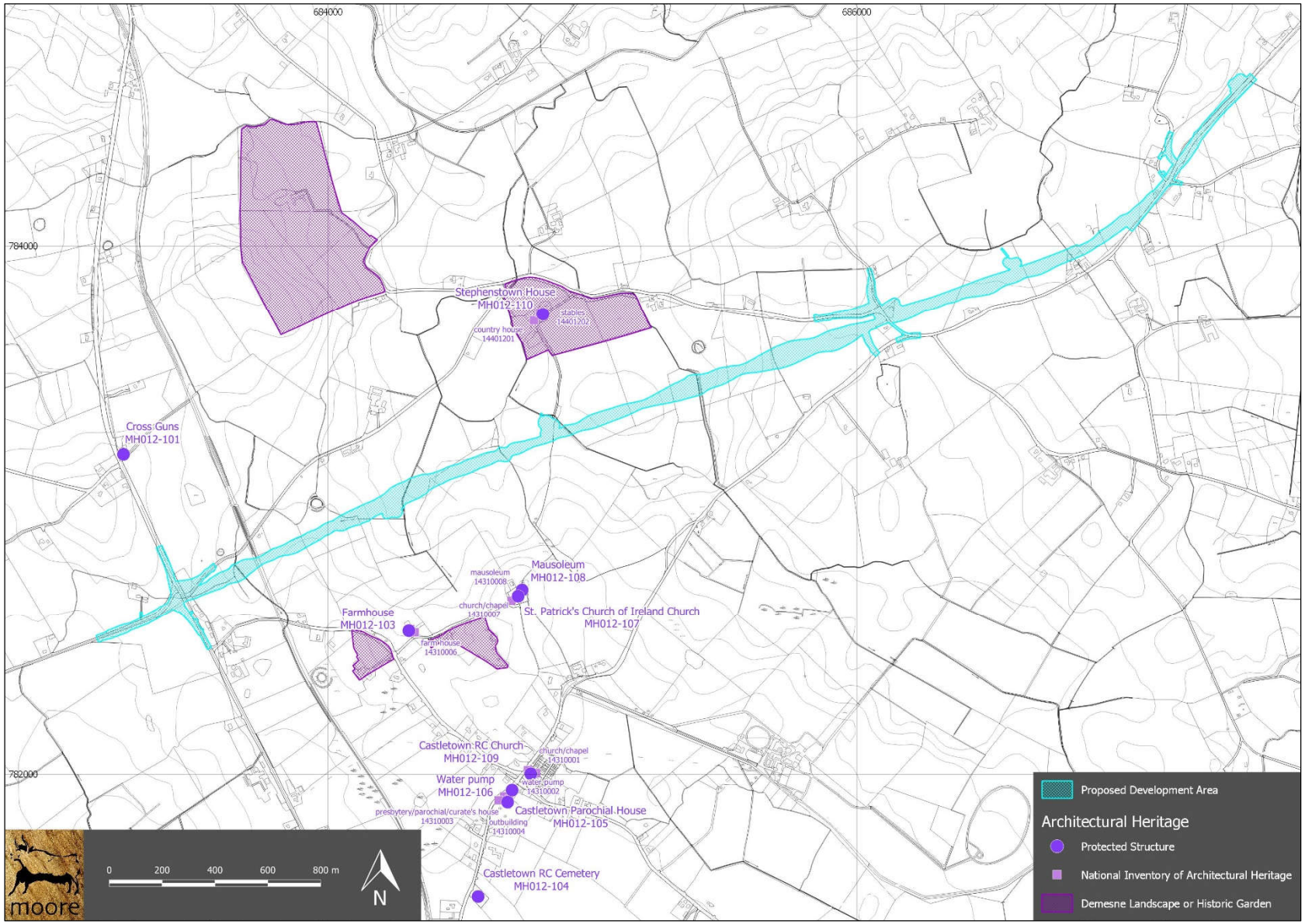

Figure 21: Architectural (NIAH) sites, demesne landscapes and gardens in the vicinity of the preferred route option

2.4.3 Designed Landscapes/Demesnes, Historic Gardens & Country Estates

The Architectural Section of the DCHG is in the process of a multi-phase study looking at Designed Landscapes and Historic Gardens that appear as shaded areas on the First Edition Ordnance Survey Maps, circa. 1830.

'The objective of this survey is to begin a process of understanding of the extent of Ireland's historic gardens and designed landscape. Sites were identified using the 1st edition Ordnance Survey maps. These were compared with current aerial photography to assess the level of survival and change.'

A part of this study OSI First Edition historic mapping (circa 1830) was used to digitise the extent of demesne landscapes and historic gardens within the preferred route option and its environs (Figure 21).

There are four demesne landscapes and historic gardens in the surroundings of the preferred route option; none are within the preferred route option. One of the demesne landscapes, that associated with Stephenstown House, has an associated protected structure (RPS No. MH012-110).

Two historic gardens are indicated on the Ordnance Survey 6 Inch historic maps, surveyed circa 1830, to the south of the preferred route option. On the 6 Inch Maps these are associated with Castletown Cottage and Glebe House. By the time of the survey of the 25 Inch historic maps, circa 1900, Castletown Cottage was in ruins and Glebe House was referred to as Drakestown Rectory. Current aerial photography indicates that there is now a modern house on the site of Castletown Cottage and there is no sign of the principal dwelling at Drakestown Rectory. There are some ruins potentially associated with outbuildings from the original house, located to the rear of a modern farm shed. Neither of these sites appear in the NIAH Garden Survey. A mound indicated to the east of Glebe House is possibly the remains of an archaeological monument, and is still evident in the field boundary, however it is currently not recorded in the archaeological inventory.

West of the preferred route option, the 6 Inch historic map indicates a demesne landscape which contains 'Stables' as the only named building. The stables are situated in the approximate centre of the landscape, with two large buildings indicated within the landscape along its eastern boundary. By the time of the survey of the 25 Inch map (circa 1900) the buildings along the eastern boundary have gone, but the 'Stables' remain, however they are no longer named. The building referred to as Stables is north of the preferred route option and is still extant to this day. Their layout appears to be unchanged from what appears in the 6 Inch historic map. The structure does not appear in either the RPS or in the NIAH. The landscape appears in the NIAH Garden Survey as Headstown, which is the name of the townland within which it is located. There is no evidence from the historic mapping that the demesne landscape extended further to the south between the time or the 6 Inch survey (circa 1830) and the 25 Inch survey (circa 1900). However, it can be seen that following the construction of the railway line to the west, the road to the south that formed the southern boundary of the demesne became severed and fell into disuse.

Stephenstown House (RPS No. MH012-110) has an associated demesne landscape indicated on the 6 Inch Historic Map. The 25 Inch historic map indicates formal gardens to the south of the house and both the 6 Inch and 25 inch maps indicate a circular feature to the east of the house, which was noted by Niall Roycroft (2008) to be a landscape feature, pleasure gardens. It has been noted that the house is still

extant, although unoccupied and in a state of disrepair, as are the associated outbuildings. There are cast iron gates and iron fencing along the entrance avenue to the house east of the house, which are referred to in the Record of Protected Structures. The house and associated landscape are situated directly north of the preferred route option. A laneway extending from Stephenstown House to the south, outside of the demesne landscape, provided access to fields and cottages. The cottages are referred to by Niall Roycroft (2008) as Gladys' Cottage, now in ruins. Other built features

Remote sensing using historical maps and aerial imagery, as well as the ground survey along the route (detailed below) identified a number of other historical built features which are within the proposed route corridor and will be impacted by the development but are not under statutory listings. These include the railway embankment of the disused Navan and Kingscourt railway line in Area 2-3, a drystone retaining wall in Area 6, a laneway providing access to Stephenstown House in Area 8, as well as townland boundaries, some of which exist as ditches and mature hedgerows (detailed above, Section 2.3.15). These are considered as sites for the purpose of assessing their significance and the impact of the development, and mitigation measures (survey recording) are recommended accordingly (Table 8).

2.5 Fieldwork

2.5.1 Walkover Survey Method

The purpose of the field survey was to identify potential archaeological, historical or vernacular heritage features which may be subject to direct or indirect impacts as a result of the proposed road realignment. The site visits also sought, where possible, to identify or clarify anomalies detected by the geophysical survey and assessment.

The fieldwalking survey was carried by William Anderson and Billy Quinn in July 2019 in fine weather conditions with good visibility. The project area was navigated using a hand-held GPS and with the GIS mapping loaded on to a portable device. Notes, photographs and GPS points were taken to record any potential archaeological features as well as to record ground conditions, tracks that provide access to particular fields and other cultural and natural aspects of the landscape.

The survey and recording were organised using the system of field numbering employed for the geophysical survey report (Nicholls 2019). This divides the preferred route option into 21 areas, corresponding with fields, running from west to east (Figure 17). Particular attention was paid to locations where geophysical survey had identified anomalies that were suspected to be archaeological sites (magnetometer responses specified in the survey report - Nicholls 2019). Other areas of archaeological potential were also noted, within and adjacent to the project area.

2.5.2 Survey Results

2.5.2.1 Area 1, Chainage 0.000 to 0.150

Physical Environment

Area 1 crosses a small portion at the south of a field north of the present N52 alignment. Only a short off shoot of the preferred route option crosses this land, which is undulating with a general west to east trending slope. At the time of survey, the field was under tall crops, but was accessed along existing tracks.

Archaeological Potential

Area 1 is the location of two registered monuments, both raths (ME012-012--- and ME012-013---), the latter of which is the subject of a Preservation Order (PO no. 11/1970) (Figure 22). The Preservation Order, made in 1970, reportedly followed the demolition of the adjacent rath ME012-012---, which is no longer discernible on the ground or through geophysics. The location of the preferred route option in relation to the two raths was assessed (Figure 23). Currently the N52 alignment passes directly beside the raths, and the new alignment will take the road further to the south of them. The western part of the field, where the majority of the preferred route option crosses, has undergone ground disturbance, and has lower archaeological potential. Geophysical survey identified tentative pit locations in Area A, but these are at the edge and outside of the preferred route option. Therefore, within the preferred route option, Area 1 has low to moderate archaeological potential for the discovery of previously unrecorded sites and low sensitivity with regard to known sites impacted by the proposed development.

2.5.2.2 Area 2, Chainage 0.050 to 0.300

Physical Environment

Area 2 is on the south side of the present N52 and bounded to its east by the disused Navan and Kingscourt railway line which runs on an embankment. This is the point where the preferred route option diverts from the current N52 alignment, which veers to the northeast while the preferred route option follows an east-northeast alignment. The western part of Area 2 has undergone ground disturbance with traces of an asphalt surface and has perhaps been artificially levelled (Figure 24). To the east, the ground falls away slightly and is an undulating field.

Archaeological Potential

Due to the ground disturbance evident at the western end, this part of Area 2 has low potential for the survival of archaeological deposits. However, the centre and east of the field do have potential for unrecorded archaeology. Geophysics returned signals which were interpreted as a potential fulacht fiadh/burned mound and possible building foundations. Bounding the eastern end of the field is the railway embankment. Area 2 has moderate to high potential for the discovery of previously unrecorded archaeological sites and low to moderate sensitivity with regard to known sites impacted by the proposed development.

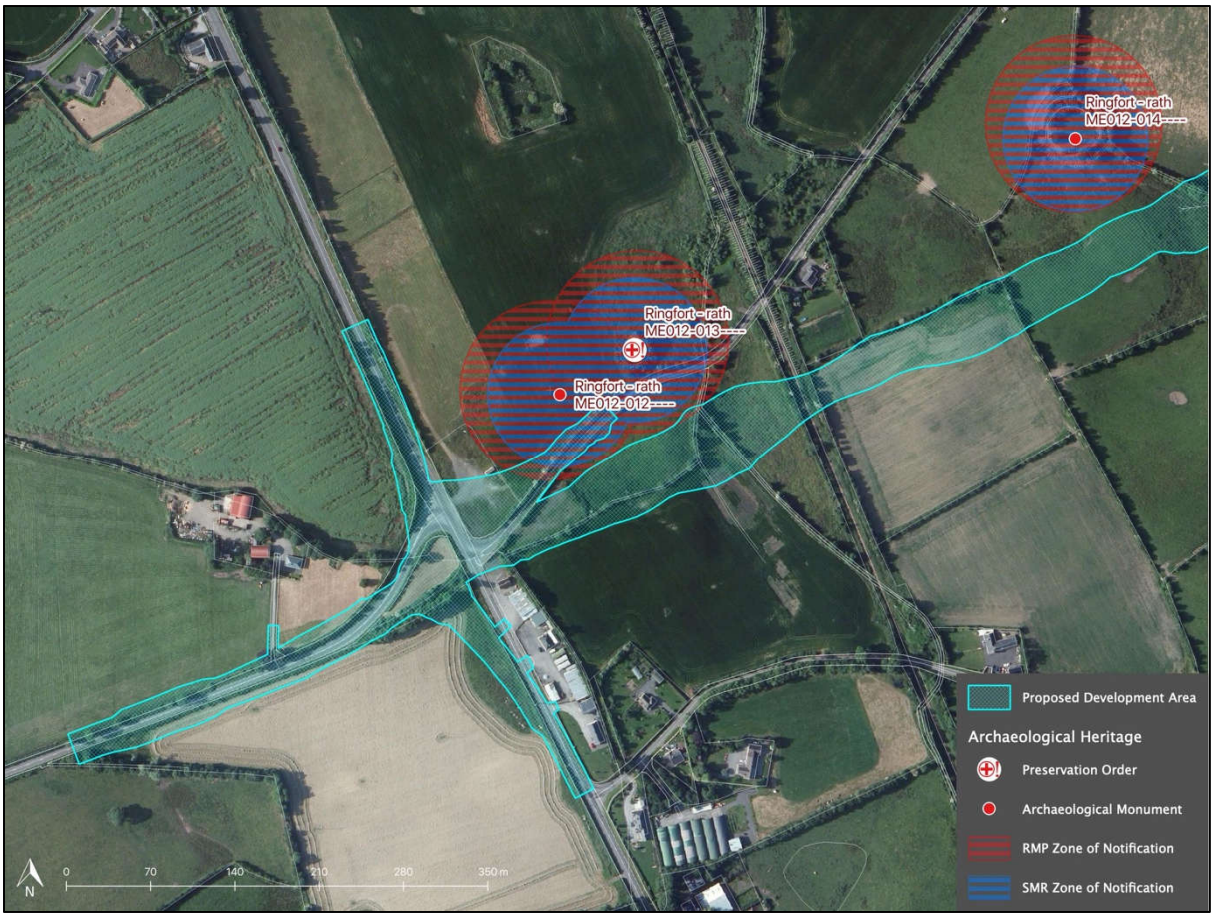

Figure 22: Map of Areas 1-3 at the western end of the preferred route option, with three ringforts/raths north of the preferred route option

Figure 23: Area 1, facing northeast, towards the location of raths ME012-012--- and ME012-013---, to the north of the present N52

Figure 24: Area 2, facing east, with evidence of ground disturbance to the west (left) and undulating field beside the railway to the east (right)

2.5.2.3 Area 3, Chainage 0.300 to 0.500

Physical Environment

Area 3 is a large, gently undulating field with a low rise at its centre and a generally west-facing aspect which slopes to the embanked railway at its west. At the time of survey the field was under crop (Figure 25).

Archaeological Potential

Geophysical survey detected two linear anomalies in Area 3, constituting two sub-rectangular features, one in the centre of the field, and the other at the west, abutting the railway reservation. The geophysics identified three areas of possible pit locations and linear trends. Area 3 has moderate potential for the discovery of previously unrecorded archaeological sites and low sensitivity with regard to known sites impacted by the proposed development.

2.5.2.4 Area 4, Chainage 0.500 to 0.700

Physical Environment

Area 4 is on a moderate, east-facing slope, with its highest point formed by a field boundary at the west and its eastern side formed by a ditch and thick hedgerow where a spring, indicated on historical maps, feeds a small stream. There are fine views to the north and east from the high ground to the west of the field. The field is open pasture which is being grazed by cattle, and the surface is uneven, with erosion caused by livestock; other ground disturbance is evident mid-slope, where there is a series of cuttings. Reference to the third edition historical map shows that these are drainage channels, drawing water from the hillside and diverting it to the north where the channels meet with a marked spring and a further channel runs northeast into the stream. At the foot of the slope, beside the ditch and stream, is a concentration of boulders, which appear to be modern fieldstone clearance.

Archaeological Potential

To the north of Area 4 is a rath (ME012-014---), which at its closest point is approximately 50m from the preferred route option boundary (Figure 26). Geophysics detected possible pit locations and linear

trends. The proximity to the rath and the geographic situation, means that Area 4 has moderate potential for the discovery of previously unrecorded archaeological sites and low sensitivity with regard to known sites impacted by the proposed development.

Figure 25: Area 3 under crop, facing west (left); Area 4, facing northeast from the higher ground at the west (right)

Figure 26: Rath to the north of Area 4 (ME012-014---) viewed from the preferred route option (left); cutting mid-slope in the centre of Area 4 (right)

2.5.2.5 Area 5, Chainage 0.700 to 0.950

Physical Environment

Area 5 is at the southern corner of a large, open field to the south of the present N52 road alignment. Within the preferred route option, the field is a gentle, east-facing slope, bounded to the south by a thickly vegetated boundary.

Archaeological Potential

On the lower slope of the field, magnetometer survey identified a feature described as a 'sub-circular ditched enclosure c.35m in diameter with concentration of pit, posthole and linear remains at interior' (Nicholls 2019: 7) (Figure 27). On the eastern side of the enclosure are two parallel lines which may be associated ditches, while of particular interest within the enclosure is a L-shaped feature. The possible

enclosure is located on a low rise that projects from the lower, east-facing slope of the hillside (Figure 28). Although there is not an obvious surface expression of the enclosure, such as a distinguishable circuit ditch, its location is signalled by the slightly raised ground. Archaeological test excavations (licence no. 19E0565) confirmed the presence of a ditch, expressed as a slightly darker coloured fill against the background natural soil; the testing also located a possible posthole and a wider ditch downhill to the east (see excavation report in Appendix for details).

The enclosure ditch may be interpreted as a rath, a relatively common form of archaeological site in the locality (six raths, as well as two enclosures, are recorded within 1km of the PDA) and a widespread feature of early medieval settlement across Ireland. Unlike the raths recorded on the RMP, this site does not have any features visible above ground – test excavations suggest the archaeological features are truncated, and this would have erased any previously existing above-ground elements. While the enclosure is confirmed as an archaeological site which would qualify for inclusion on the RMP, it does not have any higher heritage status, for example as a National Monument. Therefore, it can be considered to have a 'moderate' level of significance and sensitivity; as the site is located entirely within the PDA, the magnitude of impact is rated as 'high'; the impact significance is rated as 'significant'.

Due to the verified presence of the ditched enclosure, Area 5 has high potential for the discovery of previously unrecorded archaeological sites and moderate sensitivity with regard to known sites impacted by the proposed development.

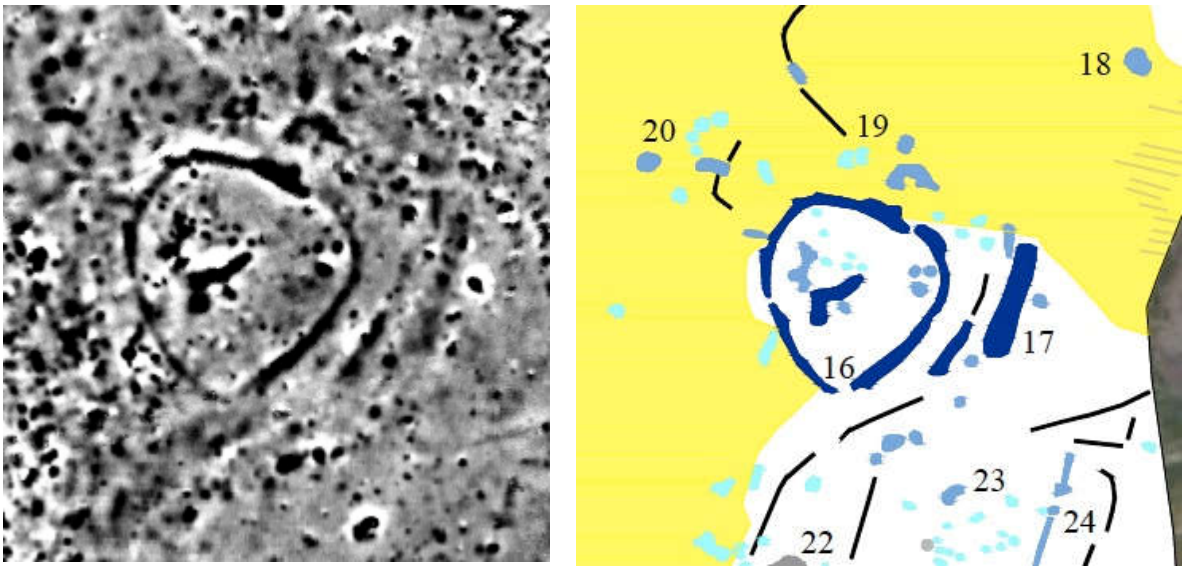

Figure 27: Magnetometer results and interpretation of results in Field 5 at Chainage 0.850. The site is located within the preferred route (after Nicholls 2019)

Figure 28: Location of potential enclosure in Area 5, views facing northeast (left) and southwest (right)

2.5.2.6 Area 6, Chainage 0.950 to 0.1050

Physical Environment

Area 6 crosses a small field which is the lower portion of a gentle, west-facing slope. To the southwest of the field is a ditch forming the boundary with Area 5.

Archaeological Potential

In the centre of the field is a small, low mound (Figure 29); its cultural status is uncertain, but geophysical survey did detect readings at its location (Response no. 26) which are classified as 'burnt/fired' and which are described a 'tentative' fulacht fiadh/burnt mound' remains. A natural soil/geological, modern ferrous or recent landuse origin should also be considered' (Nicholls 2019: 7). Bordering the east of the field is a boundary built up as a retaining wall which forms a step of more than 2m height to the field to the east (Figure 29). This wall is a possible historic feature which should be documented as a mitigation measure prior to being impacted by the proposed development (a width of approx. 65m of this feature will be removed). Area 6 has moderate to high potential for the discovery of previously unrecorded archaeological sites and low to moderate sensitivity with regard to known sites impacted by the proposed development.

Figure 29: Area 6 with small mound in its centre, facing south (left); retaining wall east of Area 6 (right)

2.5.2.7 Area 7, Chainage 1.050 to 1.320

Physical Environment

Area 7 crosses a large, level area of land, rising gently to the east, and bounded at its east side by a tall bank or ridge which forms the boundary between Castletown and Stephenstown townlands (Figure 30).

Archaeological Potential

Geophysical survey in Area 7 did not detect any features of archaeological potential, the only clear anomalies being northwest/southeast aligned linears, thought to be former field boundaries. Area 7 has low potential for the discovery of previously unrecorded archaeological sites and low to moderate sensitivity with regard to known sites impacted by the proposed development.

2.5.2.8 Area 8, Chainage 1.320 to 1.550

Physical Environment

Forming the east of Area 8 is an intersection of four fields; the preferred route option crosses a thick hedgerow as well as a farm track that connects with the Stephenstown Estate; a gateway with metal gate to the north of the preferred route option, and to the east of this track are two large fields: Areas 9 and 10.

Archaeological Potential

Geophysical survey did not detect anything of archaeological interest – the survey did record regular and closely spaced east/west lines which are probably cultivation furrows. Area 8 has low potential for the discovery of previously unrecorded archaeological sites and low sensitivity with regard to known sites impacted by the proposed development.

Figure 30: Area 7 facing east (left); Area 8 facing southwest (right)

2.5.2.9 Area 9, Chainage 1.550 to 1.850

Physical Environment

Area 9 was under tall crops (Figure 31). Area 9 crosses gently undulating land and the slope has a west-facing aspect.

Archaeological Potential

At the time the geophysical survey was carried out, Area 9 was under crop and was not surveyed. Although no anomalies were observed its archaeological potential cannot be assessed.

2.5.2.10 Area 10, Chainage 1.850 to 2.000

Physical Environment

Area 10 was under tall crops (Figure 31). Area 10 crosses gently undulating land and the slope has an east-facing aspect.

Archaeological Potential

At the time the geophysical survey was carried out, Area 10 was under crop and was not surveyed. Although no anomalies were observed its archaeological potential cannot be assessed.

Figure 31: Western side of Area 9, facing north (left); Area 10, facing west (right)

2.5.2.11 Area 11, Chainage 2.000 to 2.100

Physical Environment

Area 11 is a small, flat and low-lying field which is bounded to its east and north by a stream. At the northeast corner is a hollow of boggy ground which was the subject of geotechnical testing which was monitored by Niall Roycroft.

Archaeological Potential

Geotechnical testing of the hollow in Area 11 was monitored by Niall Roycroft who reported upon the work and the potential natural or cultural status of this feature (discussed above), which remains undetermined. The proximity of the hollow near to the mounded site just to the northeast (recorded as a ringfort-rath - ME012-004---) is conspicuous. The edges of the hollow fall at a regular angle, and it is possible that this is an artificially excavated basin (Figure 32). Geophysics detected some magnetic positives in this field. Area 11 has moderate potential for the discovery of previously unrecorded archaeological sites and low sensitivity with regard to known sites impacted by the proposed development.

Figure 32: Boggy ground – 'Stephenstown hollow' – at the north of Area 11

2.5.2.12 Area 12, Chainage 2.100 to 2.250

Physical Environment

Area 12 crosses a small portion of a field which is bounded to the west by a farm track in a cutting that is bordered to the west by a south-north flowing stream (Figure 33).

Archaeological Potential

Just to the north of Area 12 is a prominent mounded site, classed as a ringfort-rath (ME012-004---), though it resembles a motte; it stands at a distance of approximately 80m from the preferred route option at its nearest point (Figure 33, Figure 34). Geophysical survey in this field identified a number of linear features, but only the northern half of the preferred route option corridor was surveyed. Though no above-ground archaeological features are visible within Area 12, the proximity of the registered monument and the results of geophysics gives this area high potential for the discovery of previously unrecorded archaeological sites and low sensitivity with regard to known sites impacted by the proposed development.

2.5.2.13 Area 13, Chainage 2.250 to 2.410

Physical Environment

Area 13 runs perpendicular to a long, west-facing slope which has a moderate incline at its top, eastern end and gentler middle and lower slopes. The location affords fine views to the west, including in the near vicinity the mounded rath (ME012-004---) and the rolling hills behind (Figure 35).

Archaeological Potential

There are no prominent landscape features on the hillside, but geophysical survey detected a large number of linear anomalies in Area 13, some of which may be drainage ditches or former field boundaries, but which also include curvilinear and subcircular shapes. The upper, eastern end of Area 13 is bounded by a deep ditch and hedgerow which is the boundary between Stephenstown and Fringestown townlands. Area 13 has moderate to high potential for the discovery of previously

unrecorded archaeological sites and low to moderate sensitivity with regard to known sites impacted by the proposed development.

Figure 33: Mounded rath (ME012-004---) to the north of Area 12 – view from the closest point of the preferred route option (left); the rath and farm track running to its west (right)

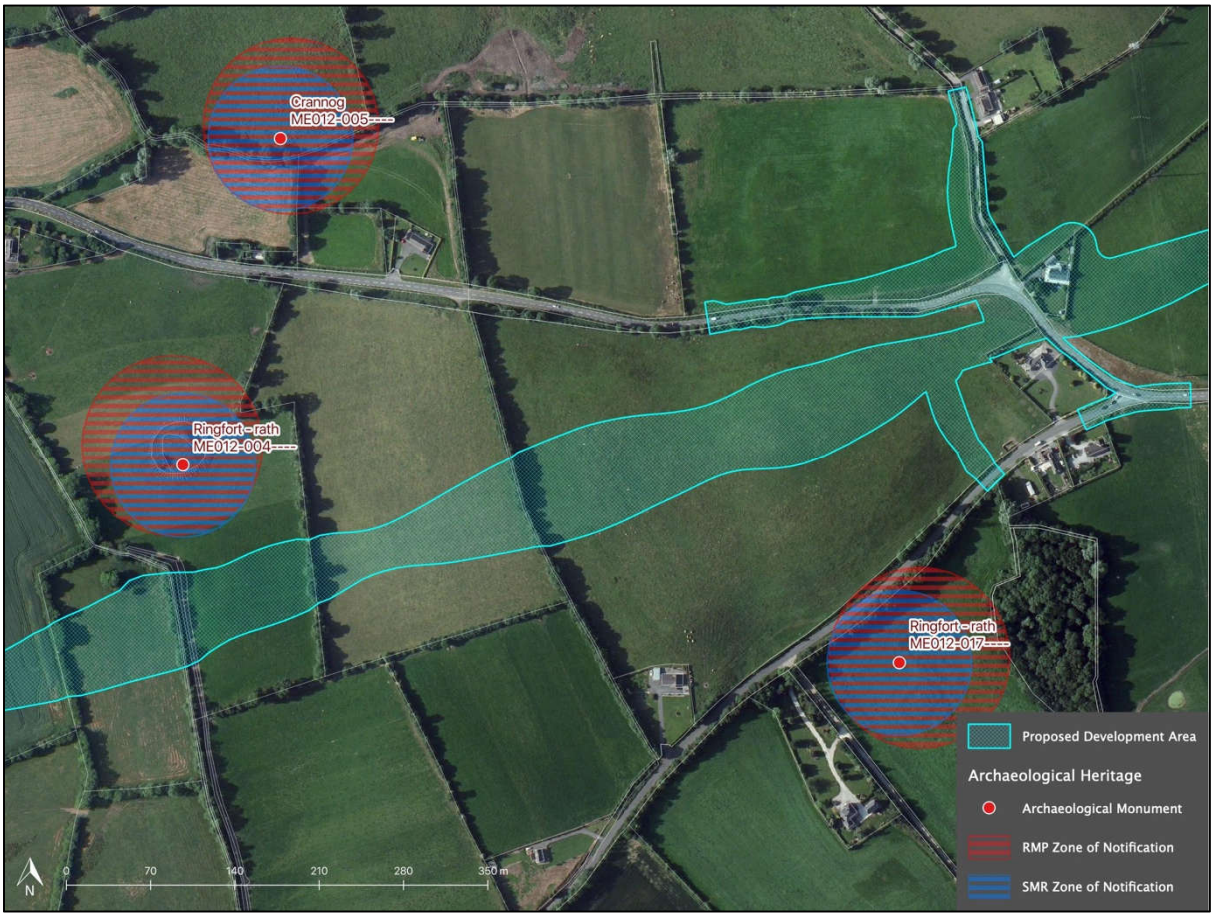

Figure 34: Map of Areas 12-15 in the centre of the preferred route option, at Stokes Cross Roads

Figure 35: Area 13, views facing west along the preferred route option alignment, with the rath ME012-004--- visible in the middle ground

2.5.2.14 Area 14, Chainage 2.410 to 2.860

Physical Environment

Area 14 crosses a large, open field to the southwest of Stokes Crossroads, the junction between the N52 and Castletown Road (Figure 34). In the centre of the field is a prominent hillock (drumlin) and the western end of the area rises to a ridge at the western boundary of Fringestown townland (Figure 36). The field is open, uncultivated pasture.

Archaeological Potential

Geophysical survey here detected a number of linear anomalies: the 2015 survey recorded part of a sub-rectangular enclosure to the south and outside of the present preferred route option (Nicholls 2015: 4-5). Within the present preferred route option boundary, geophysics located potential pits and ditches, and the more recent survey located what are called 'poorly defined and small-scale positives of potential interest' (Nicholls 2019: 10). There is no surface expression of any archaeological features in this field. Area 14 has moderate potential for the discovery of previously unrecorded archaeological sites and low sensitivity with regard to known sites impacted by the proposed development.

Figure 36: Raised ground in the centre of Area 14, facing east (left); view facing west towards low ridge marking the Stephenstown-Fringestown townlands boundary (right)

2.5.2.15 Area 15, Chainage 2.860 to 3.160

Physical Environment

Area 15 is immediately north of Stokes Crossroads, where the preferred route option crosses to the northern side of the present N52 alignment (Figure 34). Area 15 crosses an undulating field with a generally north sloping aspect.

Archaeological Potential

At the southwest corner of the field, abutting the verge of the N52 and a modern property parcel, magnetometer survey detected a feature described in the report as an 'oval enclosure, c.36m NW-SE with large and small-scale responses at interior and periphery suggesting ditch remains, probable pit locations and postholes' (Nicholls 2019: 10) (Figure 37). From the south of the enclosure, two parallel lines form an off-shoot to the southwest, and another linear off-shoot is on the north; a curved linear feature intersects with and seems to overlie the enclosure ditch on its north side.

Archaeological test excavations confirmed the presence of a ditch, expressed as a dark fill against the background natural soil and as a cut into the natural ground; in places the fill contained fragments of animal bone and charcoal (see excavation report in Appendix for details). The ditched enclosure is located on slightly raised ground which gradually slopes downwards to the north and east (Figure 38). There is no above ground expression for the feature in terms of ditches or banks, but it does occupy a conspicuously raised portion of ground in the western corner of the field.

South-east of the enclosure, geophysics detected 'multiple poorly defined linear anomalies and discrete positives suggesting substantial archaeological settlement' (Nicholls 2019: 10). These are located just to the south of the route corridor.

The enclosure may be interpreted as a rath, a relatively common form of archaeological site in the locality (six raths, as well as two enclosures, are recorded within 1km of the PDA) and a widespread feature of early medieval settlement across Ireland. Unlike the raths recorded on the RMP, this site does not have any features visible above ground – test excavations suggest the archaeological features are truncated, and this would have erased any previously existing above-ground elements. While the enclosure is confirmed as an archaeological site which would qualify for inclusion on the RMP, it does not have any higher heritage status, for example as a National Monument. Therefore, it can be considered to have a 'moderate' level of significance and sensitivity; as the site is located entirely within the PDA, the magnitude of impact is rated as 'high'; the impact significance is rated as 'significant'.

Due to the verified presence of the ditched enclosure, and the linear anomalies detected by geophysics, Area 15 has high potential for the discovery of previously unrecorded archaeological sites and low to moderate sensitivity with regard to known sites impacted by the proposed development.

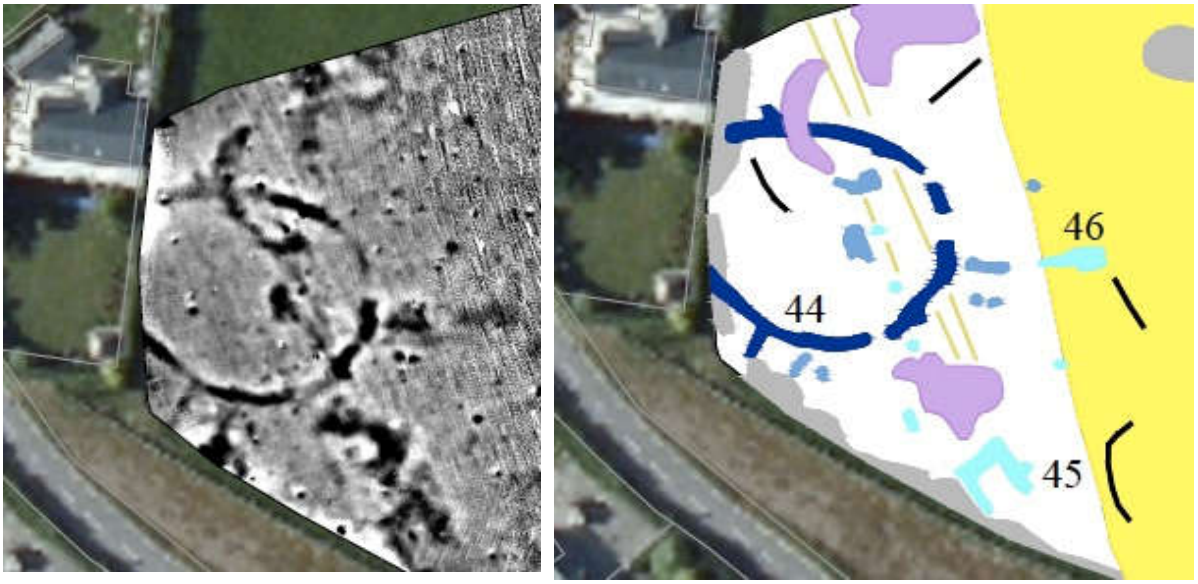

Figure 37: Magnetometer results and interpretation of results in Field 15 (after Nicholls 2019)

Figure 38: Location of possible enclosure in Area 15, facing north across the N52 at Stokes Cross (left) and west across open pasture (right)

2.5.2.16 Area 16, Chainage 3.160 to 3.420

Physical Environment

Area 16 crosses fairly level ground on the north side of the N52, with no distinctive topographic features.

Archaeological Potential

Geophysical survey detected 'poorly defined linear responses and small-scale positives of uncertain origin', with no responses of definite archaeological character (Nicholls 2019: 10). Area 16 has low to moderate potential for the discovery of previously unrecorded archaeological sites and low sensitivity with regard to known sites impacted by the proposed development.

2.5.2.17 Area 17, Chainage 3.420 to 3.600

Physical Environment

Area 17 is a small field beside a farm, which forms the modern boundary between Fringestown and Mitchelstown townlands, and crosses level ground on the north side of the N52.

Archaeological Potential

Geophysics did not detect any responses of definite archaeological character in Area 17, although here there were small-scale positives of potential note (Nicholls 2019: 11). Area 17 has low to moderate potential for the discovery of previously unrecorded archaeological sites and low sensitivity with regard to known sites impacted by the proposed development.

2.5.2.18 Area 18, Chainage 3.600 to 3.710

Physical Environment

Area 18 crosses a small field to the east of a farm. The ground appears heavily eroded, and land use here includes modern farming practices as well as quarrying – there are several quarry pits just to the north of the preferred route option.

Archaeological Potential

In the western portion of Area 18, geophysical survey detected several linear responses, although none of definite archaeological character (Nicholls 2019: 11), and the ground here appears uneven, perhaps as the result of modern building or dumping of materials (Figure 39). However, the presence of curvilinear responses from the geophysical survey merits further investigation. A modern agricultural shed and yard of no cultural heritage significance will be removed. Area 18 has moderate potential for the discovery of previously unrecorded archaeological sites and low sensitivity with regard to known sites impacted by the proposed development.

2.5.2.19 Area 19, Chainage 3.710 to 4.070

Physical Environment

Area 19 crosses a moderate to steep, southeast-facing slope from which there are good views to the east (Figure 39).

Archaeological Potential

Geophysical survey across the southwest portion of this area found responses described as 'possible segment of weakly magnetic enclosure ditch' along the northern boundary of the preferred route option (Nicholls 2019: 11). This is on the more level side of the field, and the fairly steep aspect of the slope across the rest of the area suggests there being less archaeological potential here. A house which does not appear on either the 1st or 2nd Edition OS maps, and does not appear on any heritage database or designation will be removed at this location. Overall, Area 19 has moderate potential for the discovery of previously unrecorded archaeological sites and low sensitivity with regard to known sites impacted by the proposed development.

Figure 39: Area 18, facing west towards area where geophysics recorded several linear responses (left); the moderate to steep slope crossed by Area 19 as it returns to meet the present N52 alignment (right)

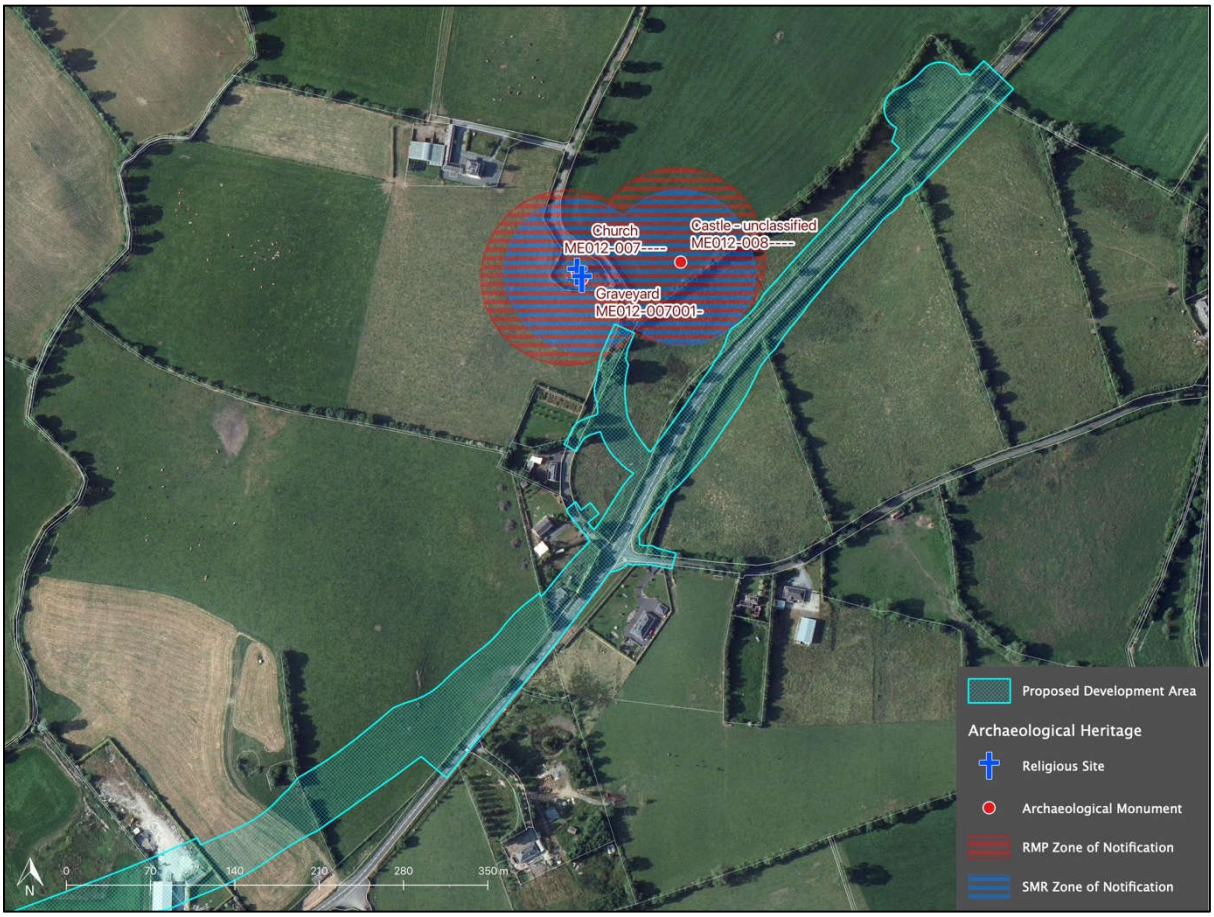

Figure 40: Map of the eastern end of the preferred route option at Clontail townland, including Area 20

2.5.2.20 Area 20, Chainage 4.070 to 4.555

Physical Environment

Area 20 is formed by a portion of land northwest of the current N52 alignment and east of a local road in Clontail. At its western end, the field is on raised ground, which slopes to the northeast.

Archaeological Potential

Magnetometer survey here detected a feature described as a 'sub-circular enclosure c.35m in diameter, containing multiple linear, pit and posthole features, with external ditch remains and positive responses evident to E' (Nicholls 2019: 12) (Figure 41). The possible enclosure is located on raised ground which slopes downwards to the northeast. There is not any surface expression of the enclosure, and there are signs of ground disturbance in its near vicinity (Figure 42).

Test excavations confirmed the presence of a ditched enclosure and located a number of other subsurface archaeological features including a rectangular posthole and a pit in which was found a piece of metal slag (see excavation report in Appendix for details). The ditched enclosure is located outside the preferred route alignment and will not be directly impacted upon. During construction the site will be permanently fenced off and clearly demarcated to ensure there will be no impact from construction works or construction traffic.

The enclosure may be interpreted as a rath, a relatively common form of archaeological site in the locality (six raths, as well as two enclosures, are recorded within 1km of the PDA) and a widespread feature of early medieval settlement across Ireland. Unlike the raths recorded on the RMP, this site does not have any features visible above ground – test excavations suggest the archaeological features are truncated, and this would have erased any previously existing above-ground elements. While the enclosure is confirmed as an archaeological site which would qualify for inclusion on the RMP, it does not have any higher heritage status, for example as a National Monument. Therefore, it can be considered to have a 'moderate' level of significance and sensitivity; as the site is located just outside the PDA (but may have features that extend into the PDA and includes features verified through testing which are only 5m distance from the PDA boundary line), the magnitude of impact is rated as 'medium'; the impact significance is rated as 'moderate'.

Due to the verified presence of the ditched enclosure, and the linear anomalies detected by geophysics, Area 15 has high potential for the discovery of previously unrecorded archaeological sites and low to moderate sensitivity with regard to known sites impacted by the proposed development.

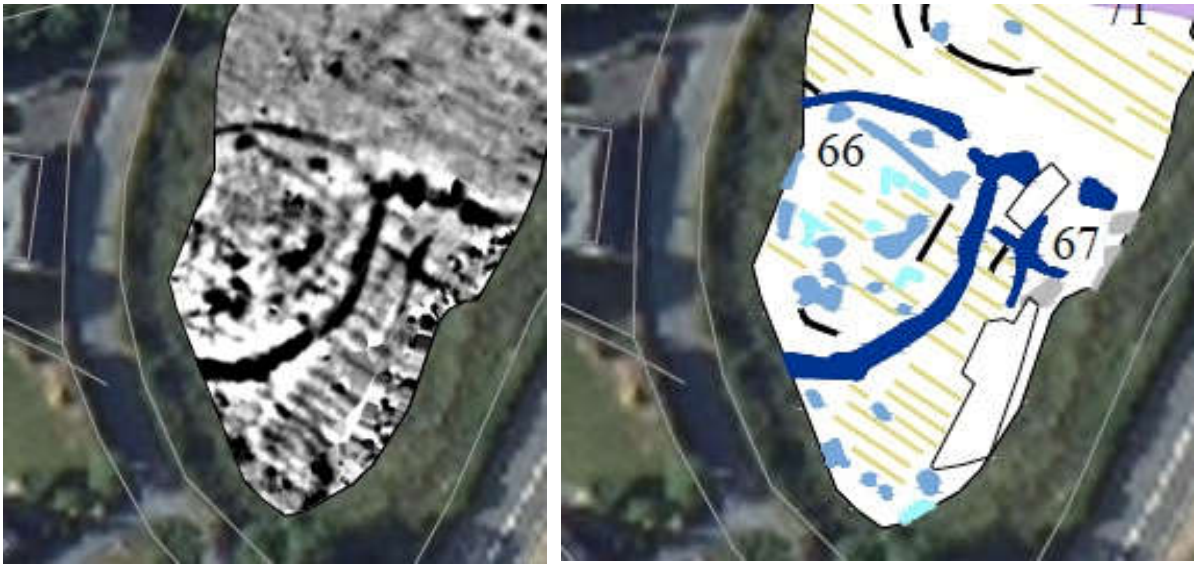

Figure 41: Magnetometer results and interpretation of results in Field 20 (after Nicholls 2019)

Figure 42: Location of the feature detected in Area 20, facing north (left) and view from the location of the feature facing east (right)

2.5.2.21 Area 21, Chainage 4.555 to 4.800

Physical Environment

Area 21 is a flat field on the south/east side of the present N52 alignment. This area was surveyed with geophysics but is not located within the preferred route option.

Archaeological Potential

Geophysics detected some magnetic positives in Area 21. The field has low to moderate potential for the discovery of previously unrecorded archaeological sites and low sensitivity with regard to known sites impacted by the proposed development.

2.5.2.22 Clontail

Further survey inspected the locality of Clontail, where there are three recorded archaeological monuments: the graveyard, church and location of Stokestown Castle (Figure 40). These locations, north of the preferred route option, were visited to ascertain the potential impact of the development on these places. The graveyard (ME012-007001---) is situated on a prominent hillock, skirted by a road and embanked with a retaining wall, whose sides are so steep as to suggest this to be an artificially constructed mound (Figure 43). On top of the hillock there are wall alignments which are suspected to be the location of the church (ME012-007---). From this position there are fine views to the east and south, and the proposed location of the road can be seen to the southwest (Figure 43). There are no visible remains of any structure at the supposed location of Stokestown Castle (ME012-008---).

Figure 43: Northeast side of Clontail graveyard (left); view facing southwest from the top of Clontail graveyard, along the preferred route option (right)

2.6 Potential Impacts

The nature of the impacts is assessed with reference to the Glossary of Impacts provided in the Advice notes on Current Practices in the preparation of Environmental Impact Statements (EPA 2003), the draft Revised Guidelines on the Information to be contained in Environmental Impact Statements (EPA 2015), Guidelines for the Assessment of Architectural Heritage Impact of National Road Schemes (NRA 2006) and Guidelines for the Assessment of Archaeological Heritage Impact of National Road Schemes (NRA 2006).

Table 8 lists all the individual sites and potential sites which are located within or in the immediate vicinity of the landtake/CPO and describes the type of impact experienced and mitigation recommended; Table 9 lists the six recorded archaeology sites close to the PDA, with an assessment of impacts on their settings. The overall level of impact is calculated by assessing the sensitivity/significance of the resource against the magnitude of the impact producing an overall significance rating (Appendix 4).

2.6.1 Potential Direct Impacts

Direct negative impacts may occur where sites of archaeological, architectural and cultural heritage significance are located within the footprint of the proposed development, which would potentially be impacted upon by ground disturbances.

In relation to the proposed development, direct, physical impacts on the archaeological, architectural and cultural heritage can manifest themselves in the following ways:

- Where an archaeological, architectural or cultural heritage site, structure, monument or feature is located within an area where works takes place and the works either intentionally or unintentionally entail the alteration or removal of all or part of the site, structure, monument or feature a direct, physical impact will occur;
- Direct, physical impacts can also occur in gaining access to the site. Where archaeological, architectural or cultural heritage sites, structures, monuments or features are intentionally or unintentionally removed or altered when transporting and/or facilitating access for machinery, equipment and/or materials to or from site a direct physical impact will occur; and

- There is the potential for direct, physical impacts on previously unrecorded archaeological and architectural sites, structures, monuments or features.

If these impacts cannot be remediated, for example if archaeological deposits are destroyed during excavations, then the impacts will be permanent.

2.6.1.1 Potential direct Impacts on Recorded Archaeological Monuments

There will be no direct impact on any recorded archaeological monuments by the proposed development. The road alignment runs close to (within 100m of) six recorded monuments and is partially with the ZoN of three of these monuments (Figure 4). There is potential for archaeological material associated with the recorded monuments to extend into the preferred route option, which therefore may be impacted by the development.

2.6.1.2 Potential direct Impacts on unrecorded Archaeological Monuments

On the basis of results from geophysical surveys, ground survey and test excavations, it is established that there are previously unrecorded (undesignated) archaeological features within the preferred route option. Test excavations have confirmed the presence of three ditched enclosures (two entirely within the proposed route and one very close); geophysical survey located a number of other potential archaeological features including possible pits, a possible fulacht fiadh/burnt mound, a building foundation, and linear trends; and field and desk survey recorded additional potential sites including a mound, trackways, historic townland boundaries and a hollow near to a raised rath. In total, 46 archaeological sites or undesignated potential cultural heritage sites have been identified (Table 8). Of these sites or potential sites 41 will be directly impacted upon by the proposed development.

2.6.1.3 Potential direct Impacts Architectural Sites

There are no Protected Structures or NIAH register sites within the preferred route option or adjacent to the route alignment. However, there are a number of undesignated vernacular features including historic townland boundaries and field boundaries formed by ditches, hedges and walls and the embankment and bridge of the disused Navan and Kingscourt railway. Therefore, while there is likely to be no direct impact on any Protected Structures or NIAH sites, some undesignated historical and vernacular features are likely to be impacted. In most cases, the impact is major within the landtake, but is small in relation to the overall feature, for example, a 40m section of the railway embankment will be impacted.

2.6.1.4 'Do Nothing scenario'

In this instance, there would be no impact on any potential unrecorded sub surface deposits.

2.6.1.5 'Worst Case' scenario'

In this case, construction work could potentially negatively impact previously unknown sites resulting in the loss or damage of archaeological artefacts and features.

2.6.2 Potential Impacts on setting

Impacts on setting are primarily visual and examine the effect of the development upon the setting of a site within the wider landscape. Visual impacts can be reduced with sensitive site development and screening. The impact of the development is usually proportional to the extent to which that development is visible to and from the extant recorded monuments and features.

2.6.2.1 Archaeological Sites

There are no recorded archaeological sites/monuments located within the boundary of the preferred route option. However, there are 22 archaeological (RMP) monuments, equating to 16 sites, within 1km of the preferred route option. Of these, six are within 100m of the preferred route option (ME012-004----, ME012-007----, ME012-008----, ME012-012----, ME012-013---- and ME012-014----), three of which have Zones of Notification that extend into the preferred route option.

Following the review of information and the field survey, it is concluded that there will be an impact on the setting of these six archaeological sites. The impact on four of these sites is 'minor/low'. The impact on the setting of two of these sites (ME012-004---- and ME012-014----) is classed as 'medium'.

The bivallate ringfort ME012-014----, is located at the intersection of three field boundaries and the PDA passes through two of the associated fields on a substantial embankment as it heads east. The site is located approximately 50m from the landtake in Area 4 and its Zone of Notification is just beyond the route corridor. Where the site is currently located approximately 100m from the existing N52 and is shielded by tall hedgerows, the proposed development will bring the road within approximately 50-60m of the site.

The rath ME012-004---- is situated on a prominent (artificial) mound with no associated vegetation and expansive views over the surrounding area. The site is located approximately 80m from the route corridor in Area 12 and its Zone of Notification is just beyond the route corridor. Where the site is currently located 125m south of the existing N52 and is partially obscured from view by the undulating terrain, the proposed development will bring the road to within 80m of the site across flat terrain.

The impact of the proposed development on the setting of the other four sites in the vicinity is minor. At the western end, the new route will take the road further away from the raths ME12-012---- and ME12-013-- (as described above in the survey report, Section 2.5.2.1). In the east, the route passes close to Clontail Church with its associated graveyard (ME012-007---- and ME012-007001-) and the adjacent unclassified castle (SMR No. ME012-008----), but follows an alignment similar to the existing road, and impacts on the setting of these sites will be largely unchanged.

2.6.2.2 Architectural Sites

There are no recorded architectural sites whose setting is likely to be affected by the proposed development. Impacts on the setting of unrecorded architectural features were assessed as slight.

2.6.3 Construction Phase Impacts

Archaeological and cultural heritage issues will be resolved where possible at the pre-construction and construction stages of the development. This will include any necessary archaeological monitoring and

inspection work required along the proposed road development during the site preparation/ advanced works phase of the development.

CHS20-01, the ditched enclosure in Clontail townland will be permanently fenced off and clearly demarcated to ensure there will be no impact from construction works or construction traffic.

The contractor or sub-contractor working on the site during the construction phase will be subject to the relevant planning legislation and to the National Monuments legislation and will comply with national policy guidelines and statutory provisions for the protection of the archaeological, architectural and cultural heritage.

For works that may be located outside the CPO of the approved development such as site compounds and other temporary works areas or ancillary works such as haul roads that are directly related to the proposed route, the contractor or sub-contractor is subject to the relevant planning legislation. The National Monuments Service of the DCHG will be contacted in advance of such works so that advice may be issued with regard to the relevant permission required to carry out the work.

2.6.4 Operational Phase

Archaeological and cultural heritage surveys and investigations will be completed by the operational phase of the development.

2.6.5 Predicted Residual Impacts

2.6.5.1 Construction Phase

Residual impacts in relation to the setting of archaeological monuments in terms of visibility to and from monuments (see Table 9) are envisaged.

During the construction phase a mechanism for recording, protecting and where necessary resolving existing archaeological monuments and newly revealed sites within the landtake will have to be agreed with the TII Project Archaeologist and The National Monuments Service of the DCHG.

If features are to be left in-situ, detailed plans will be required as to the layout and extent of these features/ sites as well as a geographical location. Before and after photographs will be required as well as a full report on the preservation of the site and how this was achieved, by the National Monuments Service.

2.6.5.2 Operational Phase

Residual impacts in relation to the setting of archaeological monuments in terms of visibility to and from monuments (see Table 9) are envisaged.

It is anticipated that after mitigation measures have been applied to direct impacts that there will be no significant residual archaeological and cultural heritage impacts. With excavation and planned recording, a comprehensive record will be achieved throughout the proposed road development at the pre-construction and construction stage of the development.

3 Mitigation Measures and Residual Impacts

Archaeological research and fieldwork identified 52 sites or possible sites within and in the immediate vicinity of the N52 Grange to Clontail road alignment. Six of the 52 sites are recorded archaeological monuments which are close to the alignment and will not be directly physically impacted by the development (an assessment of the impact on the settings of these sites is contained in Table 9). Five of these sites comprise geophysical anomalies located outside the alignment. The remaining 41 sites, two of which are confirmed as ditched enclosures, are within the alignment and will be impacted by the development (Table 8).

The following mitigation measures are recommended in different areas of the route alignment as summarised in Table 7 and detailed in Table 8.

- Excavation – This will entail licensed archaeological excavation in full of any identified archaeological remains.
- Targeted testing –A targeted programme of archaeological testing will involve mechanically removing topsoil at the location of the potential features identified from geophysical survey and ground survey followed by investigation by hand in order to establish the nature and extent of any archaeological deposits that may be present. Should any subsurface archaeological features be encountered, an appropriate mitigation strategy will be implemented. This may entail licensed archaeological excavation in full or part of any identified archaeological remains.
- General testing – of the whole road alignment. This typically will involve testing of 12% of the landtake using central line trenches with off-sets. Identified archaeological sites may require full excavation. A programme of archaeological test trenching will be designed in order to establish the presence or absence, as well as the nature and extent, of any archaeological deposits that may be present. Should any subsurface archaeological deposits or features be encountered, an appropriate ameliorative strategy will be implemented. This will entail licensed archaeological excavation in full or part of any identified archaeological remains (preservation by record).
- Survey recording – of identified features such as townland boundaries – by means of measured survey, photography, collection of spatial data and written description.
- Archaeological monitoring.

Test Excavation Strategy

Given the presence known archaeological sites in proximity to the proposed realignment, the identification of new areas of archaeological potential and the proven potential for discovery of previously unknown sites or features along the proposed route, it is proposed that a programme of archaeological blanket test excavation in accordance to the guidelines be undertaken within the land acquisition area of the proposed road realignment.

The purpose of this blanket testing strategy is to determine the location, date, nature and extent of any previously unknown archaeological sites.

The testing strategy will be guided by the results of the geophysical, geotechnical data and test excavation results. These findings will be used to inform the layout of the archaeological test excavation trenches.

The archaeological test trenching strategy shall entail mechanical excavation of a 2m wide (or at least a 1.8m wide) trench along the centre-line of the proposed route with regular off set trenches to the edge of the landtake to comprise a testing sample of a minimum of 12% of land take. The frequency and pattern of the trenching layout is not prescribed and the testing array may vary from one area to another, with the agreement of the TII Project Archaeologist, the DCHG and the NMI to take account of local topographic factors. In areas of increased archaeological potential the level of testing can be increased accordingly.

The process of archaeological excavation, recording and publication of results ensures that all the features are recorded and excavated in advance of development.

Excavation results in the removal of archaeological remains from their natural environment. Archaeological excavation ensures that this removal is systematically and accurately recorded, drawn and photographed, providing a paper and digital archive and adding to the archaeological knowledge of a specified area. The detailed technical reports arising from this will form part of the national archive of archaeological data in the Sites and Monuments record curated by the DCHG.

Features and sites that have been investigated by advance test excavation and have proven to be archaeological in nature will be excavated by hand - for example the verified ditched enclosures in Areas 5 and 15.

As far as is practicably possible these works should be completed in advance of construction. Should there be areas that are not available for advance works, then archaeological monitoring of those areas during construction may be required.

PLEASE NOTE: the above recommendations are subject to the approval of the National Monuments Section at the Department of Culture, Heritage and the Gaeltacht.

4 Conclusions

Geophysical and ground survey identified additional areas of archaeological potential. Three clearly defined subcircular features identified by geophysical survey were investigated using test excavations, which confirmed the presence of archaeological features and deposits at all three locations. A total of 52 recorded sites, anomalies or areas of archaeological potential are identified within and close to the proposed road alignment. Six of these are recorded archaeological monuments which are close to the alignment and will not be directly physically impacted by the development, five others are geophysical anomalies also located outside the alignment; the remaining 41 anomalies or areas of archaeological potential are within the preferred route alignment.

Overall, the general area supports substantial early medieval and medieval occupation. This is reflected in the concentration of raths, which assessment and fieldwork for the proposed development has supported through the identification, through geophysics and test excavation, of another three circular enclosures that do not have any above-ground expression. Fewer pre-medieval monuments have been

recorded, but evidence of long-term, prehistoric occupation in the wider area is found further to the west, at Raffin Fort.

The level of impact of the proposed development on the cultural heritage resource has been calculated by assessing the sensitivity/significance of sites and potential sites against the magnitude of the impact producing an overall significance rating. The methodology for this is described in more detail in Appendix 4 of this document.

Prior to the mitigation measures described herein in section 3 of this document there will be 41 direct physical impacts on archaeological features and sites or potential archaeological features or sites. These include the following:

- Three direct impact with an impact significance level of significant.
- Thirty-six direct impacts with an impact significance level of moderate.
- Two direct impacts with an impact significance level of slight or none.

There will be an impact on the setting of six archaeological sites. The impact on four of these sites is 'minor/low'. The impact on the setting of two of these sites (ME012-004---- and ME012-014----) is classed as 'medium'.

It is anticipated that after mitigation measures have been applied to direct impacts that there will be no significant residual archaeological and cultural heritage impacts as outlined in Table 8. With excavation and planned recording, a permanent record will be achieved throughout the proposed road development at the pre-construction and construction stage of the development.

Table 7: Summary of impacts and mitigation per area of the proposed development area

Area	Townland	Identified sites	Impacted sites	Mitigations recommended
1	Castletown (Morgallion)	3	0	None
2	Castletown (Morgallion)	4	4	Targeted testing, general testing, survey recording
3	Castletown (Morgallion)	3	3	General testing
4	Castletown (Morgallion)	4	3	General testing
5	Castletown (Morgallion)	5	5	Excavation, general testing
6	Castletown (Morgallion)	3	3	Targeted testing, general testing, survey recording
7	Castletown (Morgallion)	2	2	General testing, survey recording
8	Stephenstown	1	1	General testing
9	Stephenstown	1	1	General testing, survey recording
10	Stephenstown	0	0	General testing
11	Stephenstown	2	2	General testing
12	Stephenstown	2	1	General testing
13	Stephenstown	2	2	General testing, survey recording
14	Fringestown	3	3	Targeted testing, general testing
15	Fringestown	4	2	Excavation, targeted testing, general testing
16	Fringestown	1	1	General testing
17	Fringestown	2	1	General testing
18	Mitchelstown	1	1	General testing
19	Mitchelstown	3	2	Targeted testing, general testing
20	Clontail	5	3	Excavation, targeted testing, general testing
21	Clontail	1	0	None

Table 8: Catalogue of sites, impacts and mitigation measures

Area	ID No.	Site type	Description	Townland	Relation to landtake	Chainage	Confidence	Sensitivity	Magnitute of Impact	Impact Significance	Mitigation	Residual Impact
1	CHS01-01	Geophysics	Tentative pit locations (geophysics response nos. 1-3)	Castletown (Morgallion)	Adjacent/ Outside LMA (20m)	Beetween 0.100 and 0.150	Weak	Low	Low	None	None	None
2	CHS02-01	Geophysics	Potential fulacht fiadh/burned mound (geophysics response no. 4)	Castletown (Morgallion)	Within	0.220	Moderate	Low	Medium	Potentially moderate	Targeted testing	None
2	CHS02-02	Geophysics	Possible building foundation (geophysics response no. 5)	Castletown (Morgallion)	Within	0.140	Moderate	Low	Medium	Potentially moderate	Targeted testing	None
2	CHS02-03	Geophysics	Tentative features (geophysics response no. 6)	Castletown (Morgallion)	Within	0.220	Weak	Low	Medium	Potentially moderate	General testing	None
2	CHS02-04	Survey	Railway embankment	Castletown (Morgallion)	Within	0.320	Strong	Moderate	Medium	Moderate	Survey recording	None
3	CHS03-01	Geophysics	Possible pit locations and linear trend (geophysics response no. 7)	Castletown (Morgallion)	Within	0.345	Weak	Low	Medium	Potentially moderate	General testing	None
3	CHS03-02	Geophysics	Possible pit location and linear trend (geophysics response no. 8)	Castletown (Morgallion)	Within	0.410	Weak	Low	Medium	Potentially moderate	General testing	None
3	CHS03-03	Geophysics	Possible pit locations (geophysics response nos. 9-10)	Castletown (Morgallion)	Within	Beetween 0.450 and 0.500	Weak	Low	Medium	Potentially moderate	General testing	None
4	CHS04-01	Geophysics	Possible pit locations	Castletown (Morgallion)	Within	Beetween 0.520 and 0.550	Weak	Low	Medium	Potentially moderate	General testing	None

Area	ID No.	Site type	Description	Townland	Relation to landtake	Chainage	Confidence	Sensitivity	Magnitute of Impact	Impact Significance	Mitigation	Residual Impact
			(geophysics response nos. 11-12)									
4	CHS04-02	Geophysics	Possible pit locations and linear trend (geophysics response no. 13)	Castletown (Morgallion)	Within	0.570	Weak	Low	Medium	Potentially moderate	General testing	None
4	CHS04-03	Geophysics	Magnetic positives (geophysics response nos. 14-15)	Castletown (Morgallion)	Within	Beetween 0.600 and 0.620	Weak	Low	Medium	Potentially moderate	General testing	None
5	CHS05-01	Geophysics and test excavation	Ditched enclosure (geophysics response no. 16); sections identified during test excavation	Castletown (Morgallion)	Within	0.850	Strong	Moderate	High	Significant	Excavation	None
5	CHS05-02	Geophysics and test excavation	Ditch (geophysics response no. 17), located during test excavation	Castletown (Morgallion)	Within	0.880	Strong	Moderate	High	Significant	Excavation	None
5	CHS05-03	Geophysics	Magnetic positives (geophysics response nos. 18-21)	Castletown (Morgallion)	Within	Beetween 0.780 and 0.940	Weak	Low	Medium	Potentially moderate	General testing	None
5	CHS05-04	Geophysics	Magnetic positives (geophysics response nos. 22-24)	Castletown (Morgallion)	Within	Beetween 0.840 and 0.890	Weak	Low	Medium	Potentially moderate	General testing	None
5	CHS05-05	Geophysics	Magnetic positives (geophysics response no. 25)	Castletown (Morgallion)	Within	0.950	Weak	Low	Medium	Potentially moderate	General testing	None
6	CHS06-01	Geophysics and survey	Potential fulacht fiadh/burned mound (geophysics response no. 26)	Castletown (Morgallion)	Within	1.000	Weak	Low	Medium	Potentially moderate	Targeted testing	None
6	CHS06-02	Geophysics	Magnetic positives (geophysics response nos. 27-28)	Castletown (Morgallion)	Within	1.000	Weak	Low	Medium	Potentially moderate	General testing	None

Area	ID No.	Site type	Description	Townland	Relation to landtake	Chainage	Confidence	Sensitivity	Magnitute of Impact	Impact Significance	Mitigation	Residual Impact
6	CHS06-03	Survey	Retaining wall between 6-7	Castletown (Morgallion)	Within	1.050	Strong	Moderate	Medium	Moderate	Survey recording	None
7	CHS07-01	Geophysics	Magnetic positives (geophysics response nos. 29-30)	Castletown (Morgallion)	Within	1.175	Weak	Low	Medium	Potentially moderate	General testing	None
7	CHS07-02	Mapping and survey	Townland boundary between Area 7 (Castletown) and 8 (Stephenstown)	Castletown (Morgallion) / Stephenstown	Within	1.340	Strong	Moderate	Medium	Moderate	Survey recording	None
8	CHS08-01	Geophysics	Magnetic positives (geophysics response nos. 31-32)	Stephenstown	Within	Beetween 1.360 and 1.410	Weak	Low	Medium	Potentially moderate	General testing	None
9	CHS09-01	Mapping and survey	Track - demesne access	Stephenstown	Within	1.600	Strong	Moderate	Medium	Moderate	Survey recording	None
11	CHS11-01	Geophysics	Magnetic positives (geophysics response no. 33)	Stephenstown	Within	2.070	Weak	Low	Medium	Potentially moderate	General testing	None
11	CHS11-02	Survey	Hollow, possible archaeological status; test pits excavated	Stephenstown	Within	2.100	Weak	Low	Medium	Potentially moderate	General testing	None
12	CHS12-01	Geophysics	Magnetic positives (geophysics response no. 34)	Stephenstown	Within	2.170	Weak	Low	Medium	Potentially moderate	General testing	None
13	CHS13-01	Geophysics	Magnetic positives (geophysics response nos. 35-37)	Stephenstown	Within	2.290	Weak	Low	Medium	Potentially moderate	General testing	None
13	CHS13-02	Mapping and survey	Townland boundary between Area 13 (Stephenstown) and 14 (Fringestown)	Stephenstown/ Fringestown	Within	2.425	Strong	Moderate	Medium	Moderate	Survey recording	None

Area	ID No.	Site type	Description	Townland	Relation to landtake	Chainage	Confidence	Sensitivity	Magnitute of Impact	Impact Significance	Mitigation	Residual Impact
14	CHS14-01	Geophysics	Linear response (geophysics response no. 38)	Fringestown	Within	2.510	Weak	Low	Medium	Potentially moderate	General testing	None
14	CHS14-02	Geophysics	Magnetic positives (geophysics response nos. 39-42)	Fringestown	Within	Beetween 2.530 and 2.560	Weak	Low	Medium	Potentially moderate	General testing	None
14	CHS14-03	Geophysics	Curving trend (geophysics response no. 43)	Fringestown	Within	2.595	Weak	Low	Medium	Potentially moderate	Targeted testing	None
15	CHS15-01	Geophysics and test excavation	Ditched enclosure (geophysics response no. 44); sections identified during test excavation	Fringestown	Within	2.920	Strong	Moderate	High	Significant	Excavation	None
15	CHS15-02	Geophysics	Linear response (geophysics response nos. 45-46)	Fringestown	Response 46 Within. Response 45 outside LMA	2.950	Weak	Low	Medium	Potentially moderate	General testing	None
15	CHS15-03	Geophysics	Linear ditches (geophysics response nos. 47-50)	Fringestown	Adjacent /Outside LMA (5m at closest point)	3.050	Weak	Low	Lowe	None	None	None
15	CHS15-04	Geophysics	Linear response (geophysics response nos. 51-52)	Fringestown	Adjacent /Outside LMA (4m at closest point)	2.990	Weak	Low	Low	None	None	None
16	CHS16-01	Geophysics	Linear response (geophysics response nos. 53-57)	Fringestown	Within	Beetween 3.150 and 3.400	Weak	Low	Medium	Potentially moderate	General testing	None
17	CHS17-01	Geophysics	Magnetic positives (geophysics response nos. 58-60)	Fringestown	Within	Beetween 3.450 and 3.500	Weak	Low	Medium	Potentially moderate	General testing	None

Area	ID No.	Site type	Description	Townland	Relation to landtake	Chainage	Confidence	Sensitivity	Magnitute of Impact	Impact Significance	Mitigation	Residual Impact
17	CHS17-02	Mapping	Townland boundary between Area 17 (Fringestown) and 18 (Mitchelstown)	Fringestown / Mitchelstown	Within	3.600	Strong	Low	Very low	Slight/none	None	None
18	CHS18-01	Geophysics	Magnetic positives (geophysics response nos. 61-62)	Mitchelstown	Within	3.680	Weak	Low	Medium	Potentially moderate	General testing	None
19	CHS19-01	Geophysics	Curving linear (geophysics response no. 63)	Mitchelstown	Within	3.800	Weak	Low	Medium	Potentially moderate	Targeted testing	None
19	CHS19-02	Geophysics	Magnetic positives (geophysics response nos. 64-65)	Mitchelstown	Within	3.850	Weak	Low	Medium	Potentially moderate	General testing	None
19	CHS19-03	Mapping and survey	Townland boundary between Area 19 (Mitchelstown) and 20 (Clontail)	Mitchelstown/ Clontail	Within	4.070	Strong	Low	Very low	Slight/none	None	None
20	CHS20-01	Geophysics and test excavation	Ditched enclosure (geophysics response nos. 66-67); sections identified during test excavation	Clontail	Adjacent (approx. 2m north at closest point)	4.120	Strong	Low	Low	Slight/None	Excavation of any related features within landtake.	None
20	CHS20-02	Geophysics	Linear response (geophysics response nos. 68-70)	Clontail	Within	4.200	Weak	Low	Medium	Potentially moderate	Targeted testing	None
20	CHS20-03	Geophysics	Magnetic positives (geophysics response nos. 71-72)	Clontail	Within	4.160	Weak	Low	Medium	Potentially moderate	General testing	None
21	CHS21-01	Geophysics	Magnetic positives (geophysics response nos. 73-74)	Clontail	Adjacent	Beetween 4.600 and 4.750	Weak	Low	Low	Slight/none	None	None

Table 9: Catalogue of sites, impacts on setting

Area	ID number	Site type	Description	Townland	Relation to landtake	Chainage	Sensitivity	Magnitute of Impact	Impact Significance	Mitigation	Residual Impact
1	CHS01-02	SMR	Rath ME012-012---	Castletown (Morgallion)	Adjacent (28m north)	0.150	Low	Minor/Low	Slight Adverse	None	None
1	CHS01-03	SMR	Rath ME012-013---	Castletown (Morgallion)	Adjacent (38m north)	0.210	Moderate	Minor/Low	Moderate Adverse	None	None
4	CHS04-04	SMR	Rath ME012-014---	Castletown (Morgallion)	Adjacent (51m north)	0.620	High	Medium	Large Adverse	None	None
12	CHS12-02	SMR	Rath ME012-004---	Stephenstown	Adjacent (89m north)	2.150	High	Medium	Large Adverse	None	None
20	CHS20-04	SMR	Church ME012-007--- & Graveyard ME012-007001---	Clontail	Adjacent (53m north)	4.250	High	Minor/Low	Moderate Adverse	None	None
20	CHS20-06	SMR	Castle ME012-008---	Clontail	Adjacent (69m north)	4.300	Low	Minor/Low	Slight Adverse	None	None

Appendix 1. Results of archaeological testing

To Licensing Section, National Monuments Service, DCHG & National Museum of Ireland

Report on the results of Archaeological Testing of Area 5 (Castletown), Area 15 (Fringestown) and Area 20 (Clontail) along the Proposed N52 Realignment, Grange to Clontail, County Meath

Excavation Licence No.: 19E0565

Detection Licence No.: 19R0198

Licence Holder: Declan Moore

Prepared for: Atkins on behalf of Meath County Council

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Revision Reference	Date Issued	Issued To
19155 19E0565 Testing Report	05/11/2019	Client for review
19155 19E0565 Testing Report	18/11/2019	Client for review

Contract

This report was commissioned by Atkins on behalf of Meath County Council

Report prepared by **Declan Moore**

Archaeological Consultants

Report reviewed by **Billy Quinn**

Archaeological Consultant

Purpose

This report describes the results of a programme of archaeological testing carried out in Areas 5, 15 and 20 along the N52 Realignment between Grange and Clontail in County Meath. The results, conclusions and recommendations contained within this report are based on information available at the time of its preparation. Whilst every effort has been made to ensure that all relevant data has been collated, the author and Moore Group accept no responsibility for omissions and/or inconsistencies that may result from information becoming available subsequent to the reports completion. Moore Group accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

Filename: 19155 19E0565 Testing Report RevA.docx

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Abbreviations

AAP	Area of Archaeological Potential
ASI	Archaeological Survey of Ireland
DCHG	Department of Culture, Heritage and the Gaeltacht
DLHG	Demesne Landscapes and Historic Gardens
NIAH	National Inventory of Architectural Heritage
NMI	National Museum of Ireland
RMP	Record of Monuments and Places
RPS	Record of Protected Structures
SMR	Sites and Monuments Record

Coordinate System

All GPS coordinates given in this report are in Irish Transverse Mercator (ITM).

5 Introduction

MOORE GROUP was commissioned by Atkins on behalf of Meath County Council to complete a programme of archaeological testing of three geophysical anomalies interpreted as enclosures detected in Area 5 (Castletown), Area 15 (Fringestown) and Area 20 (Clontail) along the proposed realignment of the N52 between Grange and Clontail in County Meath.

The proposed scheme is located on land situated approximately halfway between Kells and Ardee in County Meath, and it formed by a corridor that runs parallel to the existing N52 secondary road (Figure 1). The proposed scheme comprises of a new single carriageway road extending SW-NE from the N52 intersection with the R162 in Grange townland terminating in Clontail townland to the north of Mitchelstown Bridge. The proposed route corridor has a length (maximum west/east along the centre line) of 4.9km and covers a surface area of 28.85 hectares.

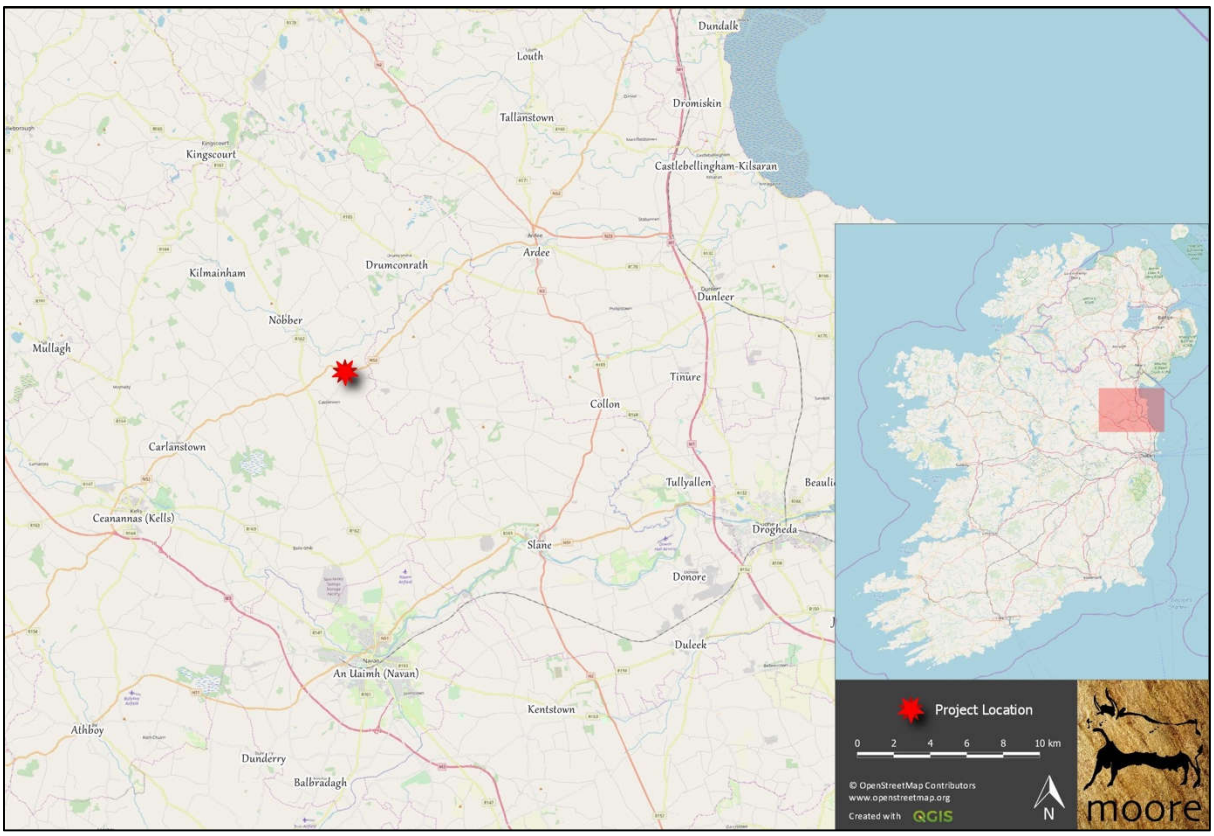

Figure 44 Location of the Proposed Development Area (PDA)

5.1 Locational Details

The N52 Grange to Clontail Scheme is located parallel to the existing N52 between Kells and Ardee in County Meath. The three sites are located in greenfield contexts in Castletown (Morgallion By.), Fringestown and Clontail townlands and all are accessed via roadside field gates:

Table 10 Location and site details

County	Meath
Barony & Parish	Clontail – Slane Lower Barony, Mitchelstown Civil Parish
	Fringestown – Morgallion Barony, Castletown Civil Parish
	Castletown - Morgallion Barony, Castletown Civil Parish
Road	N52 Kells to Ardee Road
Townlands	Castletown Fringestown, Clontail
RMPs / SMRs within 300m	ME012-014 (Ringfort-Rath), 220m west of Area 5 feature ME012-017 (Ringfort-Rath), 290m south of Area 15 feature ME012-007 (Church), 160m north of Area 20 feature ME012-007001 (Graveyard), 140m north of Area 20 feature ME012-008 (Castle), 175m northeast of Area 20 feature
Test Area Locations	Test Area 5, Castletown ITM 684205/783063
	Test Area 15, Fringestown ITM 686172/783748
	Test Area 10, Clontail ITM 687160/784306

6 Archaeological Testing

The definition cited below are those published by the Department of Culture, Heritage and the Gaeltacht (DCHG).

'Test excavation is that form of archaeological excavation where the purpose is to establish the nature and extent of archaeological deposits and features present in a location which it is proposed to develop (though not normally to fully investigate those deposits or features) and allow an assessment to be made of the archaeological impact of the proposed development. It may also be referred to as archaeological testing' (DAHGI 1999a, 27).

6.1 Methodology

A geophysical survey of the proposed realignment of the N52 Grange to Clontail road completed in 2019 (licence number 19R0077 - Nicholls, 2019) identified a number of magnetic anomalies of archaeological potential (Nicholls, 2019. Three of these anomalies in Areas 5, 15 and 20 were clearly defined oval or sub-circular shapes with dimensions characteristic of enclosures or ringforts. Of additional concern was a memo issued to the author and the client's representative from Mr. Niall Roycroft of TII noting the potential for encountering human remains. Folkloric sources mention 'Croppy' burials in Drakestown and Castletown. These shallow burials may have been carried out within an enclosure/ringfort.

Trench locations were established using a Stonex S9 GNSS Rover Kit. A 16–ton mechanical digger equipped with a ditching bucket was used to excavate topsoil under the supervision of Senior Archaeologist.

The testing regime involved mechanically excavating 24 trenches, 10m in length by 2m wide, at each of these circular anomalies to identify the nature and extent of these potential archaeological features and to attempt to establish whether human remains were present in any of the sites. Topsoil was removed by mechanical digger and any potential archaeological features exposed were then investigated by hand.

6.2 Results of Testing

Archaeological testing of three sub- circular geophysical features in Area 5 (Castletown), Area 15 (Fringestown) and Area 20 (Clontail) took place over four days in overcast weather conditions between the 30th of September and the 3rd of October 2019. The trenches were excavated using a 14-tonne backhoe excavator with a 2m wide ditching bucket. On exposure of archaeological deposits, mechanical excavation ceased, and the features were manually cleaned back in advance of completing the photographic and written record.

6.2.1 Area 5, Castletown

Townland: Castletown (Morgallion By.) **ITM**: E 684219, N 783035

This site is located to the south of the N52 in a large irregularly shaped, undulating, pasture field accessed via a farm gate to the immediate east of a dwelling house. The field has a centrally placed gently sloping ridge orientated NW SE that drains to a channel along its eastern boundary. The south western corner of the field follows the eastern arc a tree lined bi-vallate ringfort 9SMR ME012-014--).

The 2019 magnetometer survey identified a feature on the southern terminal of the ridge described in the report as a 'sub-circular ditched enclosure c.35m in diameter with a pit, posthole and L-shaped feature in the interior' (Nicholls 2019: 7). On the eastern side of the circuit are two parallel lines that were interpreted as associated ditches.

Testing was carried out on the 2nd and 3rd of October 2019 and consisted of eight trenches, TT5-1-TT5-8 each 10m in length. Generally, a sod and silty brown clay 320-350mm overlay a natural grey brown sandy with gravels with patches of reddish-brown silty clay and medium sized boulders.

Testing detected archaeological features in TT5-2, TT5-3, TT5-4, TT5-5, TT5-7 and TT5-8.

The ditch of a circular enclosure/ rath was visible at the west and north of the site, in TT5-2, TT5-3 and TT5-5; additional features were noted in trenches TT5-4, TT5-7 and TT5-8. The ditch was evident as a band of slightly darker coloured clayey silt fill with a few stone inclusions contrasting with the surrounding natural that varied from greyish brown sands and gravel (in TT5-2) or reddish-brown clayey soil (in TT5-3 and TT5-5). The ditch was best defined in in TT5-3 appearing as a 1.3m wide band running north west across the western terminal of the trench. In TT5-4, the supposed interior of the site, geophysics indicated the presence of a dog leg anomaly. Excavation exposed a 1.8m long band of gravel and concentration of medium sized stone with occasional charcoal flecks that corresponds to this feature. A possible posthole, 300mm in diameter with associated clumps of charcoal, was noted to the north of the trench.

In TT5-7, a sloping trench, the west part of the trench has a grey brown sands and gravel base; a modern plastic water hose crosses the trench to the east; due to this disturbance the trench was extended to the east exposing a deeper, darker coloured layer containing occasional bone. It is uncertain whether

this material represents a feature or natural soil creep. A fragment of (18th/19th c) clay pipe bowl was found in topsoil of TT5-7.

TT5-8, the easternmost trench, was situated on a curvilinear anomaly interpreted as an external ditch. The trench confirmed the presence of a band of material 1.4 m wide composed of dark brown silt with inclusions of charcoal and tiny fragment of burnt bone contrasting with the lighter natural.

Based on the geophysical results it would appear to be an external ditch associated by orientation and dimension with the rath.

Visible areas of the ditch and the suspected posthole were recorded using DGPS.

Figure 45 Test regime Area 5

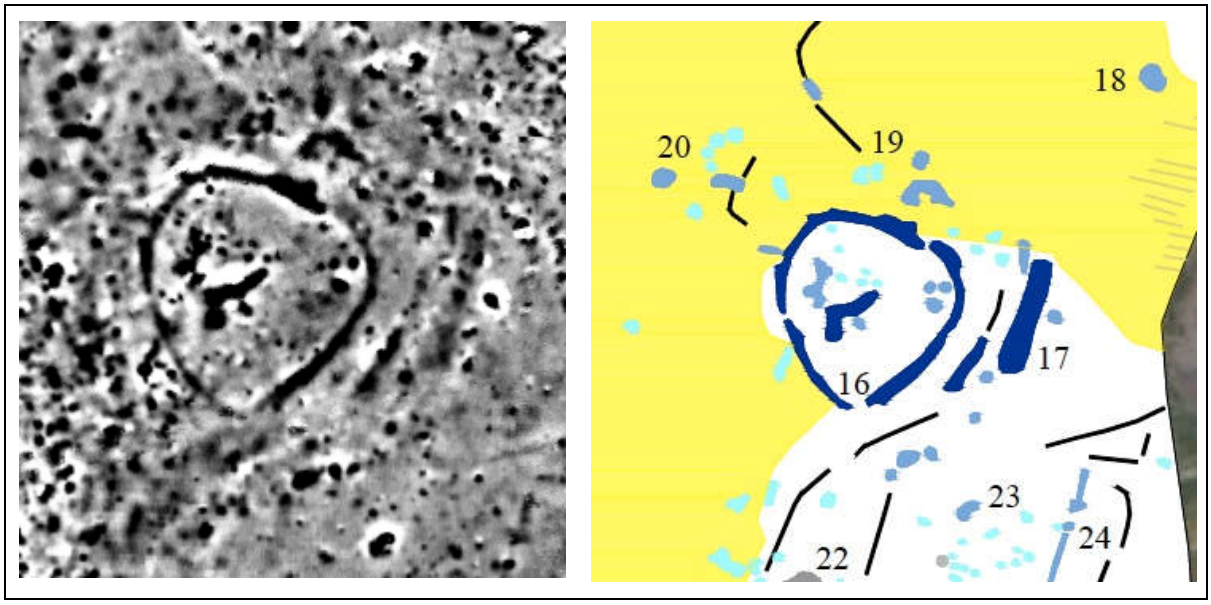

Figure 46 Magnetometer results for Area 5.

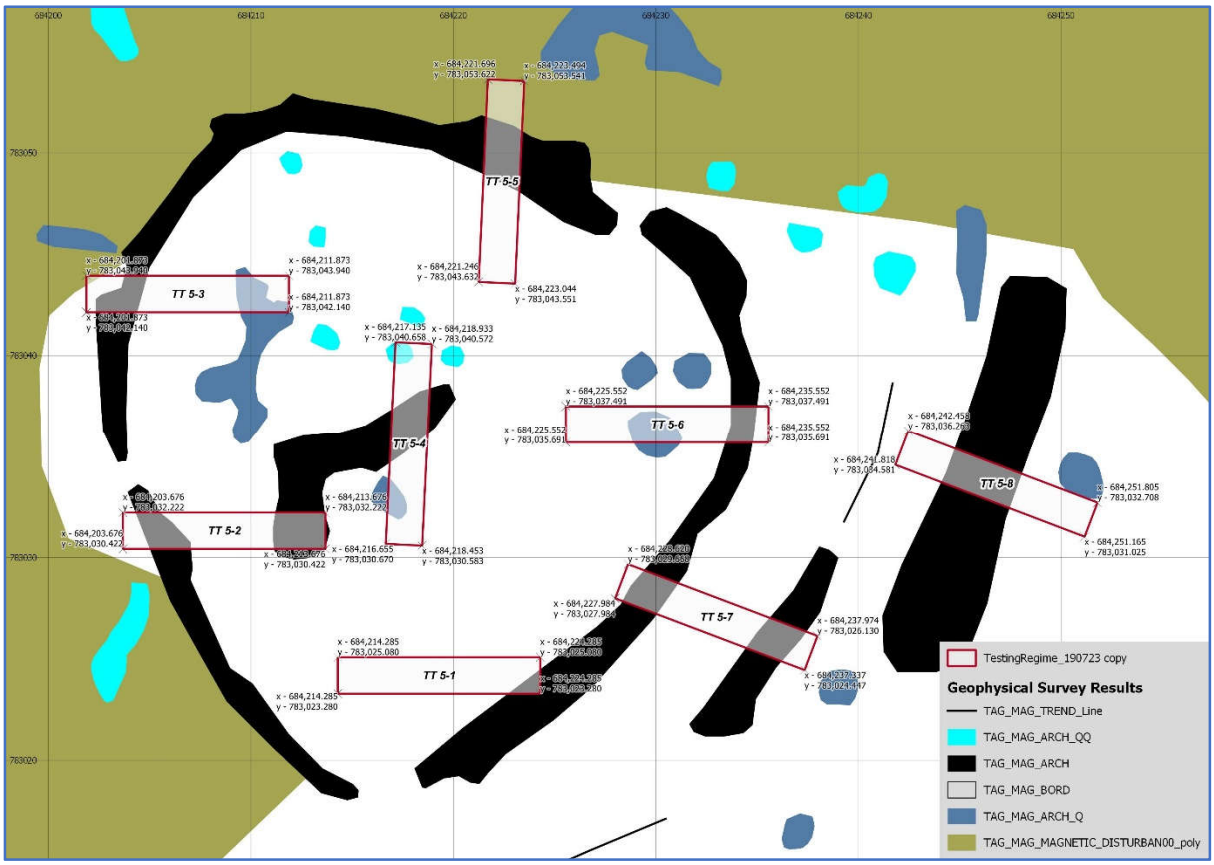

Figure 47 Location of Test trenches TT5-1 to 8 in possible enclosure Area 5

Plate 1 Ditch in TT5-2, dotted yellow, facing west

Plate 2 Ditch in TT5-3, facing east

Plate 3 Ditch in TT5-5,facing west

Plate 4 Soil variation in TT5-8 facing east

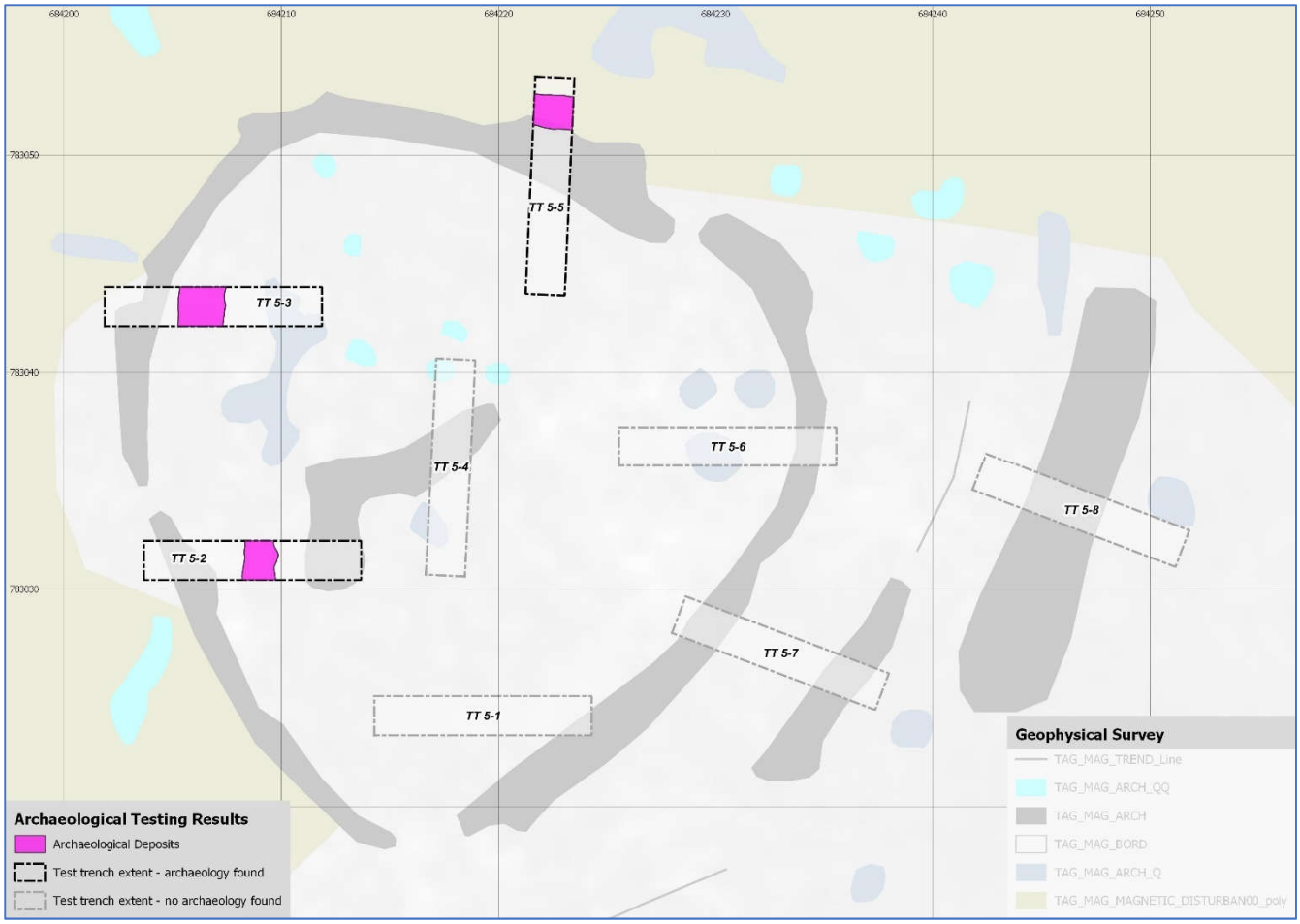

Figure 48 Location of Test trenches TT5-1 to 8 showing results of testing

Table 11 Results of testing in Area 5

TT5. No.s	Location	Description
TT 5.1	Aligned east/west to intersect with the feature's south eastern circuit	Trench 1 max depth 800mm. Topsoil is 350mm on grey brown sandy gravel clay. No features evident.
TT 5.2	Aligned east/west to intersect with the western circuit of the feature and the L-shaped feature in the interior	Trench 2 max depth 600mm on to gravelly sand, 350mm topsoil. **Ditch** evident as a band of red silty brown fill 1.4m wide with occasional charcoal fleck crossing trench 5.3m from western peg.
TT5.3	Aligned east/west to intersect with the western circuit of the feature and an anomalous feature in the interior	Trench 3 Max depth 450mm. **Ditch** exposed at 400mm measuring 1.2 wide located west of centre 5.3m from west peg. The **Ditch** has a brown clayey silt with charcoal fleck land less stony inclusions contrasting with the lighter gravelly natural.
TT 5.4	Aligned north/south to intersect the L-shaped feature in the interior	Trench 4, Max depth of excavation 500mm. Topsoil 25mm at crown of hillock. Geophysics shown a dog leg anomaly 1.8m that corresponds generally with a band of gravel and concentration of medium sized stone and bedrock. May be infill. **Posthole** to north of trench 300mm diameter with associated clumps of charcoal.

TT 5.5	Aligned north/south to intersect with the northern circuit	Trench 5 had an evident band of reddish-brown silt 1.6m wide towards northern end of trench corresponding to **ditch**. The fill material was similar to trench 2.
TT 5.6	Aligned east/west to intersect with the eastern circuit	Trench 6, max depth 350mm. Stony gravel with bedrock. Topsoil averaging 200mm No features evident
TT 5.7	Aligned roughly northwest/southeast to intersect with the eastern circuit of the feature and a possible external ditch	Trench 7 Steep down slope, water hose, band of Stony fill off centre. Trench extended west by approx 5m dark brown clayey silt subsoil containing bone, charcoal and fragment of pipe bowl. Maybe cast down bank material. No obvious sign of ditch.
TT 5.8	Aligned roughly northwest/southeast to intersect with a possible external ditch feature	Trench 8 Sloping trench 500mm deep. Topsoil 200mm. Geophysics shows anomalous thick band crossing trench. 4.4m west of peg. 1.4 m wide composed of dark brown silt with inclusions of charcoal and tiny fragment of burnt bone. Possible **external ditch**.

6.2.2 Area 15, Fringestown

Townland: Fringestown **ITM:** E 686155, N 783735

Area 15, Fringestown, is on a low knoll in a pasture field north of Strokes Crossroads - the junction of the Castletown Road (L3406) and the N52. The site is to the south east of a house on a gently downward slope with good views in all directions. The nearest archaeological monuments include a ringfort (SMR ME012-017-) 300m to the south west in Fringestown and a souterrain (SMR ME012-006001-) 630m to the north north east in Carnacop. The magnetometer survey identified a feature described in the report as an 'oval enclosure, c.36m NW-SE with large and small-scale responses at interior and periphery suggesting ditch remains, probable pit locations and postholes' (Nicholls 2019: 10). At the south of the enclosure, two parallel lines form an off-shoot to the southwest, and another linear off-shoot is on the north; a curved linear feature intersects with and seems to overlie the enclosure ditch on its north side. East of the enclosure, geophysics detected 'multiple poorly defined linear anomalies and discrete positives suggesting substantial archaeological settlement'. The possible enclosure is located on slightly raised ground which gradually slopes downwards to the south and south east. There is no above ground expression for the feature.

Testing carried out on the 30th of September 2019 consisted of the mechanical excavation of eight trenches, each 10m in length. Four trenches were aligned to intersect with the feature's circuit the remainder to investigate anomalies within the interior. Archaeological deposits were detected in five trenches; TT15-1, TT15-4, TT15-5, TT15-6, and TT15-8.

Ground conditions consisted of a topsoil of brown silty clay 300mm thick overlying natural grey brown sands and gravels with cropping rock.

The ditch of the circular enclosure was most clearly seen to the west of the site, in TT15-5. Here, a linear band of dark silt, 1.2m in width, crossed the north of the trench contrasting in colour and composition to the lighter natural sand and gravel. The ditch fill contained inclusions of animal bone and teeth. Edging

the ditch to the south was a spread of oxidised red soil, possibly the result of *in situ* burning. The ditch was also evident in the section profile as a notable dip in the depth of topsoil reaching a maximum depth of 700mm, which is 400mm lower than the average the topsoil depth. Also, of note to the south end of the TT15-5 were two patches of dark, charcoal-rich soil, which appear to be archaeological features. The one furthest to the south has maximum dimension of 1300mm (north/south); the other has maximum dimension of 800mm (north/south). Both appear to be cut into the natural and may be pits.

In TT15-4 the ditch was not as pronounced but still identifiable as a 2m wide darker siltier band with a dip in the depth of the topsoil to 800mm. The ditch contrasts with lighter, clay to northeast and to bedded sandstone to the southwest.

In TT15-6, a trench in the interior of the site natural ground differed across its length from east to west from dark soil towards an area of smooth, stone-free clay in the centre breaking to stony ground to the west. No distinct features evident.

In TT15-7 the natural is at a shallow depth (300mm); one piece of eroded earthenware was recovered (not diagnostic). No other features evident.

TT15-8 animal bone found towards the east of the trench at 750mm depth. The ditch was visible towards east of trench at a depth of 620mm. The fill material, darkened silt with frequent stones, was not as clear as evidenced in trench 5.

In TT15-1 is a faint area of dark soil which may be the shadow of the circuit ditch with some animal bone present.

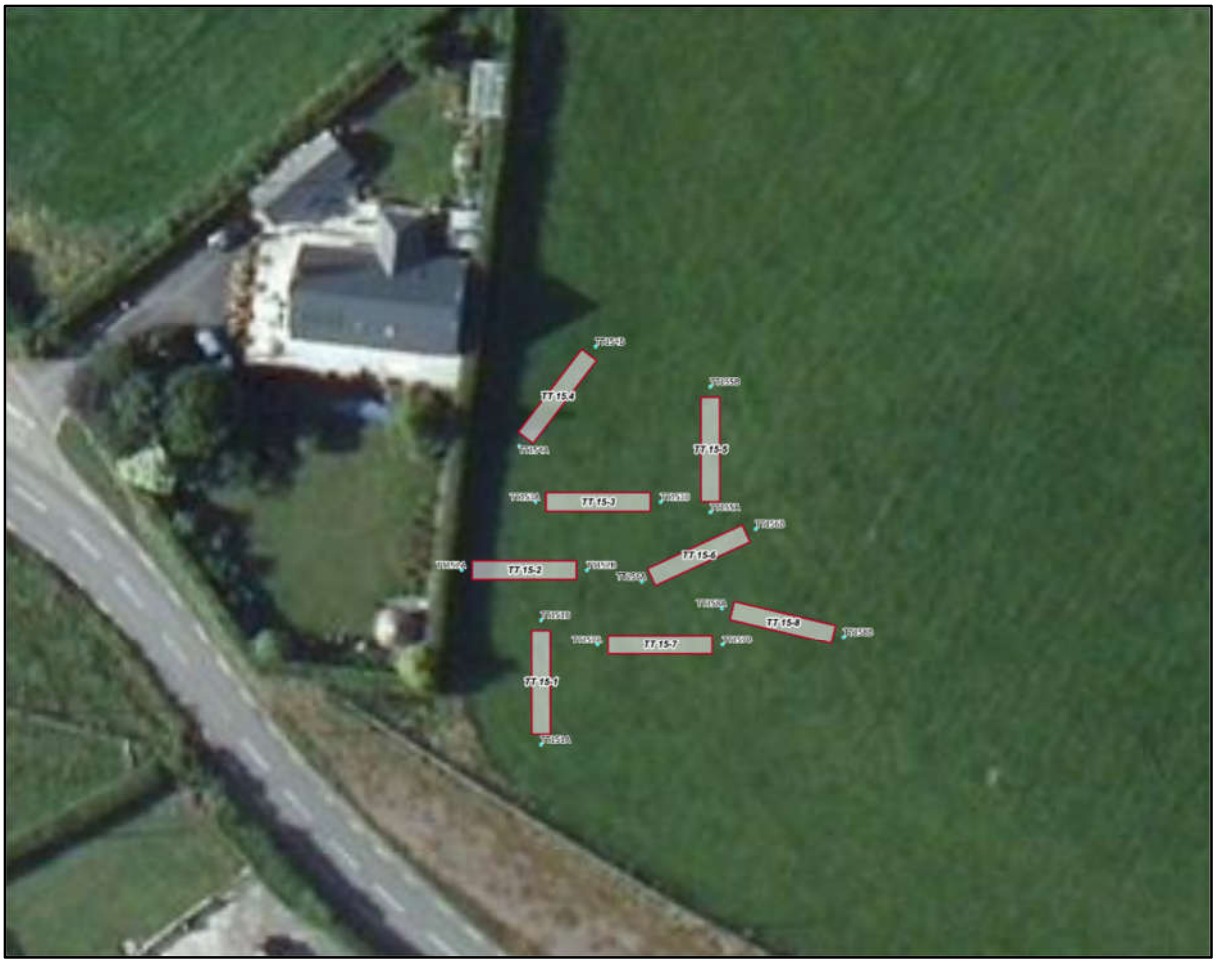

Figure 49 Test Regime Area 5

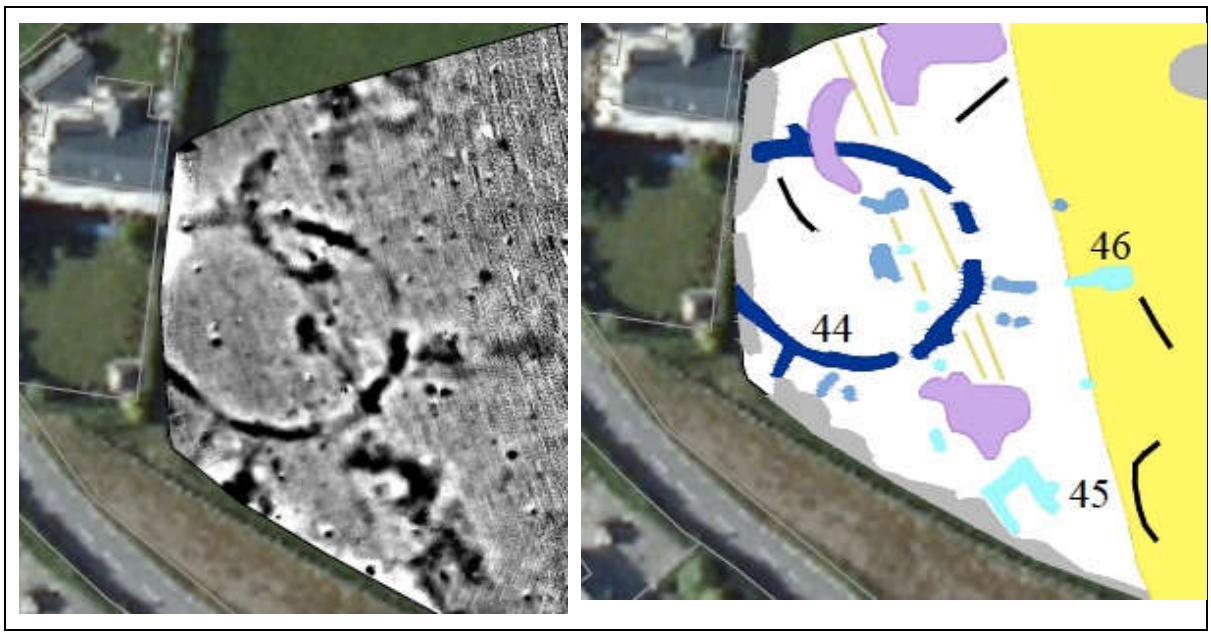

Figure 50 Magnetometer results Area 15

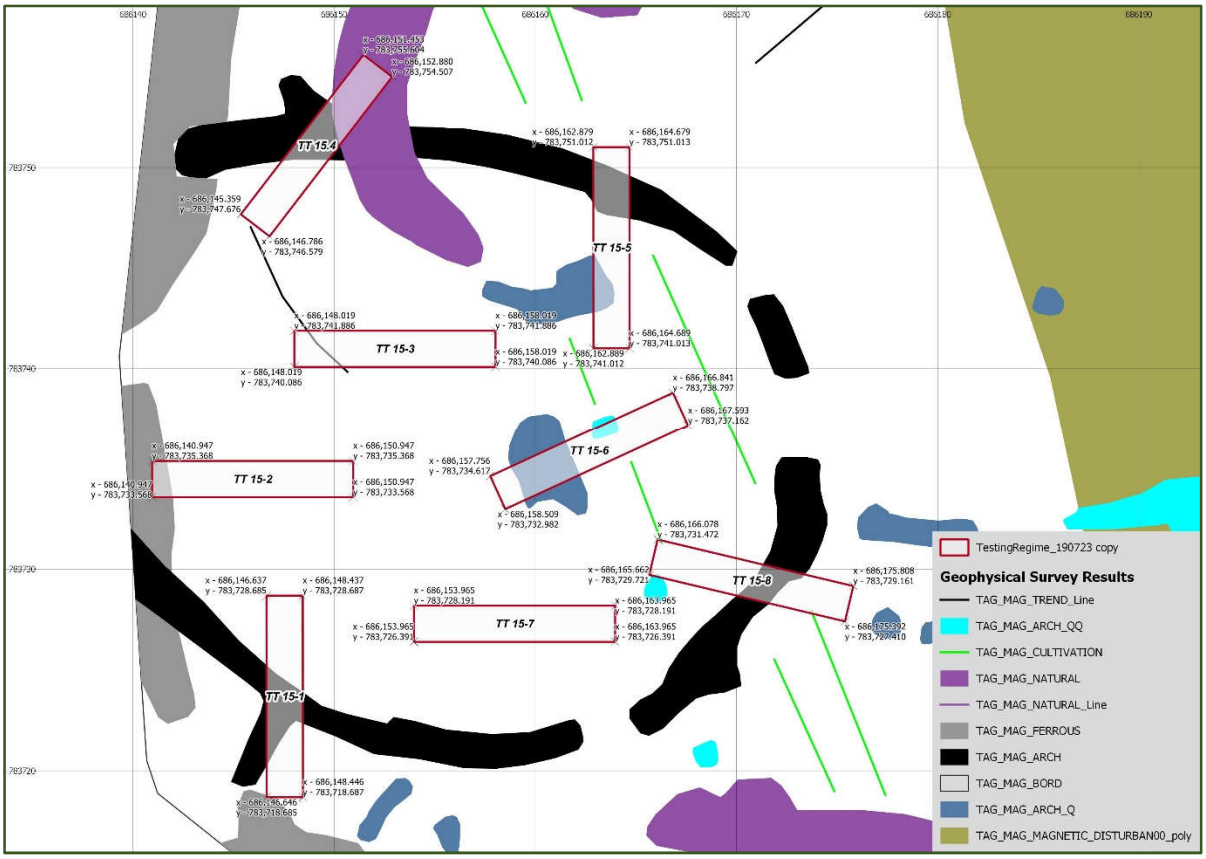

Figure 51 Test trenches investigated in possible enclosure Area 15.

Plate 5 Ditch in north of TT15-5, facing west

Plate 6 Ditch in north of TT15-5, facing south note oxidised clay

Plate 7 Bone within ditch fill in north of TT15-

Plate 8 Burnt feature towards south of TT15-5, facing north

Plate 9 Feature in south of TT15-5, facing north

Plate 10 Feature in south of TT15-5, facing north

Plate 11 TT15-8 ditch to east

Plate 12 TT15-1 central silty band

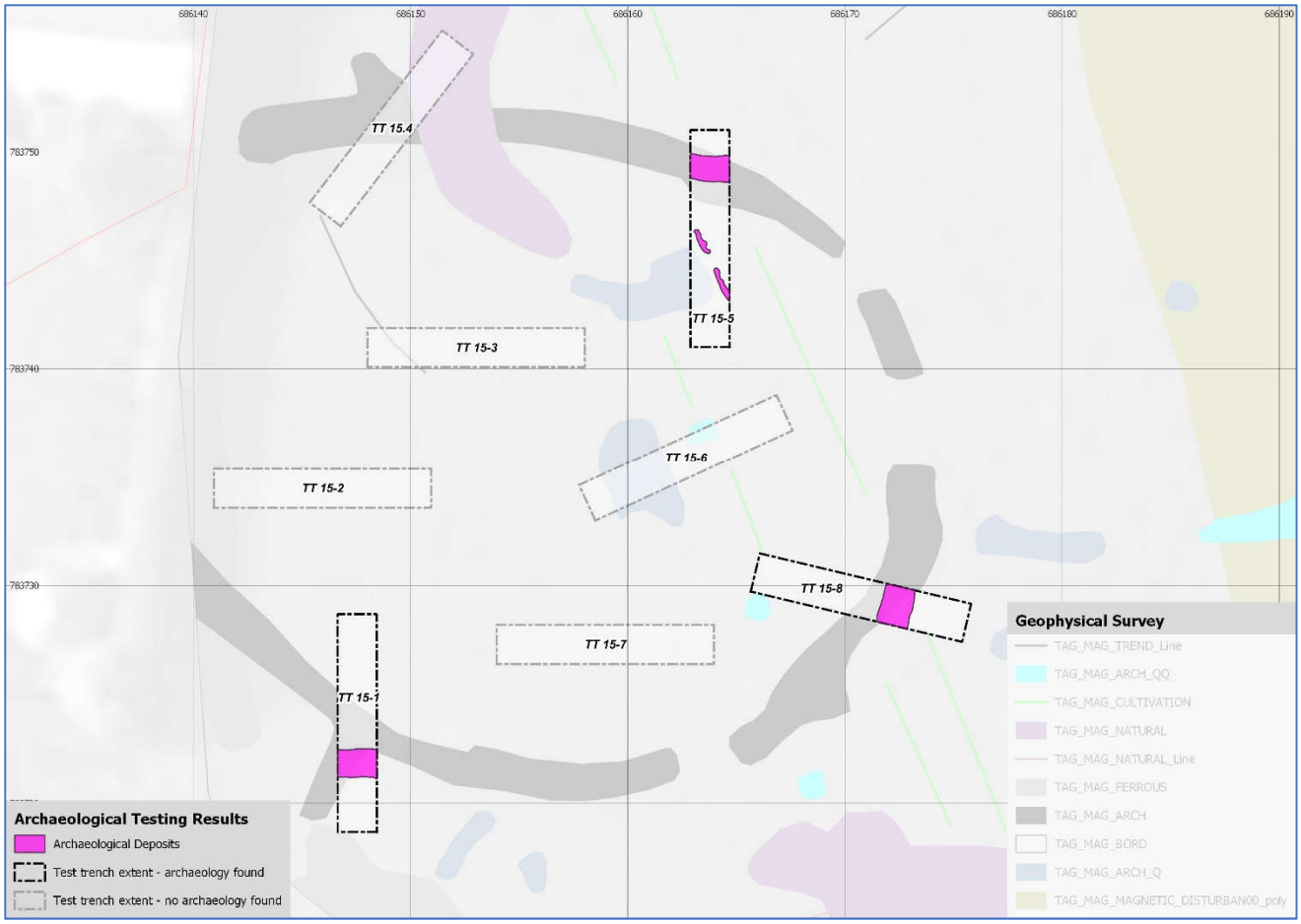

Figure 52 Location of Test trenches TT15-1 to 8 showing results of testing

Table 12 Results of testing in Area 15

TT. 15-No.s .	Location	Description
TT 15.1	Aligned north/south to intersect with the feature's southern circuit and an anomalous offset feature	Trench 1, Max depth 500mm breaking to gravelly natural. Towards centre is a feint area of dark brown silt with animal bone and occasional charcoal fleck. This deposit may represent the **ditch** but nit as apparent as found in Trench 5.
TT 15.2	Aligned east/west to investigate the interior of the feature	Trench 2. Max depth 500mm. No features evident.
TT 15.3	Aligned east/west to investigate an anomalous feature in the interior.	Trench 3. Max depth 500mm. No features evident.

TT 15.4	Aligned roughly north/south to intersect the northern circuit of the feature and a curving anomaly with an offshoot.	Trench 4. Max depth 600mm. Natural changes from gravelly stone to clay at a depth of 420mm. Potential **ditch** exposed near centre of trench evident as a darker feature with indistinct edge's measuring 2 m wide.
TT 15.5	Aligned north/south to intersect with the northern circuit of the feature and an anomalous interior feature	Trench 5 excavated to a max. depth of 600mm. **Ditch** evident at northern end as a pebbly fill in a dark silt with charcoal and bone 1.2m wide. Two other district features to South. Both pits had charcoal rich infill. Southernmost feature was a 1. 3m Long with black charcoal stained soil. The other feature was 0. 8m in length.
TT 15.6	Aligned east/west to intersect with a number of anomalous interior features	Trench 6 Max depth 400mm. Located in interior of possible enclosure, natural ground differed across its length from West to East. No features evident.
TT 15.7	Aligned east/west to investigate the interior of the feature.	Trench 7 was dug to an average depth of 350mm, internal trench exposed gravelly natural ground. No features evident.
TT 15.8	Aligned roughly northwest/southeast to intersect with the south eastern sector of the feature	Trench 8 dug to an average depth of 440mm across southeast arc of enclosing element. The **ditch** was visible towards east of trench as a darkened silt with frequent stones contrasting with the lighter natural clay.

6.2.3 Area 20, Clontail

Townland: Clontail ITM: E 687163, N 784302

Area 20 in Clontail townland is located in a long, relatively narrow, field to the north of a crossroads that leads to a nearby Church and graveyard SMR ME012-007 & 007001 and the former site of Stokestown Castle SMR ME012-008. The magnetometer survey detected a feature to the immediate north of a field gate described in the report as a 'sub-circular enclosure c.35m in diameter, containing multiple linear, pit and postholes, with external ditch remains and positive responses evident to E' (Nicholls 2019: 12) (Figure 9). This enclosure, of which there is no surface expression, is on raised ground that slopes downwards to the south and southeast.

Test excavations were carried out on 1 October and consisted of nine trenches, each 10m in length. Generally, the ground had 300mm of brown silty clay topsoil over a yellowish brown natural clay with a moderate amount of stone.

Archaeological features were detected in TT20-1, TT20-3, TT20-4, TT20-6, TT20-7 and TT20-8. Of these, the circular ditch was clearly visible in TT20-1, TT20-6 and TT20-8; other archaeological features include a small, rectangular shaped posthole in TT20-3 and a pit containing a fragment of iron slag in TT20-7. Features in field 20 were the clearest of the three investigated fields.

Excavation in TT20-1 exposed the ditch as a well-defined band of dark brown soil 2.1m wide with charcoal fleck contrasting with the yellowish natural brown clay.

TT20-2 was dug to a depth 500mm breaking to a rocky base. Darkish brown deposit with charcoal fleck, no features evident.

TT20-3 – most of the trench is greyish brown, stony clayey silt; but at the far eastern end is a zone of reddish-brown silty clay in which is cut a small, rectangular-shaped feature, perhaps a posthole

TT20-4 – the north/south aligned trench was extended to the north and widened to the east to reveal further an area of dark soil with frequent stone in which was found a sherd of pottery with clear glaze, probably post-medieval – the dark soil may be an extended area of topsoil, but could be a dug feature, perhaps post-dating the circular ditch.

TT20-5 very gravelly trench dug to a max depth 600mm. In the area of the geophysical anomaly was found bone and oyster shell in silty darkened soil. No obvious features evident.

TT20-6 – the circular ditch is clearly visible as a band of stone-filled dark dark brown silty clay with frequent stone cut into the natural reddish-brown sandy clay.

TT20-7 was situated outside the circular feature and located to investigate a cross-shaped anomaly. Excavation revealed a deposit on east side of trench 2.8 m wide by 1.1m wide. On investigation this darker coloured silty layer contained bone fragments and a lump of iron slag, indicative of metal production.

TT20-8 – Sherds of post-medieval ceramic, including the rim of a sharp-profiled bowl with traces of green-tinged transparent glaze, present in the topsoil. Ditch barely discernible as brown silty deposit with charcoal fleck.

TT20-9 dug to a max depth 800mm. The trench slopes to the east with bed rock at base. Pottery rim shard recovered from topsoil. No other features evident.

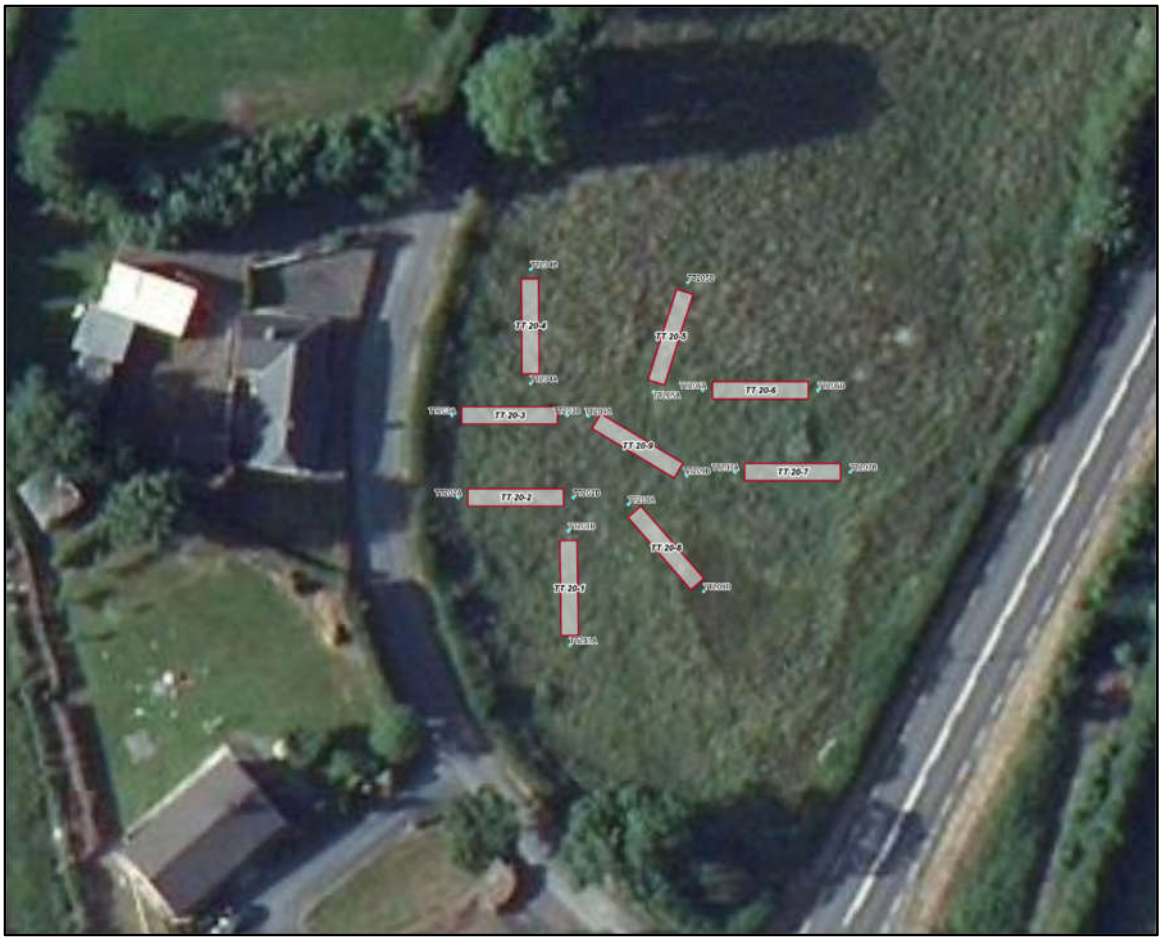

Figure 53 Testing regime Area 20

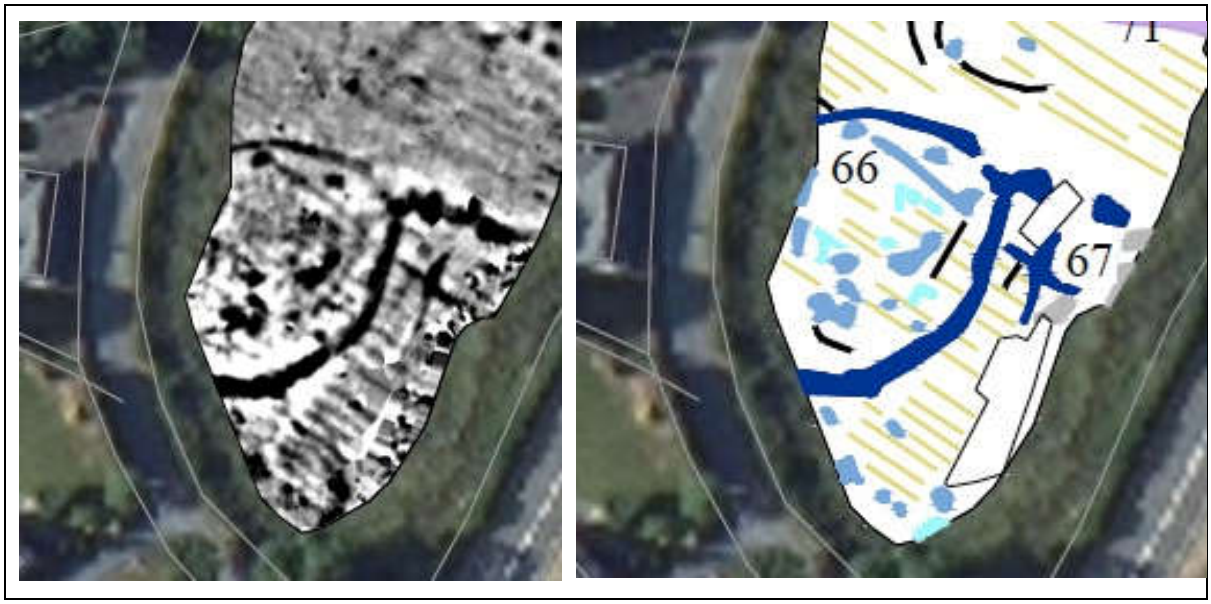

Figure 54 Magnetometer results for Area 20

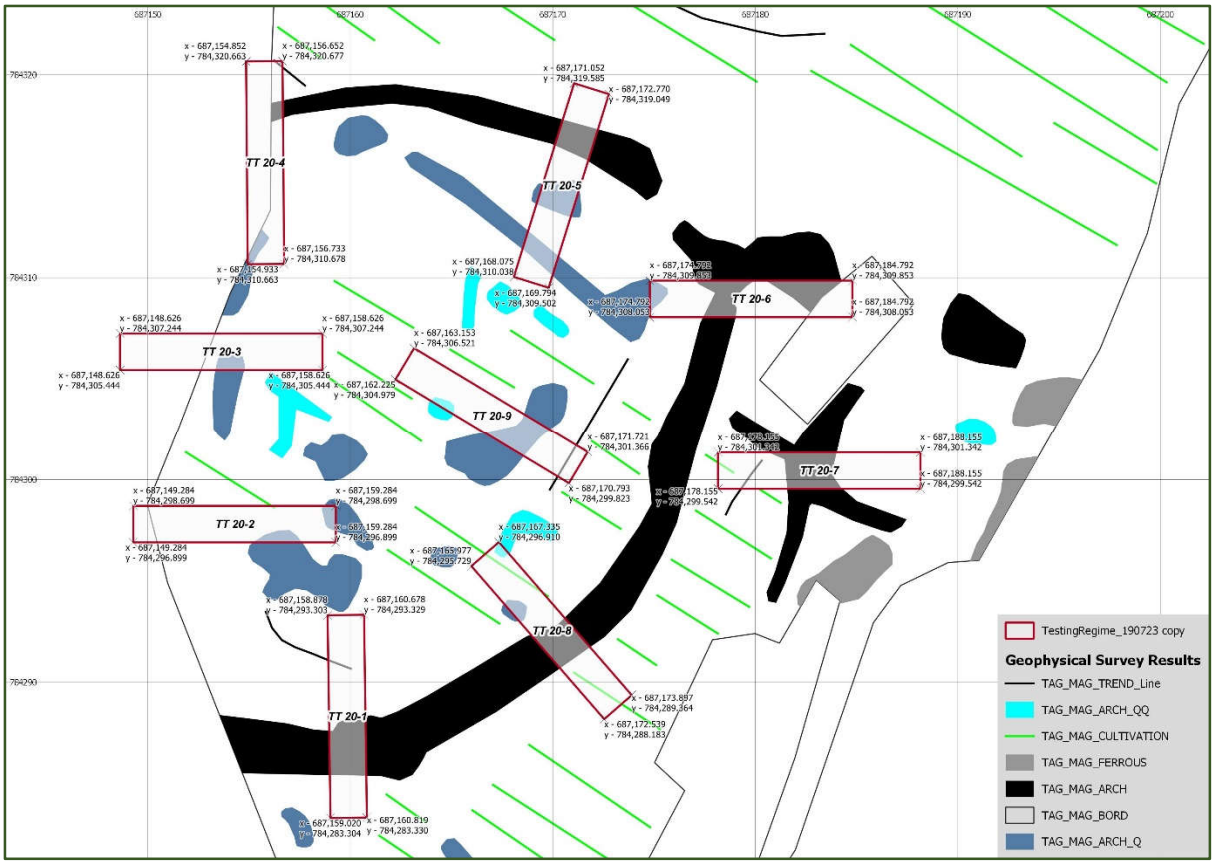

Figure 55 Test trenches investigated in Area 20

Plate 13 Ditch crossing TT20-1, facing north

Plate 14 Rectangular feature in TT20-3, facing east

Plate 15 Dark soil in the north of TT20-4

Plate 16 Glazed sherd from area of dark soil in TT20-4

Plate 17 TT20-6, facing west

Plate 18 TT20-6, facing east

Plate 19 Excavating TT20-6

Plate 20 Ditch crossing TT20-6

Plate 21 TT20-7, facing east

Plate 22 TT20-8, facing north west

Plate 23 Pit feature in TT20-7, facing south

Plate 24 Iron slag from pit feature in TT20-7

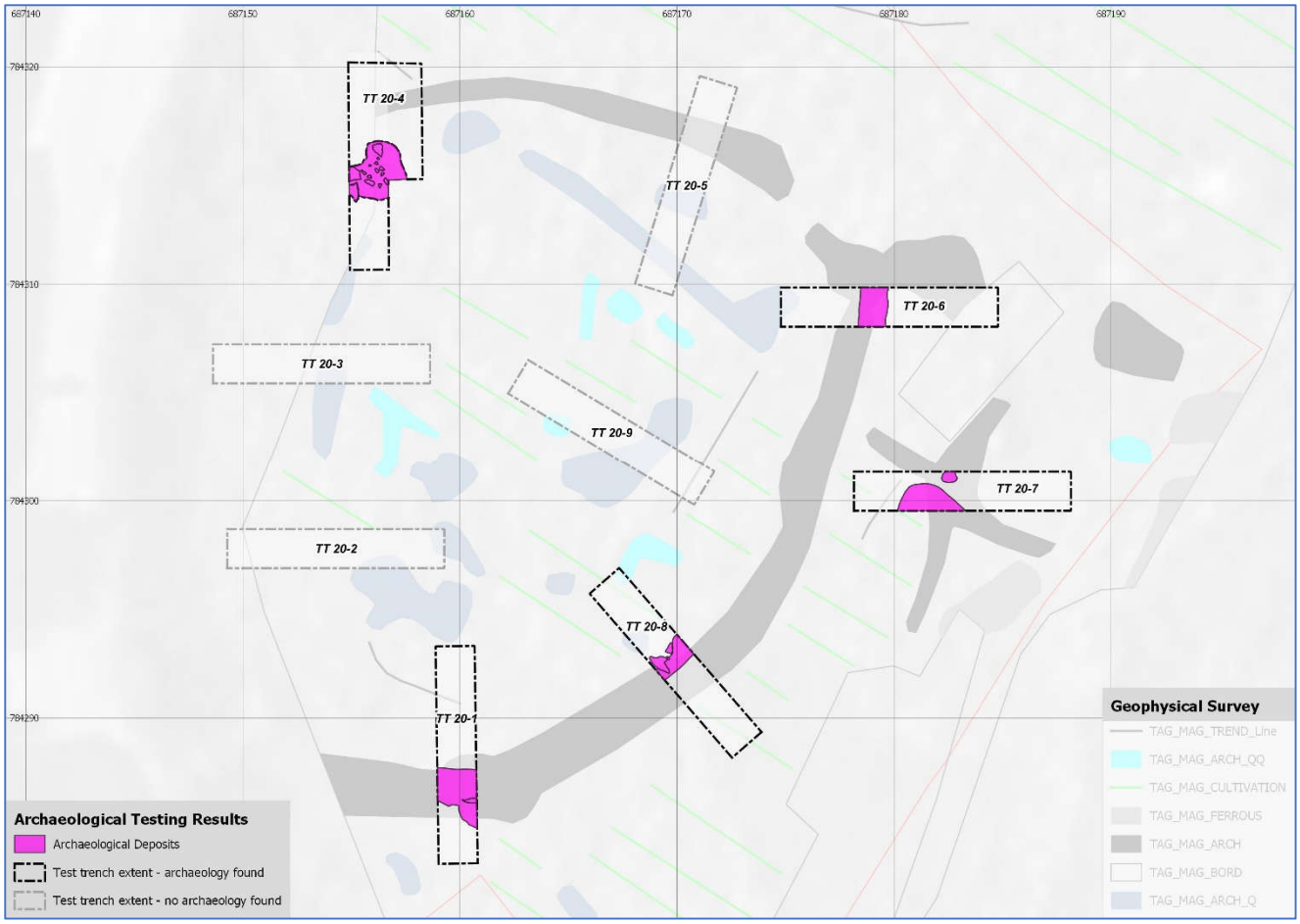

Figure 56 Location of Test trenches TT20-1 to 9 showing results of testing

Table 13 Results of testing in Area 20

TT. 20- No.s .	Location	Description
TT 20.1	Aligned north/south to intersect with the feature's southern circuit and an anomalous offset	Trench 1. Max depth of ex. 970mm. **Ditch** dug to 700mm. Width 2.1m. mid brown silty clay with stone. Charcoal and bone evident. Topsoil is 650mm. Natural yellow brown clay, rockier towards north end.
TT 20.2	Aligned east/west to investigate the interior of the feature and a number of internal anomalies	Trench 2. Max depth 500mm breaking to a rocky base. Darkish brown deposit with charcoal fleck.
TT 20.3	Aligned east/west to investigate an anomalous feature in the interior	Trench 3. Depth of ex 700mm breaking to natural boulder clay. Small rectangular pit dark brown silty clay with charcoal twigs 500m x 300m. Post medieval Pottery and animal bone.

TT 20.4	Aligned north/south to intersect the northern circuit of the feature	Trench 4. Max depth 700mm. Trench was widened and extended to east, natural Isa stony clay. Southern half of trench linear dark deposit with frequent medium sized stone. Glazed pottery shard in topsoil some animal bone.
TT 20.5	Aligned roughly north/south to intersect the northern circuit of the feature and some anomalous internal features	Trench 5. very gravelly. Max depth 600mm. At area of anomoly found bone and oyster shell in Stony darkened soil.
TT 20.6	Aligned east/west to intersect with an anomalous interior feature, part of the eastern circuit of the feature and a potentially related offset feature to the east of the main feature	Trench 6. Max depth 600mm. Topsoil 400. Natural is reddish brown sandy clay cut by **ditch** 1.4 m wide in dark brown silty clay with frequent stone.
TT 20.7	Aligned east/west to investigate an external feature	Trench 7. Similar natural to 6. Max depth 500. Feature on east side of trench 2.8 m wide by 1.1m wide. Bone, charcoal and slag in pit.
TT 20.8	Aligned roughly northwest/southeast to intersect with the south eastern sector of the feature	Trench 8. Max depth 550mm. Topsoil 350 clay and stone. Ditch not very evident discernible as a feint brown silty deposit with charcoal fleck.
TT 20.9	Aligned roughly northwest / southeast to investigate internal features.t	Trench 9 Max depth 800mm slopes to east with bed rock at base. Pottery rim shard recovered from topsoil.

7 Conclusion

The programme of archaeological testing was carried out by Declan Moore and two assistants between 30th of September and the 3rd of October 2019. In total, 25 test trenches were excavated across the three test areas generally overcast and showery conditions. The trenches were machine excavated under the direct supervision of the author using a 13-tonne backhoe excavator with a 2m wide toothless, ditching bucket. All the trenches were deliberately sited to investigate anomalies identified in the Geophysical Survey.

In Area 5, the Castletown site, testing exposed archaeological levels in six of the eight trenches; TT5-2, TT5-3, TT5-5 all contained dark silty bands cutting through the lighter brown greyish gravelly clay natural. TT5-7 and TT5-8 also found variations in the colour and composition of exposed soils that may indicate the presence of an external ditch. A fragment of burnt bone was retrieved from TT5-8. Within the potential enclosure TT5-4 contained a central deposit with charcoal clumps and a possible post hole.

In Fringestown, testing of Area 15 identified archaeological features in five of the eight trenches. The ditch was noted as a silty band in trenches TT15-1, TT15-4, TT15-5, TT15-6, and TT15-8. The ditch was most apparent in TT15-4 where deposits also contained charcoal and fragments of animal bone.

Area 20 located south of Clontail Church had a deposit consistent with a ditch fill in TT20-1, TT20-6 and TT20-8; other features included a possible posthole in TT20-3 and a pit with iron slag in TT20-7.

The results of the testing programme confirmed the findings of the Geophysical Survey - in all three test areas deposits of archaeological potential were found that roughly corresponded to the magnetometers anomalies. Testing did not identify any human remains.

Targeted testing based on the results of the magnetometer survey exposed archaeological material at all three sites, including a sub circular enclosing ditch, internal cut and fill features and external ditches. These features are consistent with a rath, defined as a roughly circular or oval area surrounded by an earthen bank with an external fosse. Some examples have two (bivallate) or three (trivallate) banks and fosses, but these are less common and have been equated with higher status sites belonging to upper grades of society. They functioned as residences and/or farmsteads and broadly date from 500 to 1000 AD.

8 Recommendations

While it is acknowledged that preservation *in-situ* of archaeological remains is the preferable option wherever possible, the possible archaeological remains identified within the proposed development area will be impacted upon by ground disturbances. As such excavation of all archaeological remains should be carried out.

It is recommended that prior to commencement of construction works the areas of archaeological potential identified herein be opened out and topsoil stripped in order to further assess the nature and extent of these features.

Overburden within these areas should be removed by a mechanical excavator under strict archaeological supervision. Mechanical excavation should cease following the identification of archaeological levels. Recording of archaeological features should then be carried out prior to excavation and removal by hand by a team of archaeologists under the direction of a licence eligible archaeologist and in consultation with the National Monuments Service of the Department of Culture, Heritage and the Gaeltacht and the National Museum of Ireland. If required, the open excavation areas may be increased in size and all archaeological deposits recorded to the depth of the natural subsoils.

Full provision should be made available within the construction programme to allow for the resolution of all archaeological features on site and to ensure that these works are completed prior to construction commencing.

The above recommendations are subject to the approval of the National Monuments Service (Department of Culture, Heritage and the Gaeltacht), the National Museum of Ireland and Galway County Councils Conservation/Heritage Officer.

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Appendix 3. Conventions, Directives and Legislation

Ireland has ratified several European and international conventions in relation to the protection of its cultural heritage. This section summarises Ireland's obligations as a signatory to a number of International and European conventions relating to the protection and conservation of cultural heritage sites. Also included is a synopsis of existing national legislation governing the care and protection of our cultural heritage resources.

a. Conventions

I) ICOMOS Xi'an Declaration, 2005

Ireland is a signatory to an international declaration sponsored by International Council on Monuments and Sites (ICOMOS), the Xi'an Declaration on the Conservation of the Setting of Heritage Structures, Sites and Areas, 2005, that endeavours to ensure the safeguard and conservation of the World's cultural heritage as part of its sustainable and human development.

II) EIA Directive 85/337/EEC as amended

To assist planning and other consent authorities in deciding if significant effects on the environment are likely to arise in the case of development below the national mandatory EIS thresholds, the Minister for the Environment, Heritage and Local Government published a Guidance document in August 2003.

III) The European Landscape Convention 2000

In 2002 Ireland ratified the European Landscape Convention - also known as the Florence Convention, which promotes the protection, management and planning of European landscapes and organises European co-operation on landscape issues. It is the first international treaty to be exclusively concerned with all dimensions of European landscape.

IV) Valletta Convention, 1997

In 1997 the Republic of Ireland ratified the Council of Europe, European Convention on the Protection of the Archaeological Heritage (the 'Valletta Convention'). Obligations under the Convention include: provision for statutory protection measures, including the maintenance of an inventory of the archaeological heritage and the designation of protected monuments and areas.

V) Granada Convention, 1997

Under the European Convention on the Protection of the Architectural Heritage (Granada Convention), 1997, the Republic of Ireland is obliged to maintain inventories of architectural heritage, to protect the architectural heritage and adopt conservation policies as integrated planning objectives.

VI) UNESCO World Heritage Convention, 1972

This Convention provides for the identification, conservation and preservation of cultural and natural sites of outstanding universal value for inclusion in a world heritage list. The World Heritage status is a non-statutory designation and no additional statutory controls result from this designation. However, the

impact of proposed development upon a World Heritage Site will be a key material consideration in determining planning applications.

b. Legislation

I) The Planning and Development (Strategic Infrastructure) Act 2006

The Planning and Development (Strategic Infrastructure) Act 2006 ensures the protection of the archaeological heritage resource by requiring that all applications under this Act are accompanied by an EIS including information on material assets, including the architectural and archaeological heritage, and the cultural heritage.

II) The National Monuments Act 1930, as amended

Irish legislation for the protection of archaeological heritage is based on the National Monuments Acts 1930 and amendments of 1954, 1987, 1994 and 2004. These acts are the principal statutes governing the care of monuments in the Irish Republic. They provide for the protection of national monuments through the use of preservation orders. The overall state archaeological service is provided by the Department of Culture, Heritage and the Gaeltacht (DCHG) and delivered through the Planning and Heritage Section of the DCHG and the National Museum of Ireland (Irish Antiquities Division) on behalf of the Minister.

Monuments are protected under the National Monuments Acts in a number of ways:

- National Monuments in the ownership or guardianship of the Minister or a local authority;
- National Monuments, which are subject to a preservation order;
- Historic monuments or archaeological areas recorded in the Register of Historic Monuments; and
- Monuments recorded in the Record of Monuments and Places (RMP).

III) The Planning and Development Act 2000, as amended

Under arrangements which came into operation on 1 January 2000 (The Planning and Development Act 2000), the system of listing buildings was replaced with strengthened procedures for the preservation of protected structures and structures in architectural conservation areas (ACA).

IV) The Architectural Heritage and Historic Properties Act, 1999

This Act provides for the establishment of a national inventory of architectural heritage which forms the basis for recommendation from the Minister to local authorities of sites for inclusion in the local authorities Record of Protected Structures

c. Other Policy Contexts and Guidelines

I) The Archaeological Survey Database (ASD)

The ASD is maintained by the National Monuments Service of the DoCHG and contains the most up to date information on archaeological monuments within the State. The site is regularly updated with new sites as they come to light and has increasing volumes of information about individual sites.

II) The National Inventory of Architectural Heritage (NIAH)

NIAH data is available to be viewed and / or download from the www.buildingsofireland.ie website. The website contains detailed notes and photographs of all structures included in the recommendations made by the Minister to the relevant local authorities.

III) The Framework and Principles for the Protection of the Archaeological Heritage guidelines, 1999

This document sets out the basic principles of national policy on the protection of the archaeological heritage. A key principle set out in these guidelines is that there should always be a presumption in favour of avoidance of developmental impacts on the archaeological heritage and preservation in-situ of archaeological sites and monuments must be presumed to be the preferred option.

Guidance on Heritage Impact Assessments for Cultural World Heritage Properties – A publication of the International Council on Monuments and Sites, January 2011;

 Guidelines on the information to be contained in Environmental Impact Statements, 2002, EPA;

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 Guidelines for the Assessment of Architectural Heritage Impact of National Road Schemes, 2006, NRA;

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 Guidelines for the Testing and Mitigation of the Wetland Archaeological Heritage for National Road Schemes, 2006, NRA; and

 National Landscape Strategy for Ireland 2015-2025, Department of Arts, Heritage and the Gaeltacht.

d. Meath County Development Plan 2013-2019

The relevant policies and objectives for, Archaeological, Architectural and Cultural Heritage management for Meath are outlined in Chapter 9, Section 9.6 of the County Development Plan.

It is the strategic policy of Meath County Council:

CSA SP 1 To ensure that the unique cultural heritage of Meath is protected, conserved and sensitively integrated into the sustainable development of the county for the benefit of present and future generations.

CSA SP 2 To ensure that features of Meath's natural heritage and green infrastructure that provide ecosystem services are protected; that biodiversity is conserved and where possible enhanced, and; that the character of landscapes are maintained and enriched, and that tourist and recreational uses are facilitated in a sensitive manner.

CSA SP 3 To promote the understanding of County Meath's landscape in terms of its inherent and unique character and to recognise what elements should be preserved, conserved or enhanced.

CSA SP 4 To implement, in partnership with the County Meath Heritage Forum, relevant stakeholders and the community, the County Meath Heritage Plan and any revisions thereof.

In relation to archaeological heritage (section 9.6.9), it is the policy of Meath County Council:

CH POL 6 To promote awareness of, and access to, the archaeological inheritance of County Meath.

CH POL 7 To ensure that development in the immediate vicinity of a recorded monument is sensitively sited and designed so that it does not significantly detract from the monument. Where upstanding remains exist, a visual impact assessment may be required.

CH POL 8 To retain surviving medieval plots and street patterns in the villages and towns of Meath, where practicable, and in the course of development to record evidence of ancient boundaries, layouts, etc.

CH POL 9 To inform and seek guidance from the National Museum of Ireland if an unrecorded archaeological object is discovered, or the National Monuments Service of the Department of Arts, Heritage and the Gaeltacht in the case of the discovery of an unrecorded archaeological site, in accordance with National Monuments legislation.

It is an objective of Meath County Council:

CH OBJ 7 To protect archaeological sites and monuments, underwater archaeology, and archaeological objects, which are listed in the Record of Monuments and Places, and to seek their preservation in situ (or at a minimum, preservation by record) through the planning process.

CH OBJ 8 To seek to protect important archaeological landscapes from inappropriate development.

CH OBJ 9 To make the Record of Monuments and Places (RMP) available to the public in the Planning Office and maintain a link on the Meath website to the on-line edition at www.archaeology.ie.

CH OBJ 10 To establish in-house training programmes for Council staff carrying out repair and maintenance works to historic structures, subject to the availability of resources.

CH OBJ 11 To encourage and promote the appropriate management and maintenance of the County's archaeological heritage, including historical burial grounds, in accordance with conservation principles and best practice guidelines.

CH OBJ 12 To consider the establishment of a National Monuments Advisory Committee for Meath, subject to available resources.

In relation to architectural heritage – record of protected structures (section 9.6.10), it is the policy of Meath County Council:

CH POL 10 To conserve and protect the architectural heritage of Meath.

CH POL 11 To require that all planning applications relating to Protected Structures contain the appropriate accompanying documentation in accordance with the Architectural Heritage Protection Guidelines for Planning Authorities (2011) or any variation thereof, to enable the proper assessment of the proposed works.

CH POL 12 To encourage the retention, sympathetic reuse and rehabilitation of Protected Structures. In certain cases, land use zoning restrictions may be relaxed in order to secure the conservation of the protected structure.

CH POL 13 To encourage the retention of original windows, doors, renders, roof coverings and other significant features of historic buildings.

CH POL 14 To continue to develop the Council's advisory/educational role with regard to heritage matters and to promote awareness , understanding, and appreciation of the architectural heritage of Meath.

CH POL 15 To encourage, where appropriate, the adaptive re-use of existing buildings and sites in a manner compatible with their character and significance.

It is an objective of Meath County Council:

CH OBJ 13 To protect all structures (or, where appropriate, parts of structures) within the county which are of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest and which are included in the Record of Protected Structures (See Appendix 8).

CH OBJ 14 To review and update the Record of Protected Structures when new information becomes available and to make additions and deletions as appropriate.

CH OBJ 15 To identify and retain good examples of historic street furniture e.g. cast-iron post boxes, water pumps, signage, street lighting and kerbing.

CH OBJ 16 To make available and distribute detailed guidance notes and provide advice on architectural heritage to the public, developers, public bodies, groups and associations.

In relation to architectural conservation areas (section 9.6.12), it is the policy of Meath County Council:

CH POL 17 To identify places of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest and where appropriate to define them as Architectural Conservation Areas.

CH POL 18 To require that all development proposals within an ACA should be appropriate to the character of the area, inclusive of its general scale and materials, and are appropriately sited and sensitively designed having regard to the advice given in the Statements of Character for each area.

It is an objective of Meath County Council:

CH OBJ 20 To prohibit the demolition of a structure that positively contributes to the character of an ACA, except in exceptional circumstances. Meath County Council will require such applications to be

accompanied by a measured and photographic survey, condition report and architectural heritage assessment of the structure. Where permission for demolition is granted within an ACA, an assessment of the impact of the replacement building on the character of the ACA will be required.

CH OBJ 21 To ensure that any new development within or contiguous to an ACA is sympathetic to the character of the area and that the design is appropriate in terms of scale, height, plot density, layout, materials and finishes.

In relation to designed landscapes, historic parks, gardens and demesnes (section 9.6.13), it is the policy of Meath County Council:

CH POL19 To encourage the protection, promotion and enhancement of heritage gardens and parks in the county and support public awareness, enjoyment of and access to these sites.

It is an objective of Meath County Council

CH OBJ 22 To discourage development that would lead to a loss of, or cause damage to, the character, the principal components of, or the setting of historic parks, gardens and demesnes of heritage significance.

CH OBJ 23 To require that proposals for development in and adjoining designated landscapes and demesnes include an appraisal of the landscape, designed views and vistas, and an assessment of significant trees or groups of trees, as appropriate. The appraisal shall ensure that development proposals respect and are consistent with the historic landscape and its protection. Any development within such areas shall comply with the policies and objectives of 'Architectural Heritage Protection, Guidelines for Planning Authorities' (2011), as appropriate.

In relation to vernacular heritage (section 9.6.14), it is the policy of Meath County Council:

CH POL 20 a) To encourage the retention, sympathetic maintenance, and appropriate re-use of the vernacular heritage of Meath, in both the towns and rural areas of the County, including the retention of the original fabric, such as windows, renders, shop fronts, gates, yards, boundary walls and other significant features where possible; b) To discourage the replacement of good quality vernacular buildings or features with modern structures or features; c) To ensure that new build adjoining, and extensions to, vernacular buildings are of an appropriate design and do not detract from the building's character or that of its setting.

It is an objective of Meath County Council

CH OBJ 24 To assist the retention and development of traditional building skills in Meath subject to the availability of resources.

Other Policies/Objectives contained within the Development Plan, and not listed above, relate to specific historic/cultural elements such as individual streets, buildings, monuments, etc.

Appendix 4. Method and terminology for assessing archaeological sites

As described above, the area for the proposed road development (the landtake), was divided into 21 areas, adopting the protocol employed for the geophysical surveys (Nicholls 2019) which divided the area by established field boundaries. Small areas of land not assessed by geophysics, for example where the landtake crosses existing road junctions, are considered as part of the nearest area.

Archaeological sites and features were assigned a code (ID number) which uses the prefix CHS (cultural heritage site) and the two digit area number followed by successive numbers for each site per area. Archaeological features identified from geophysics were assigned a 'response number', as specified in the geophysics report (Nicholls 2019).

Sites in the landtake and its surroundings were identified using a variety of methods, including existing records of previously recorded sites (SMR/RMP), geophysical survey, ground survey, referring to historical maps, and test excavations, and sometimes a combination of these methods.

The identification of sites refers to the confidence with which sites can be assessed as archaeological or cultural features. A three point scale – weak, moderate and strong – is used to assess the likelihood of archaeological remains being present and the confidence of archaeological identification. This relates to the baseline rating, which also uses a three point scale – low, moderate and major – which reflects the significance and status of sites and their setting, for example, assessing registered SMR sites and other well defined features as 'major', definite subsurface archaeological features identified from geophysics as 'moderate' and geophysical trends of tentative features as 'low'.

The physical location of identified sites in relation to the landtake is expressed as either 'within' or 'adjacent', along with a distance and direction from the landtake, where sites are in close proximity. This informs the impact grading of each site.

a. Evaluation of Direct Physical Impacts

The impact grading uses a six point scale – Very High, Major, Moderate, Minor, Negligible or No Change – which is based on the ICOMOS *Guidance on Heritage Impact Assessments for Cultural World Heritage Properties* (2011). In most cases, the impact grading is either 'major', where the site is located within the landtake and therefore assumed to be impacted, or 'no change', where the site is located outside the landtake. In a small number of cases, the category 'negligible' is used, where the site is either on the edge of the landtake or there are no longer any physical features preserved, for example in the case of some townland boundaries.

I) Glossary of Impacts as defined by the EPA and the NRA Guidelines 2006

Impacts are generally categorised as either being a direct impact, an indirect impact or as having no predicted impact:

- A direct impact occurs when an item of archaeological heritage is located within the proposed development area and entails the removal of part, or all of the monument.
- Indirect impacts may be caused due to the close proximity of a development to an archaeological feature. Mitigation strategies and knowledge of detail design can often ameliorate any adverse indirect impact.
- No predicted impact occurs when the proposed development does not adversely or positively affect an archaeological site.

The impacts of the proposed development on the archaeological environment are first assessed in terms of their quality i.e. positive, negative, neutral (or direct and indirect):

- Negative Impact: A change that will detract from or permanently remove an archaeological monument from the landscape.
- Neutral Impact: A change that does not affect the archaeological heritage.
- Positive Impact: A change that improves or enhances the setting of an archaeological monument.

Magnitude of impact;

- Extent – size, scale and spatial distributions of the effect
- Duration – period of time over which the effect will occur
- Frequency – how often the effect will occur
- Context – how will the extent, duration and frequency contrast with the accepted baseline conditions.

Magnitude of Effects	
Very High	Removal of a cultural heritage site without recording.
Major/ High	Change so that the cultural heritage site is totally altered, leading to a total (including removal) or major alteration.
Moderate/ Medium	Considerable changes to setting that affect (partially alter) the character of the site.
Minor/ Low	Slight, detectable alteration to the existing baseline condition of the cultural heritage site.
Negligible	Slight changes to archaeological monument so that it is hardly affected, barely distinguishable.
No change	No change to the site.

An evaluation of the value/ significance of sites and features is based on the extent to which the site/resource contributes to the archaeological or built heritage character, though their individual or group qualities, either directly or potentially and guided by legislation, national policies, acknowledged standards, designations and criteria.

Sensitivity / Value	Criteria
Very High	Sites of international significance: World Heritage Sites National Monuments Protected Structures of international and national importance Designed landscapes and gardens of national importance Resources of acknowledged international importance or that can contribute significantly to international research objectives
High	Recorded Monuments and complexes of regional importance Designated assets that contribute to regional research objectives Architectural Conservation Areas that contain very significant buildings/structures Architectural Conservation Areas containing structures that contribute significantly to its historic character
Medium	Recently identified archaeological sites Greenfield areas with archaeological potential due research and stray finds Designated or undesignated cultural heritage sites that contribute to regional research objectives Sites listed in the NIAH Building and Garden surveys for which there are no upstanding remains
Low	Undesignated Sites of local importance Sites compromised by poor preservation and/or poor survival of contextual associations Sites of limited value but with the potential to contribute to local research objectives Historic townscapes or built up areas of limited historic integrity in their building or their settings
Negligible	Sites with very little or no surviving archaeological interest. Buildings of no architectural or historic note
Unknown	The importance of the resource has yet to be fully ascertained Structures with potential historic significance (possibly hidden or inaccessible)

A significance rating for these impacts is then given i.e. slight, moderate, significant or profound:

Profound – Applies where mitigation would be unlikely to remove adverse effects. Reserved for adverse, negative effects only. These effects arise where an archaeological site is completely and irreversibly destroyed by a proposed development. An effect which obliterates sensitive characteristics.

Significant – An impact which, by its character, magnitude, duration or intensity alters an important aspect of the environment. An impact like this would be where the part of a site would be permanently impacted upon leading to a loss of character, integrity and data about the archaeological feature/site.

Moderate – A moderate direct impact arises where a change to the site is proposed which though noticeable, is not such that the archaeological integrity of the site is compromised. This arises where an archaeological feature can be incorporated into a modern day development without damage and that all procedures used to facilitate this are reversible. An effect that alters the character of the environment in a manner that is consistent with existing and emerging trends.

Slight – An impact which causes changes in the character of the environment which are not significant or profound and do not directly impact or affect an archaeological feature or monument. An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.

Imperceptible – An impact capable of measurement but without noticeable consequences.

	Magnitude of the Impact				
Sensitivity to Impacts	**Very High**	**High**	**Medium**	**Low**	**Very Low**
Very High	Profound	Profound / Significant	Moderate	Moderate	Slight/None
High	Profound / Significant	Significant	Moderate	Moderate	Slight/None
Medium	Significant	Significant	Moderate	Moderate	Slight/None
Low	Moderate	Moderate	Moderate	Slight/None	Slight/None
very Low	Slight/None	Slight/None	Slight/None	Slight/None	Slight/None

Duration of Impacts:

- Temporary Impact Impact lasting for one year or less.
- Short-term Impacts Impact lasting one to seven years.
- Medium-term Impact Impact lasting seven to fifteen years.
- Long-term Impact Impact lasting fifteen to sixty years.
- Permanent Impact Impact lasting over sixty years.

Types of Impacts:

- Cumulative Impact – The addition of many small impacts to create one larger, more significant, impact.
- Do Nothing Impact – The environment as it would be in the future should no development of any kind be carried out.

- Indeterminable Impact – When the full consequences of a change in the environment cannot be described.
- Irreversible Impact – When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost.
- Residual Impact – The degree of environmental change that will occur after the proposed mitigation measures have taken effect.
- Worst case' Impact – The impacts arising from a development in the case where mitigation measures substantially fail.

A catalogue of identified archaeological sites and possible archaeological sites, including the basis and confidence of their identification, relation with the development area, baseline rating, impact grading and recommended mitigation, is given. A summary of impacts and mitigation per area of the proposed development area is given in **Table 7.**

b. Evaluation of Impacts on Setting

In line with EPAs Guidelines on the Information to be Contained in Environmental Impact Statements (March 2002 & Revision 2015) and DoECLGs Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment; the impact upon designated and undesignated archaeological, architectural and cultural heritage sites, structures, monuments or features have been evaluated using the following criteria:

I) Quality of Effects

- Positive Impact: A change that improves or enhances an archaeological, architectural or cultural heritage site, structure, monument or feature or its setting.
- Neutral Impact: A change that does not affect an archaeological, architectural or cultural heritage site, structure, monument or feature or its setting.
- Negative Impact: A change that will remove or negatively alter, whether in its entirety or not, an archaeological, architectural or cultural heritage site, structure, monument or feature, or detract from an observer's enjoyment or appreciation of its setting.

II) Duration of Effects

- Temporary Effects; Effects lasting less than a year
- Short term Effects, Effects lasting one to seven years
- Medium-term Effects, Effects lasting seven to fifteen years
- Long-term Effects, Effects lasting fifteen to sixty years.
- Permanent Effects, Effects lasting over sixty years

III) Types of Effects

- Cumulative Effects: The addition of many small impacts to create one larger, more significant, impact;
- 'Do-Nothing Effects': The environment as it would be in the future should no development of any kind be carried out;

- Indeterminable Effects: When the full consequences of a change in the environment cannot be described;
- Irreversible Effects: When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost;
- Residual Effects Impact: The degree of environmental change that will occur after the proposed mitigation measures have taken effect; and
- 'Worst Case' Effects: The impacts arising from a development in the case where mitigation measures substantially fail.

Evaluation of a site's 'Sensitivity to Impacts on Setting' is based upon the following criteria:

In accordance with NRA Guidelines, the importance of a site is determined based on the following criteria:

- degree of legislative protection;
- preservation /condition/ above ground expression;
- group value;
- rarity
- documentary / historical / artistic references or associations;
- amenity value (accessibility, published material such as maps / leaflets / guides, parking, visitor information etc.);
- Visual Receptors -visibility in the landscape, viewer incidents (how many, for how long and what type of people would be affected i.e. visitors to the heritage assets, walkers along mapped routes, travellers / commuters along nearby road / rail links etc.);
- fragility/vulnerability
- other developments that have already impacted on the setting of the site; and
- Professional judgement; and
- views or vistas from the site and to the site from the surrounding landscape.

The Sensitivity of a Site to Impacts on its setting can be largely intangible and therefore there is a degree of latitude allowed in the evaluation of a site's sensitivity. Based on the above criteria the sensitivity of a site to impacts on setting was classified as being very high, high, moderate, low or none i.e. no sensitivity.

c. Evaluation of Impact

The evaluation of the 'Magnitude of the Impact' that the proposed development will have on a site is an indication of the scale of the effect that the proposed development will have irrespective of the sensitivity of the site. The effects of a development on the setting of recorded sites and monuments in this instance are largely visual, but the magnitude of the impact is more than just a function of the distance that a site is located from the proposal. Factors taken into account include;

- Topography
- scale of the development,
- existing screening,
- Approach and leaving angles to the site
- cumulative impact of other development in the vicinity;

- views and vistas both to and from the site.

I) Magnitude of effects

The significance of effects can be determined by utilising the following table.

Magnitude of Effects	
Very Large Adverse	Applies where mitigation would be unlikely to remove adverse effects. Reserved for adverse, negative effects only. These effects arise where an archaeological site is completely and irreversibly destroyed by a proposed development or will result in the loss of views from a highly sensitive receptor and would constitute a dominant discordant feature in the view.
Large Adverse	An effect which, by its character, magnitude, duration or intensity significantly alters the majority of a sensitive aspect of the environment. An impact like this would be where the majority of a site would be permanently impacted upon, leading to a loss of character, integrity and data about the archaeological feature/site or where the project would cause major deterioration to a view from a highly sensitive receptor, and would constitute a major discordant element in the view. .
Moderate Adverse	A moderate impact arises where a change to the site is proposed which though noticeable, is not such that the archaeological integrity of the site is compromised, and which is reversible. This arises where an archaeological feature can be incorporated into a modern-day development without damage and that all procedures used to facilitate this are reversible. The project would cause obvious deterioration to a view from a moderately sensitive receptor, or perceptible damage to a view from a more sensitive receptor.
Slight Adverse	An effect which causes changes in the character of the environment which are not significant or profound and do not directly impact or affect an archaeological feature or monument. The project would cause limited deterioration to a view from a receptor of medium sensitivity, or cause greater deterioration to a view from a receptor of low sensitivity.
Imperceptible/Neutral	An effect which causes noticeable changes in the character of the environment but without noticeable consequences. There would be no No perceptible change in the view.

Appendix 5. A3 Figures

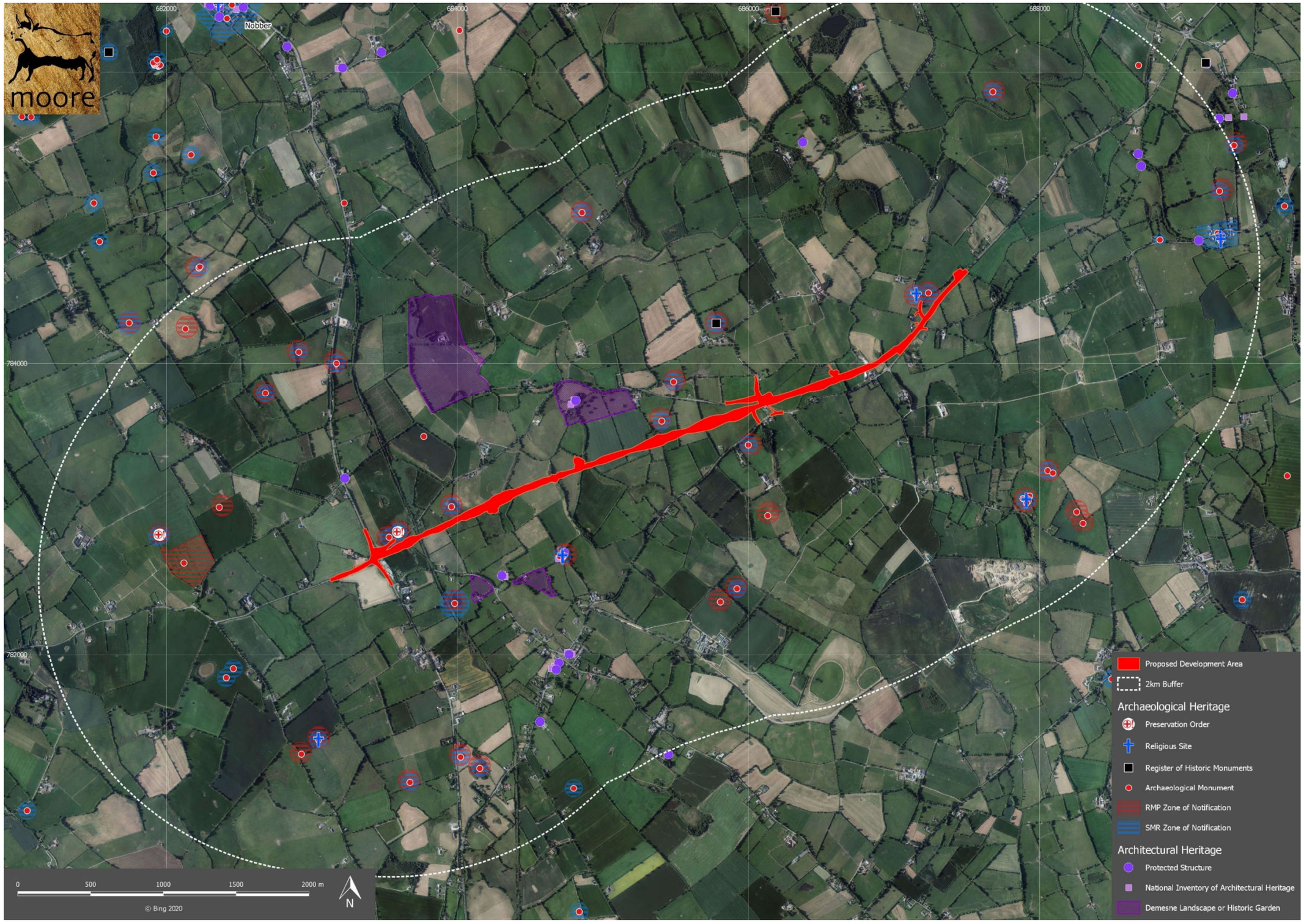


Figure 57 Proposed route and cultural heritage sites

Figure 58 Proposed route and archaeological sites in the area

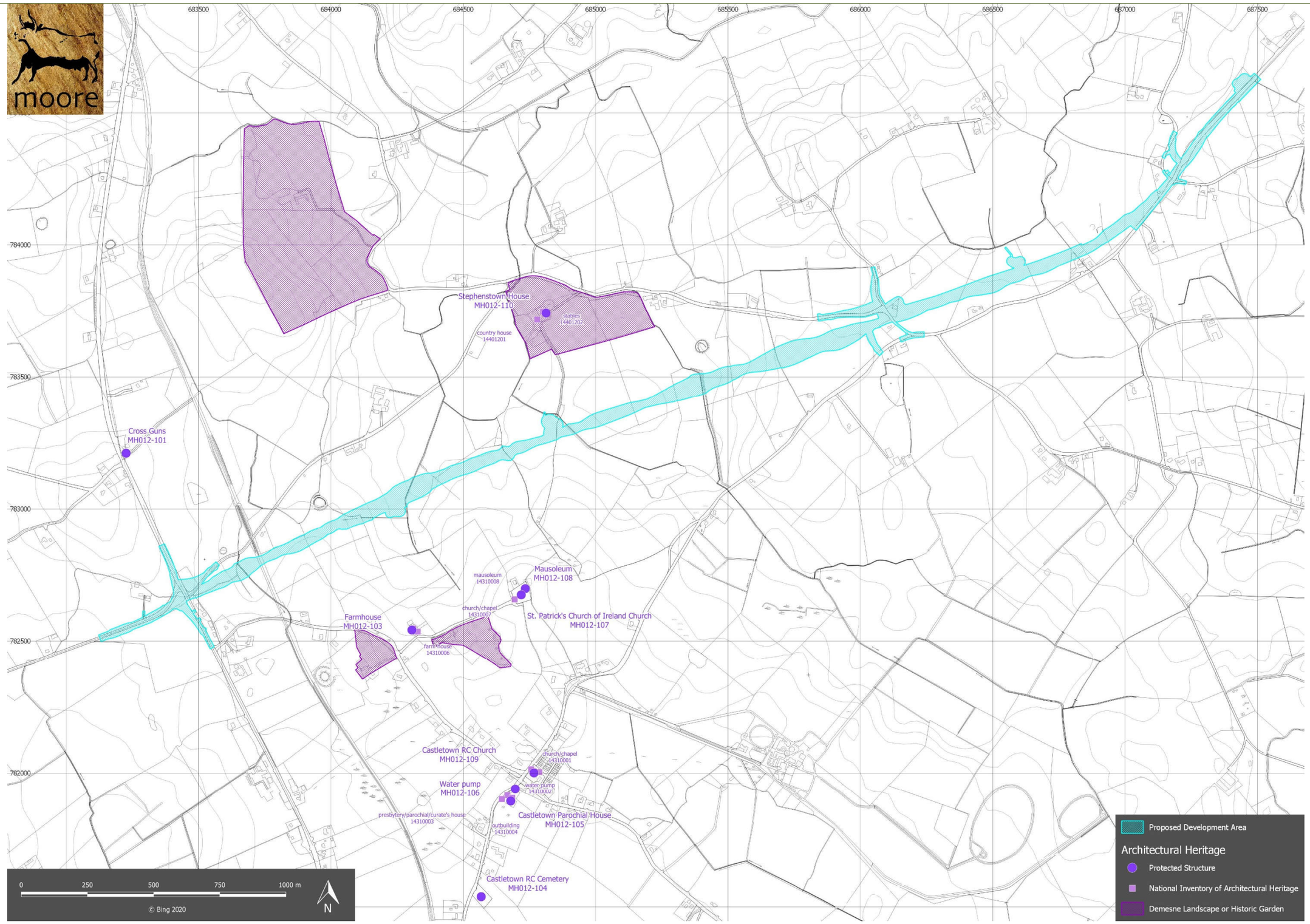


Figure 59 **Proposed route and architectural heritage sites in the vicinity**

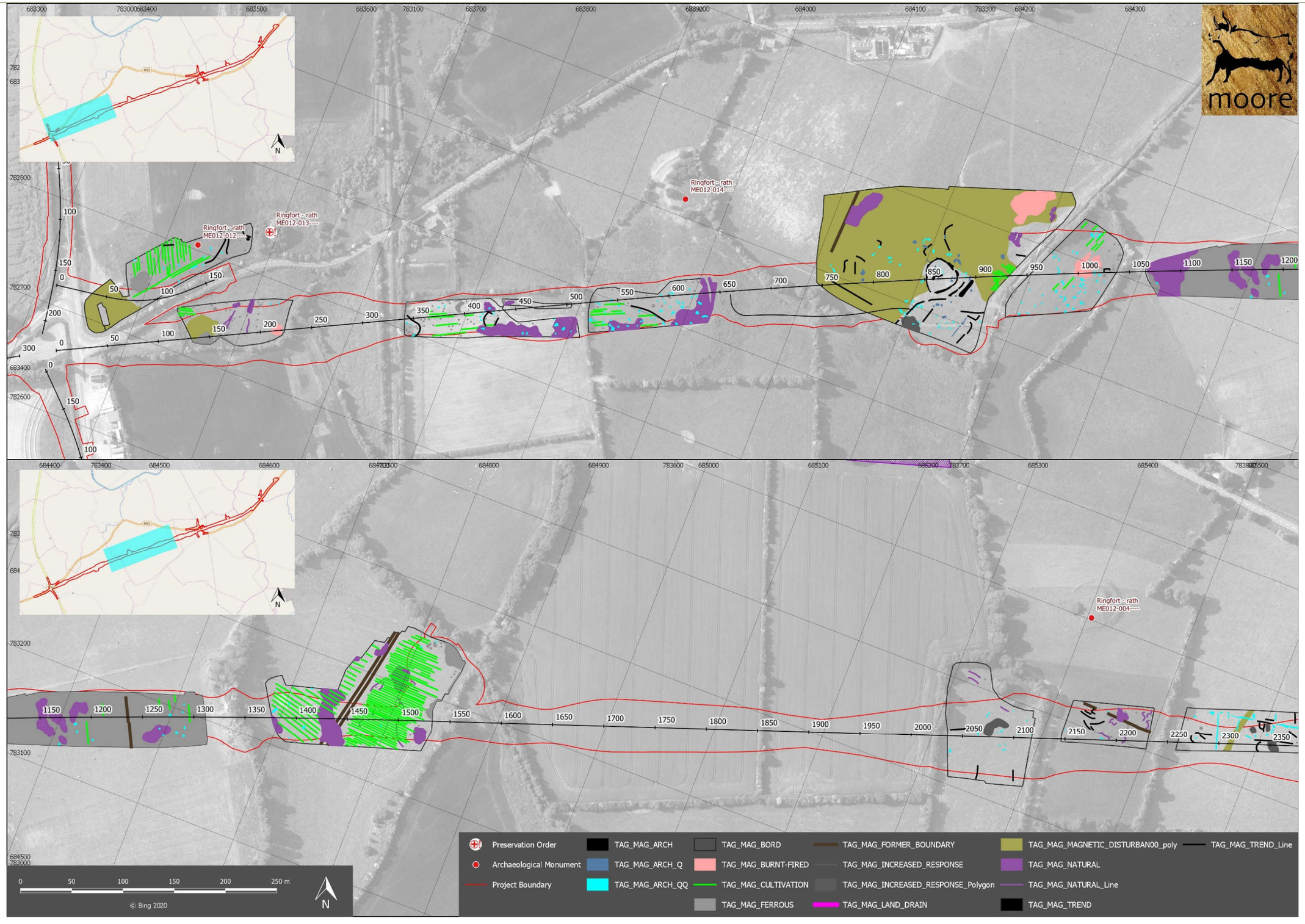


Figure 60 **Results of 2019 geophysical survey chainages 0-2350**

Figure 61 **Results of 2019 geophysical survey chainages 2350-4750**

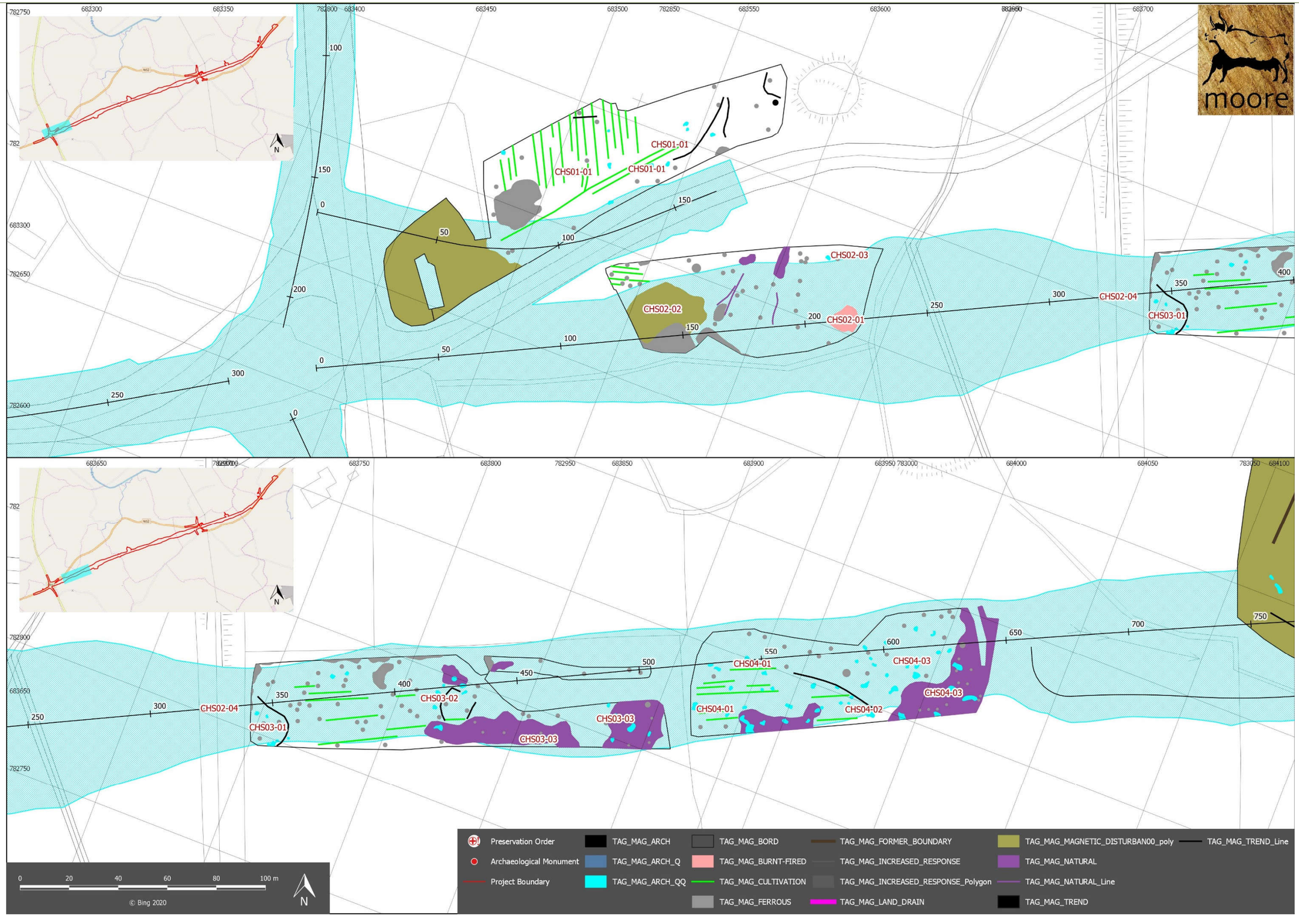


Figure 62 **Cultural Heritage sites chainages 0-750**

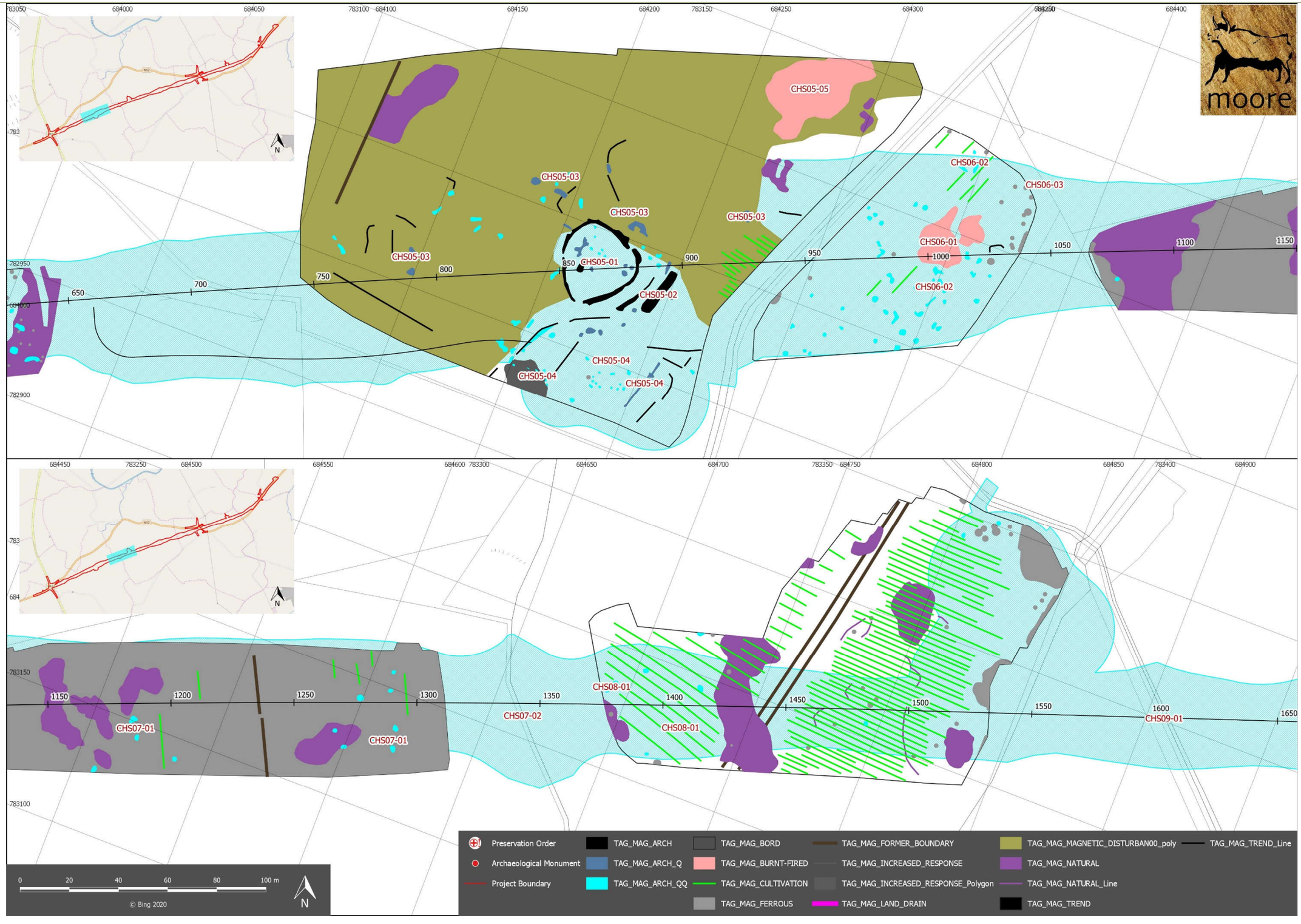


Figure 63 **Cultural Heritage sites chainages 750-1650**

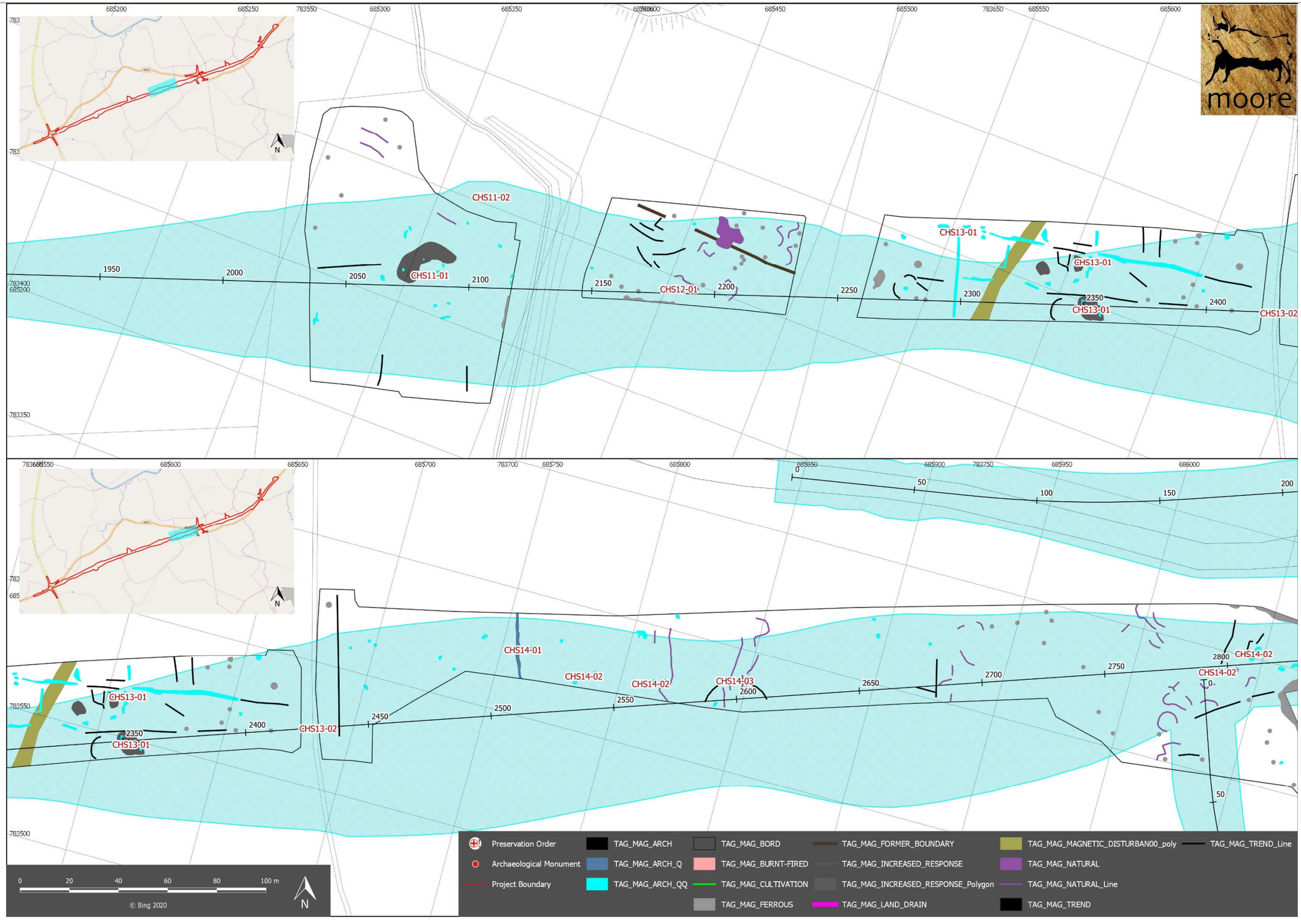


Figure 64 **Cultural Heritage sites chainages 1650-2800**

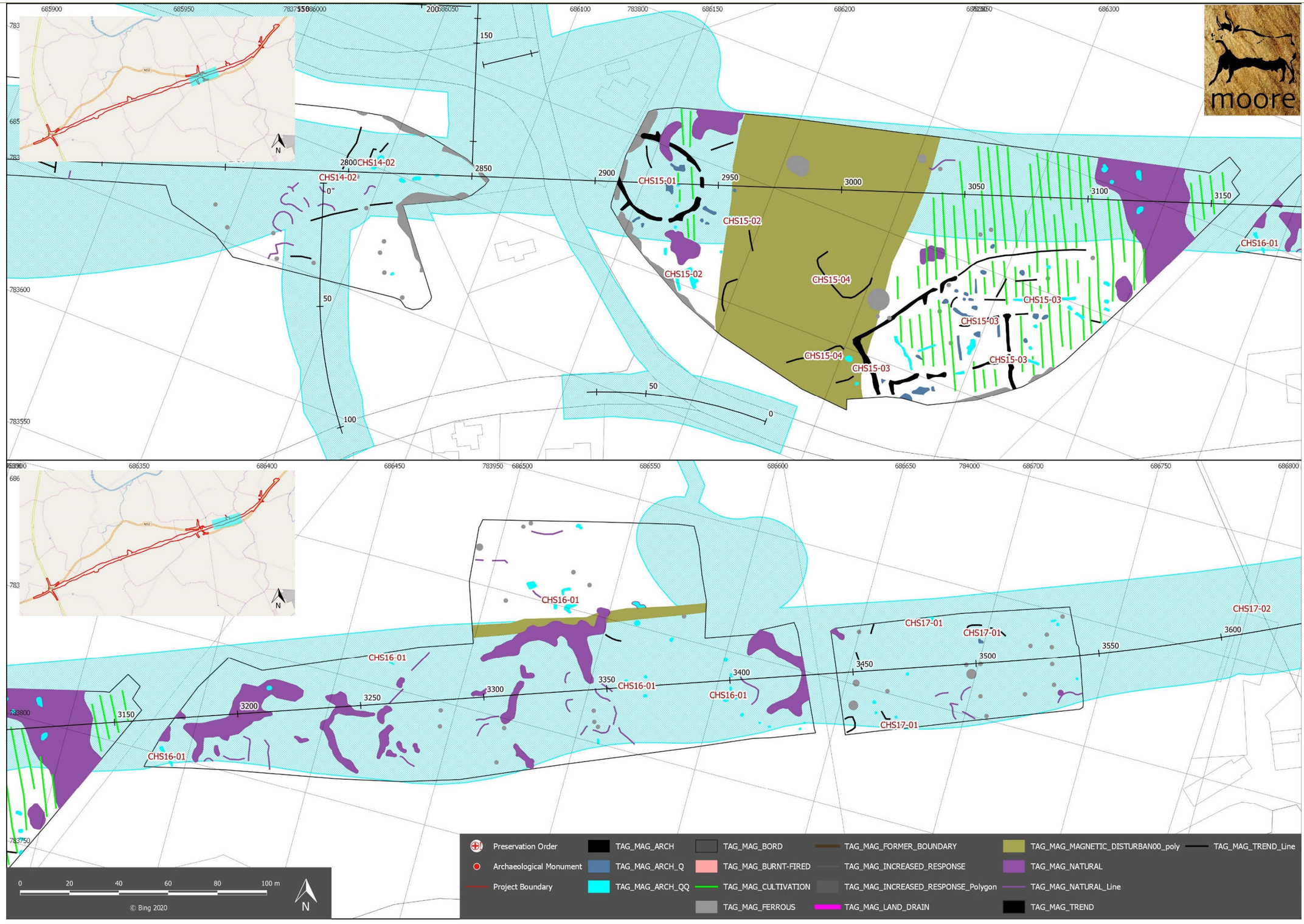


Figure 65 Cultural Heritage sites chainages 2800-3600

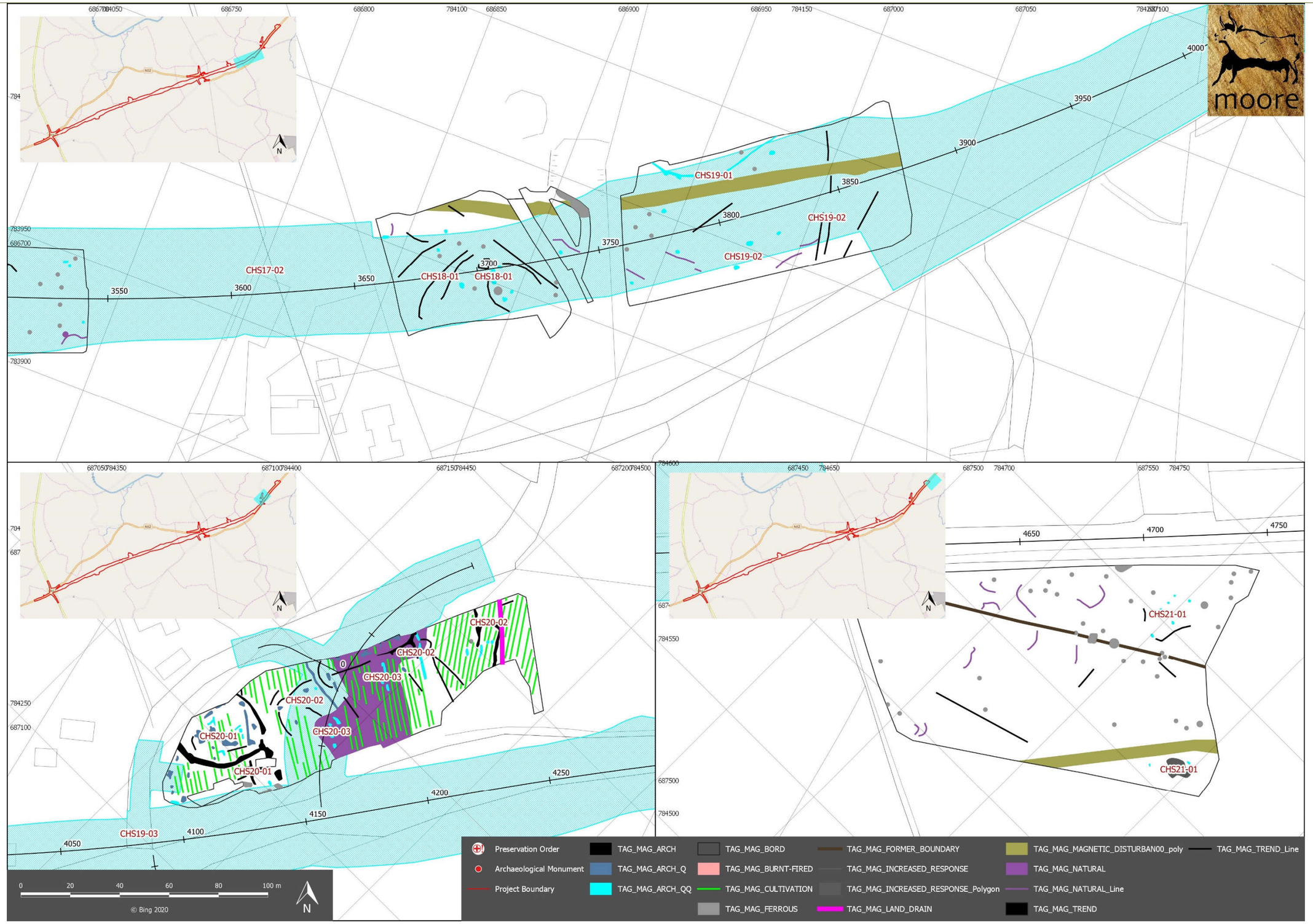


Figure 66 **Cultural Heritage sites chainages 3600-4750**

Appendix 6. Target Geophysics Report 1900IE9

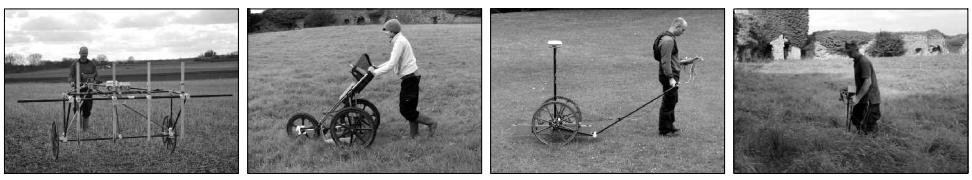
TARGET GEOPHYSICS REPORT 1500IE8

N52 STEPHENSTOWN TO FRINGESTOWN ROAD PROJECT, COUNTY MEATH

DETECTION LICENSE: 15R0141

CLIENT: MEATH COUNTY COUNCIL

TARGET archaeological geophysics



GPR

Magnetometry

Electromagnetics

Electrical Resistivity

TARGET GEOPHYSICS REPORT 1500IE8

N52 STEPHENSTOWN TO FRINGESTOWN ROAD PROJECT, COUNTY MEATH

PROJECT DETAILS

Geophysical survey was undertaken at 2 predefined locations (Areas 1 &2) situated along the route of proposed N52 Stephenstown–Fringestown road project, in Stephenstown, Castletown and Fringestown townlands, County Meath. Areas 1 & 2 border the existing N52 and comprise two separate sections of pasture land traversing 6 fields located east of the N52 junction with the R162 Navan Road and shortly west of Stokes Cross Roads. A total 6 locations within Areas 1 & 2 were investigated employing magnetometry and electromagnetic methods (M1.1-M2.3 and EMI2.1).

The survey objective was to identify, interpret and report on potential archaeological anomalies where present within the 2 sections of the proposed road corridor.

Study area location	Survey in Area 1 (M1.1-M1.3) extended eastwards from the N52 in Castletown (NGR 284203 283246) as far as NGR 284700 283297. Survey in Area 2 (M2.1-M2.3 & EMI2.1) extended from 286181 283629 in the south-west as far as Stokes Cross (686109 783652) in the north-east.
Townland(s)	Stephenstown, Castletown, Fringestown
County	Meath
Topography/landuse	Rolling lowland incorporating pasture fields
Soil typology	National Soil Survey of Ireland Association 43: gleys (60%), brown earths(20%), peaty gleys (20%) occurring over alluvium.
Archaeology	No RMP sites are located within either Areas 1 or 2 along the route of the proposed road. Both investigation areas are however deemed to be of significant archaeological potential in view of the various knolls, generally hilly landscape and proximity to recorded monuments. The latter include nearby crannog ME012-005 (Carnacop), and ringforts ME012-004 (Stephenstown), and ME012-017 (Fringestown). The site of a possible Castle is also indicated at Stephenstown House to the north-east of Area 1 (1650 Down Survey). Potentially significant features are also indicated in Area 2 by aerial photographs.
Technique(s)	Magnetometry, electromagnetic induction (EMI)

Client	Meath County Council
Consulting Archaeologists	IAC Ltd
Fieldwork	9th – 18th November 2015
Reporting	7th December 2015
Author	John Nicholls MSc
Detection License	15R0141

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1 TECHNICAL INFORMATION ON SURVEY

1.1 Data measurement and precision

A Trimble VRS Now GPS system was used to record GPS locations at a rate of 1Hz to a precision of 20-40mm (horizontal and vertical) along magnetometer and EMI instrument traverses during fieldwork. Magnetometer and EMI data were collected at a rate 30Hz and 10Hz respectively, with GPS locations used for positioning data from both methods in WGS84. Further alignment to Irish Grid was facilitated via reference points established across the site.

1.2 Geophysical instrumentation

The following geophysical instrumentation was employed for this project:

Table 1.2.1

Technique(s)	Line spacing	Sample rate	Instrumentation
Magnetometry	0.5m	30Hz	6-channel fluxgate gradiometer combined with GPS
EMI	0.75m	10Hz	CMD Mini-Explorer combined with GPS

1.3 Data processing

Data was processed using in-house, open-source and commercial software. Following collction of GPS, magnetometer and EMI measurements on site all data was processed as follows:

Table 1.3.1

No.	Description
1	Positioning of magnetometer and EMI data according to the GPS field measurements
2	Drift & zero median correction to balance data across entire sensor array (magnetometry); linear drift estimation (EMI)
4	Gridding of survey data via nearest neighbour interpolation
5	Greyscale generation at optimum range & export in tiff-format

2 GENERAL CONSIDERATIONS

2.1 Access, ground conditions and modern interference

2.1.1 Ground conditions through Areas 1 & 2 (M1.1-M2.3 & EMI2.1) were generally good, most of the lands comprising open fields under short pasture at the time of fieldwork. Magnetometer survey was complicated through the southern portion of M1.2 due to excessively wet terrain and considerable ground disturbance along the route of a farm trackway.

2.1.2 Small-scale ferrous anomalies are evident in both the magnetometer and EMI survey data. These derive mainly from modern metal debris in the topsoil. Larger concentrations of ferrous disturbance in the magnetometer data result from interference caused by metal fencing and ferrous debris at field boundary edges.

2.1.3 Natural soil/geological variations are apparent throughout both the magnetometer and EMI survey results in all survey locations. Extensive natural variation through Area 1 contributed to a disturbed and magnetically 'noisey' magnetometry data set throughout M1-1-M1.3. Interference from natural in Area 2 (M2.1-M2.3 & EMI2.1) was less problematic.

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2.1.4 Remnants of former cultivation are evident in M1.1 to the east.

2.1.5 Throughout the fieldwork period survey was complicated by excessively poor weather conditions, including prolonged heavy rain and strong wind. These poor survey conditions caused significant delay to completion of the magnetometry, and only partial completion of the EMI survey due equipment failure from water ingress.

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3 MAGNETOMETRY RESULTS

3.1 M1.1

The remains of a probable ringfort/rath are indicated by a circular enclosure ditch (1) to the south-west in the magnetometry results from M1.1. Further enclosure remains are indicated to the north-east by a broad rectangular arrangement of linear responses (2 & 3). Probable ringfort/rath site 1 measures c.28m in diameter. Rectangular anomalies 2 & 3 to the north-east cover an area c.60m north-east/south-west and 50m north-west/south-east.

Significant anomalies recorded in M1.1 are summarised below:

Table M1.1

Anomaly(s)	Location	Legend	Interpretation
1	SW	Archaeology	Circular enclosure –probable ringfort/rath site
2 & 3	NE	Archaeology & ?? Archaeology	Enclosure remains
*C=centre, N=north; E=east; S=south; W=west; NE=north-east; NW=north-west; SE=south-east; SW=south-west.			

The results from M1.1 are punctuated by numerous small-scale positive responses and weak trends, mostly angular and sub-circular in form. The potential that some of these anomalies may be of archaeological interest should not be dismissed. However, the majority likely represent continuing natural sol/geological variation across this section of the proposed scheme.

3.2 M1.2

No remains of definite archaeological character are evident in the results from M1.2. Weak trends to the south correspond with disturbed and excessively wet ground along the route of a farm trackway.

3.3 M1.3

No responses of definite archaeological character are apparent in the results from magnetometer survey in M1.3. Responses of tentative archaeological interest are indicated at survey centre, and notably to the north-west (4) and south-east (5). These poorly defined responses are deemed mainly to represent a combination of natural variation and modern interference.

Significant anomalies recorded in M1.3 are summarised below:

Table M1.3

Anomaly(s)	Location	Legend	Interpretation
4 & 5	NW & SE	?? Archaeology	Probable natural soil/geological variation
*C=centre, N=north; E=east; S=south; W=west; NE=north-east; NW=north-west; SE=south-east; SW=south-west.			

Suspected land drains are evident to the west, and zones of magnetic disturbance are also indicated. The latter are likely of modern origin. No further responses of note have been recorded in M1.3.

3.4 M2.1

No responses of definite archaeological character are apparent in the results from magnetometer survey in M2.1. Small-scale responses of tentative interest are indicated. These display no clear

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concentration or form to suggest they are of significant archaeological potential. The remaining anomalies in M2.1 likely derive from patterns of landuse and natural soil/geological variation.

3.5 M2.2

No responses of definite archaeological character are apparent in the results from magnetometer survey in M2.2. Small-scale responses of tentative interest are indicated to the north-east and south-west. These display no clear concentration or form to suggest they are of significant archaeological potential. The remaining anomalies in M2.2 likely derive from a combination of patterns of landuse and natural soil/geological variation.

3.6 M2.3

The part remains of a sub-rectangular enclosure (6) c.43m in diameter have been recorded to the south-west in M2.3. The enclosure ditch is substantial measuring c.3m in width. Linear and sub-angular responses (7) of archaeological potential are indicated at the interior of 6, with outlying ditch remains present to the west/south-west (8) and north (9). Further responses of potential interest extend from survey centre to the north-east. These comprise a series of overlapping/interconnecting linear anomalies (10—12), a number of which may represent enclosure remains or part of an early field system.

Significant anomalies recorded in M2.3 are summarised below:

Table M2.3

Anomaly(s)	Location	Legend	Interpretation
6	SW	Archaeology	Sub-rectangular enclosure (part of)
7	SW (interior of 6)	? Archaeology & ?? Archaeology	Potential ditch/pit locations
8 & 9	SW & W	? Archaeology	Probable outlying ditch remains
10-12	Centre to NE	? Archaeology	Possible enclosure remains or early field system (part of)
*C=centre, N=north; E=east; S=south; W=west; NE=north-east; NW=north-west; SE=south-east; SW=south-west.			

Numerous small-scale positives and weak trends are indicated throughout M2.3 are likely represent a combination of landuse, natural soil/geological variation and modern ferrous material. Substantial magnetic disturbance to the east/south-east is expected to represent derives recent landscaping.

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4 EMI RESULTS

4.1 EMI2.1

No anomalies of definite archaeological character are indicated in EMI2.1. The survey results from EMI2.1 generally equate with responses from patterns of landuse and natural soil/geological variation.

Significant anomalies in M1 are summarised below:

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5 CONCLUSIONS

5.1 The magnetometer survey has been successful in defining the location and extent of a number of archaeological sites situated in Areas 1 & 2 along the route of the proposed N52 Stephenstown to Fringestown Road Project. These archaeological sites include a probable ringfort/rath site in M1.1 to the south-west; probable rectangular enclosure remains to the north-east in M1.1; sub-rectangular enclosure and associated anomalies to the south-west/west in M2.3; and potential enclosure/possible field system remains at survey centre and to the north-east in M2.3.

5.2 The remaining anomalies recorded from magnetometer survey in Areas 1 & 2 are expected to derive from a combination of natural soil/geological variation, modern landuse.

5.3 The anomalies recorded from EMI survey in Area 2 are expected to derive from a combination of natural soil/geological variation and modern landuse.

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APPENDIX

Appendix 1	Technical Information

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APPENDIX 1: TECHNICAL INFORMATION

INSTRUMENTATION

GPR/Ground Penetrating Radar: GPR systems comprise a configuration/data acquisition unit, a transmitting/receiving antenna (250-500mhz), and a cart with an odometer or integrated GPS. The technique is used for identifying remains of buried foundations, structures and cavities. GPR systems transmit a continuous electromagnetic wave of energy into the ground and record reflections of that energy as it interacts with the stratigraphy and structures below the surface. Data is acquired along parallel transects, 0.5m or 1m apart, and recorded as a function of the elapsed time for the energy wave to travel from transmitter to reflector and back to the surface. The strength of reflections recorded from GPR survey is proportional to the conductive and dielectric properties of the buried objects with which the transmitted energy is incident.

Gradiometry/Magnetometry (6 sensor gradiometer system combined with GPS): Gradiometry is the most widely applied technique in archaeological prospection, and is regularly used on sites 1-100ha in size to locate and characterize buried remains of enclosure ditches, pits, hearths, furnaces and kilns. These remains often produce magnetic contrasts above localized soil/geological variation due to enhancement from burning activity and organic enrichment of the soil during archaeological settlement. Mapping of these contrasts is undertaken using an array of either caesium or fluxgate magnetometer sensors for measurement of the earth's total field or variations in its vertical component. Target uses a 6 sensor gradiometer system combined with cm precision GPS to measure magnetic anomalies from buried archaeological remains in detail, collecting data along parallel lines 0.5m or 0.75m apart, at 10-12cm intervals along each line.

Electrical Resistivity: Electrical resistivity is generally used to map locations of buried structures, including foundation remains, walls, burial cairns, and existing earthworks. Using an array of electrodes mounted on a portable frame a small electrical current is passed through the ground at regular intervals via *current* emitting probes. Variations in resistance to the flow of this electrical current as it passes through the ground are measured by *potential* probes. Single or parallel twin arrays use 1 or 2 pairs of current and potential probes fixed to a mobile frame, with 1 remote *current* and 1 *potential* probe maintained stationary 20m from the survey limit. Resistivity surveys are normally conducted at 0.5m x 1m or 1m x 1m intervals.

EMI/Electromagnetic Induction (EMI sled system combined with GPS): EMI is suitable for detection of buried remains including foundations, enclosures, ditches, pits, and kilns. The technique measures variations in both the electrical conductivity and magnetic susceptibility of the soil. EMI systems comprises of 1 transmitting and 2-4 receiving coils, providing 2-8 data sets from below surface. The transmitting coil generates a time varying primary magnetic field which propagates above and below ground, generating alternating (eddy) currents within the soil and the objects it contains. These create a secondary magnetic field proportional to the rate of change of the magnetic field, which is measured by receiving coils 0.5m and 1m from the transmitting coil. Target's EMI sled system is used to survey in vertical or horizontal modes along 0.5m, 0.75m or 1m spaced lines at 10-12cm intervals along each line.

DISPLAY

Greyscale: The greyscale format assigns a cell to each datum according to its location on the grid. The display of each data point is conducted at very fine increments, allowing the full range of values to be displayed within a given data set. This display method also enables the identification of discrete responses barely above localized soil/geological variations.

Colour Plot: Colour plots comprising RGB values linearly interpolated between a user-specified range of values can provide further insight into the varying anomalies within a given data set. Colour plots are particularly useful for EMI data where presentation of results within a confined range of values is not always feasible with other formats.

XY Trace: XY Trace displays provide a near-perspective representation of responses recorded along each instrument traverse. The format is used mainly for locating responses from modern ferrous, but can assist in identifying magnetically strong anomalies relating to hearth, kiln and furnace remains. Ferrous anomalies can also be identified via a search of the attribute table in a GIS extracting readings beyond a specified range (e.g. where z<= -15 and where z>=15), and then combining this layer with other display formats for interpretation.

Time-slice: Radargrams collected from grid based survey or parallel transects can be compiled as a 3D volume, then re-sampled to produce a series of 2D plans at incremental depth/time offsets. A series of Time-slice displays at 25-50cm offsets permits analysis of the pattern and depth of reflections within a given GPR survey area.

Magnetometry
Electromagnetic induction
Survey perimeter

ME012-006 Earthwork and souterrain

ME012-005 Crannog

Crannog

Stephenstown Bridge

Stephenstown House. Possible site of a castle on Down Survey

Stephenstown House

ME012-004 Ringfort

Stream

M2.3

Stokes Cross Roads

M2.2/EMI2.1

M2.1

STEPHENSTOWN

M1.2

ME012-017 Ringfort

FRINGE

M1.3

M1.1

N52

ME012-014 Ringfort

ME012-016 Castletown Church and associated

TARGET archaeological geophysics	**Title** Geophysical survey areas M1.1-M2.3 & EMI2.1	**Fig.** 1	
	Project N52 Stephenstown to Fringestown Road Project, County Meath	**Scale** 1:6000 @ A3	
	Client IAC Ltd on behalf of Meath County Council	**Ref.** IE15008	

0 m 240

N W E S

M1.2

M1.1

M1.3

TARGET archaeological geophysics	**Title** Magnetometry greyscales M1.1 - M1.3	**Fig.** 2	-8 nT 12
	Project N52 Stephenstown to Fringestown Road Project, County Meath	**Scale** 1:1500 @ A3	0 m 60
	Client IAC Ltd on behalf of Meath County Council	**Ref.** IE15008	N W E S

M2.1

M2.2

M2.2

M2.3

TARGET archaeological geophysics	**Title** Magnetometry greyscales M2.1 - M2.3	**Fig.** 3	-8 nT 12
	Project N52 Stephenstown to Fringestown Road Project, County Meath	**Scale** 1:1500 @ A3	0 m 60
	Client IAC Ltd on behalf of Meath County Council	**Ref.** IE15008	N W E S

M2.1

M2.2

level 1 quadrature/conductivity

-1.25 mSm 1.00

EMI2.1

level 2 quadrature/conductivity

-2.1 mSm 1.13

EMI2.1

level 3 quadrature/conductivity

-2.69 mSm 1.55

EMI2.1

TARGET archaeological geophysics

Title	EMI quadrature (conductivity) greyscales EM2.1	**Fig.**	4
Project	N52 Stephenstown to Fringestown Road Project, County Meath	**Scale**	1:1500 @ A3
Client	IAC Ltd on behalf of Meath County Council	**Ref.**	IE15008

0 m 60

N W E S

Archaeology
? Archaeology
?? Archaeology
Trend
Possible land drain
Natural
Former boundary
Cultivation
Magnetic disturbance
Ferrous

M1.1

M1.2

M1.3

1

2

3

4

5

TARGET archaeological geophysics	**Title** Magnetometry interpretations M1.1 - M1.3	**Fig.** 5	
	Project N52 Stephenstown to Fringestown Road Project, County Meath	**Scale** 1:1500 @ A3	
	Client IAC Ltd on behalf of Meath County Council	**Ref.** IE15008	

0 m 60

N W E S

M2.1

M2.2

M2.2

M2.3

6

7

8

9

10

11

12

- Archaeology
- ? Archaeology
- ?? Archaeology
- Trend
- Possible land drain
- Natural
- Former boundary
- Cultivation
- Magnetic disturbance
- Ferrous

TARGET archaeological geophysics

Title	Magnetometry interpretations M2.1 - M2.3	**Fig.**	6
Project	N52 Stephenstown to Fringestown Road Project, County Meath	**Scale**	1:1500 @ A3
Client	IAC Ltd on behalf of Meath County Council	**Ref.**	IE15008

0 m 60

N W E S

EMI2.1

Trend

Natural

Ferrous

archaeological geophysics

Title	EMI interpretation EMI2.1	**Fig.**	7
Project	N52 Stephenstown to Fringestown Road Project, County Meath	**Scale**	1:1500 @ A3
Client	IAC Ltd on behalf of Meath County Council	**Ref.**	IE15008

0 m 60

N W E S

Appendix E. Supporting Ecological Reports

Technical Note

Project:	5158291		
Subject:	Invasive Species Survey: N52 Grange to Clontail Scheme		
Author:	Colin Wilson	Atkins No.:	5158291DG0090
Date:	28/09/2018	Icepac No.:	
		Project No.:	5158291
Distribution:		Representing:	

The purpose of this technical note is to document floral invasive species surveys carried out on the emerging preferred route of the N52 Grange to Clontail Road Scheme.

Introduction

The N52 Grange to Clontail Scheme has been subject to a Phase 2-Stage 2 Route Options process where four route options (magenta, red, orange and cyan) where considered. The study area of the scheme and the routes of these four options are detailed below in Figure 1. Route Options.

The route selection process has determined that the red route is the emerging preferred route.

As part of the Phase 3-Design stage a series of ecological surveys were undertaken along the Red Route. This technical note details the findings of floral invasive species surveys undertaken along this route as well as the adjoining lands.

Atkins Ecology were engaged to undertake a non-native invasive plant species survey based upon the species listed in Part 1 of the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011).

Section 49 and 50 of Part 6 of the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011) outlines the legal context for the prohibition of the introduction and dispersal of certain plant and animal species. Specifically, Section 49, paragraph 2 states that any person without the required licence "*who plants, disperses, allows or causes to disperse, spreads or otherwise causes to grow*" any plant species listed in Part 1 of the Third Schedule within the State shall be guilty of an offence.

Furthermore, under Section 50 paragraph 1, a person without the required licence "*shall be guilty of an offence if he or she has in his or her possession for sale, or for the purposes of breeding, reproduction or propagation, or offers or exposes for sale, transportation, distribution, introduction or release*" of any plant species listed in Part 1 of the Third Schedule (See Appendix A) or anything from which "*a plant referred to in Part 1 of the Third Schedule can be reproduced or propagated or "a vector material listed in Part 3 of the Third Schedule*". This vector material is defined as "soil or spoil taken from places infested with Japanese knotweed (*Fallopia japonica*), Giant knotweed (*Fallopia sachalinensis*) or their hybrid Bohemian knotweed (*Fallopia x bohemica*)". Therefore, it is imperative to conduct surveys for IAS throughout the site during preliminary design.

The surveys were undertaken when floral species would be evident in August 2018 and primarily focused on the most common floral invasive species likely to have an impact on a national road scheme. Invasive species surveys were focused on but not limited to the following floral species: -

- Japanese Knotweed (*Fallopia japonica*)
- Himalayan Knotweed (*Persicaria wallichii*)
- Himalayan/Indian Balsam (*Impatiens glandulifera*)
- Giant Hogweed (*Heracleum mantegazzianum*)

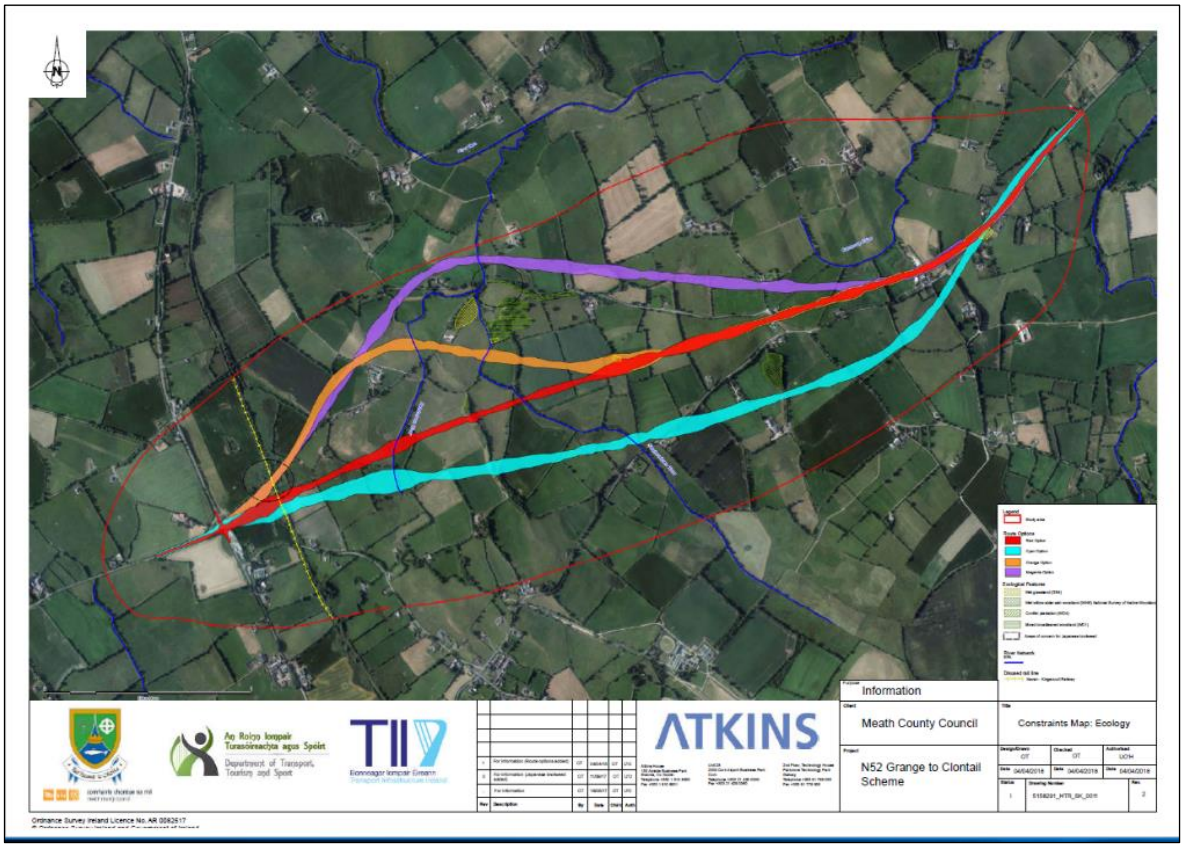


Figure 1. Route Options, with Red Route as emerging preferred route.

Historical Evidence

A desk study was undertaken to assess if any floral invasive species were known to be within the study area. The NBDC[i] datasets were reviewed for historical evidence of the noted species. None of the afore mentioned invasive floral species are noted as having been sighted or recorded within the footprint of the Red Route nor within the study area of the N52 Grange to Clontail Scheme.

Information in regard to known invasive species was requested from Meath County Council. The council have noted 2 no. of areas where Japanese Knotweed is known to have established within the study area of the scheme. These 2 no. of knotweed stands were inspected as part of the invasive species survey to determine if they have the potential to impact on the Red Route.

Survey Findings

The footprint of the Red Route, ca. 5.5km in length, along with lands within ca. 30m either side of the route, were inspected for evidence of invasive plant species.

No Japanese Knotweed was noted within the Red Route nor within ca. 30m either side of the route.

No Himalayan Knotweed was noted within the Red Route nor within ca. 30m either side of the route.

No Himalayan/Indian Balsam was noted within the Red Route nor within ca. 30m either side of the route.

No Giant Hogweed was noted within the Red Route nor within ca. 30m either side of the route.

Japanese Knotweed was noted ca. 75-80m to the north of the preferred route at Chainage 0+310 adjacent to a disused railway line. This knotweed stand covers an estimated 30-40 square meters. The location of the knotweed stand is detailed below in Figure 2. Japanese Knotweed Stand 1.

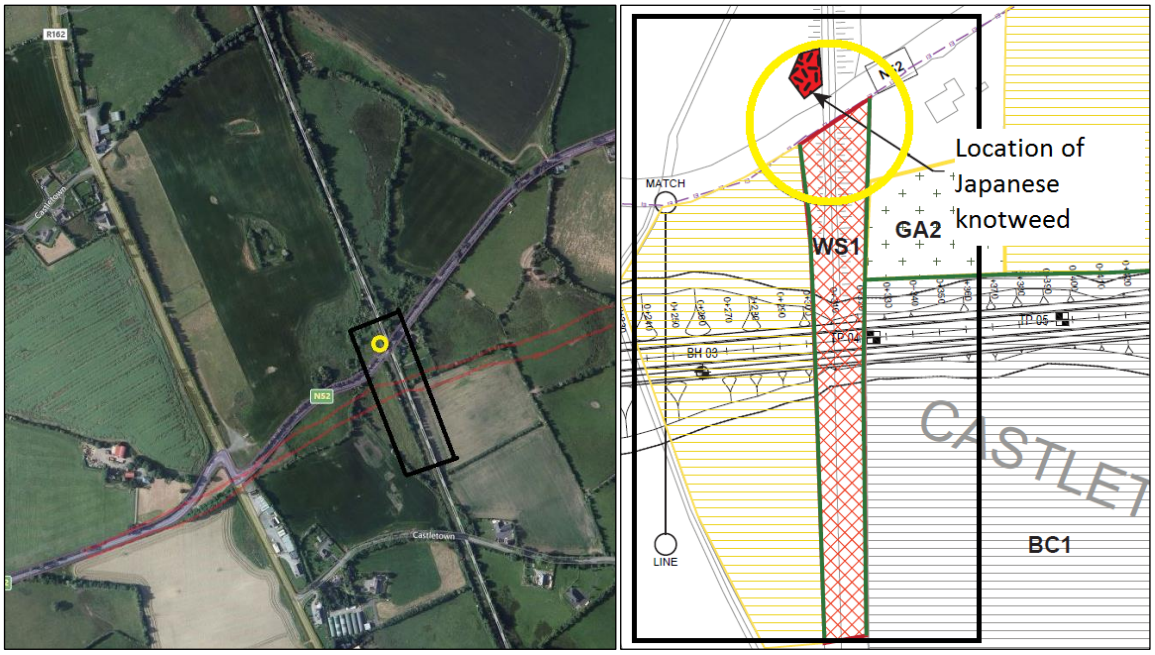


Figure 2: Japanese Knotweed Stand 1, on edge of railway embankment north of Ch.0+310.

The knotweed stand is noted as having been treated with herbicide application which is having a significant effect on growth with an estimated 80-90% of the stand showing signs of die back and the remaining summer growth is showing signs of being stunted and distorted. Plates 1-4 below indicate the effectiveness of herbicide application on this knotweed stand.

The area of knotweed is located at the base of the railway embankment adjacent to the in-situ N52 road. The knotweed stand is separated from the footprint of the Red Route by the original N52 roadway and ca. 70m of railway embankment and associated hedgerow and scrub habitat.

Plates 1 & 2: Japanese knotweed stand with dead stalks evident during August.

Plates 3 & 4: Japanese knotweed showing signs of stunted growth.

Japanese Knotweed was also noted ca. 550-600m north of the Red Route at approximate Chainage 1+500. This small stand of knotweed is located on the verge of the west bound lane of the original N52 road and it shows signs of having been treated and controlled with herbicide application. The majority of the stand is showing signs of die back with only occasional new summer shoots evident. The location of the knotweed stand is detailed below in Figure 3. Japanese Knotweed Stand 2.

Meath County Council are aware of both of the aforementioned stands and provided locations for these areas of invasive species.

Figures 5 & 6 below show the Japanese Knotweed stand indicating effectiveness of herbicide application and a number of areas of summer regrowth.

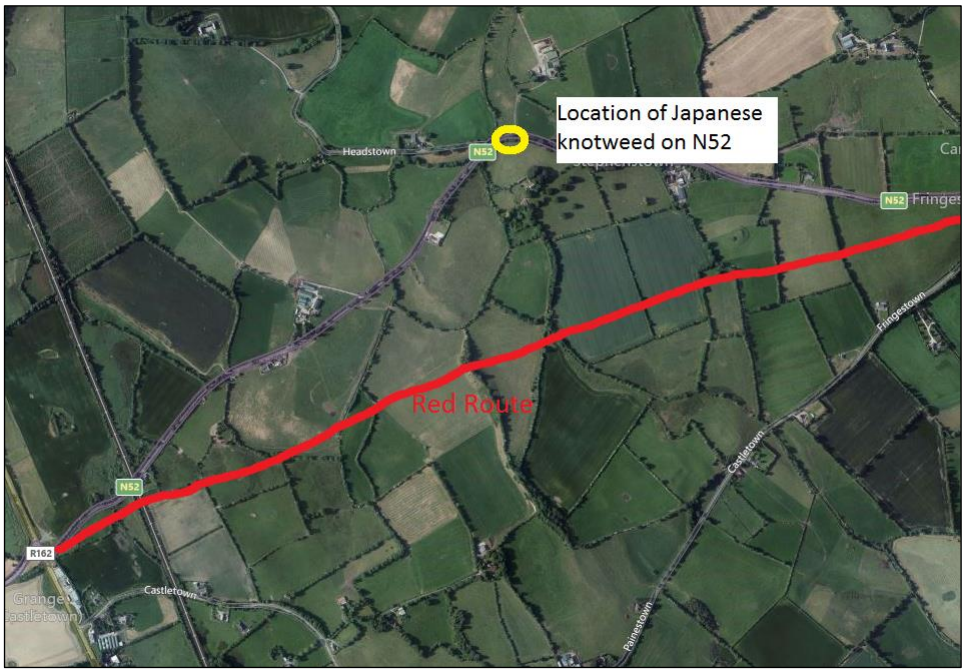


Figure 3. Japanese Knotweed Stand 2, located on verge of N52.

Figures 5 & 6: Japanese knotweed stand 2 on verge of N52 ca. 550m north of Red Route.

Conclusions

No evidence of floral invasive species was noted within the footprint of the Red Route. No evidence of Himalayan Knotweed, Himalayan/Indian Balsam or Giant Hogweed was recorded during the invasive species surveys of the Red Route.

The nearest noted invasive plant species, a Japanese Knotweed stand, is noted as ca. 75-80m from the proposed route. Due to the distance of this stand from the footprint of the Red Route and due to the physical barrier presented by the original N52 roadway it is considered that this stand will not negatively impact upon the Red Route. It is recommended that the details and extent of this knotweed stand are taken into consideration during the design phase so as to mitigate against any potential vegetative distribution during the construction phase of the scheme.

The second stand of knotweed should have no negative impact upon the proposed N52 Grange to Clontail Scheme due to the distance (ca. 550- 600m) from the proposed route. It is recommended that the design phase notes the extent and location of this knotweed stand so that site vehicles do not cause unwanted vegetative transportation along the original N52 during the construction phase of the project.

As no floral invasive species have been noted within, or in immediate proximity to, the emerging preferred route it is considered that there will be no negative impact upon the N52 Grange to Clontail Scheme from the afore mentioned invasive floral species Japanese Knotweed (*Fallopia japonica*), Himalayan Knotweed (*Persicaria wallichii*), Himalayan/Indian Balsam (*Impatiens glandulifera*) and Giant Hogweed (*Heracleum mantegazzianum*).

[i] https://maps.biodiversityireland.ie/Map

Technical Note

Project:	5158291		
Subject:	Habitat Survey: N52 Grange to Clontail Scheme		
Author:	Colin Wilson	Atkins No.:	5158291DG0091
Date:	28/09/2018	Icepac No.:	
		Project No.:	5158291
Distribution:		Representing:	

The purpose of this technical note is to document habitat surveys carried out on the emerging preferred route of the N52 Grange to Clontail Road Scheme.

Introduction

The N52 Grange to Clontail Scheme has been subject to a Phase 2-Stage 2 Route Options process where four route options (magenta, red, orange and cyan) where considered. The routes of these four options are detailed below in Figure 1. Route Options.

The route selection process has determined that the Red Route is the emerging preferred route. As part of the Phase 3-Design stage a series of ecological surveys were undertaken along the Red Route. This technical note details the findings of habitat surveys carried out during August 2018 within the footprint Red Route and adjoining lands.

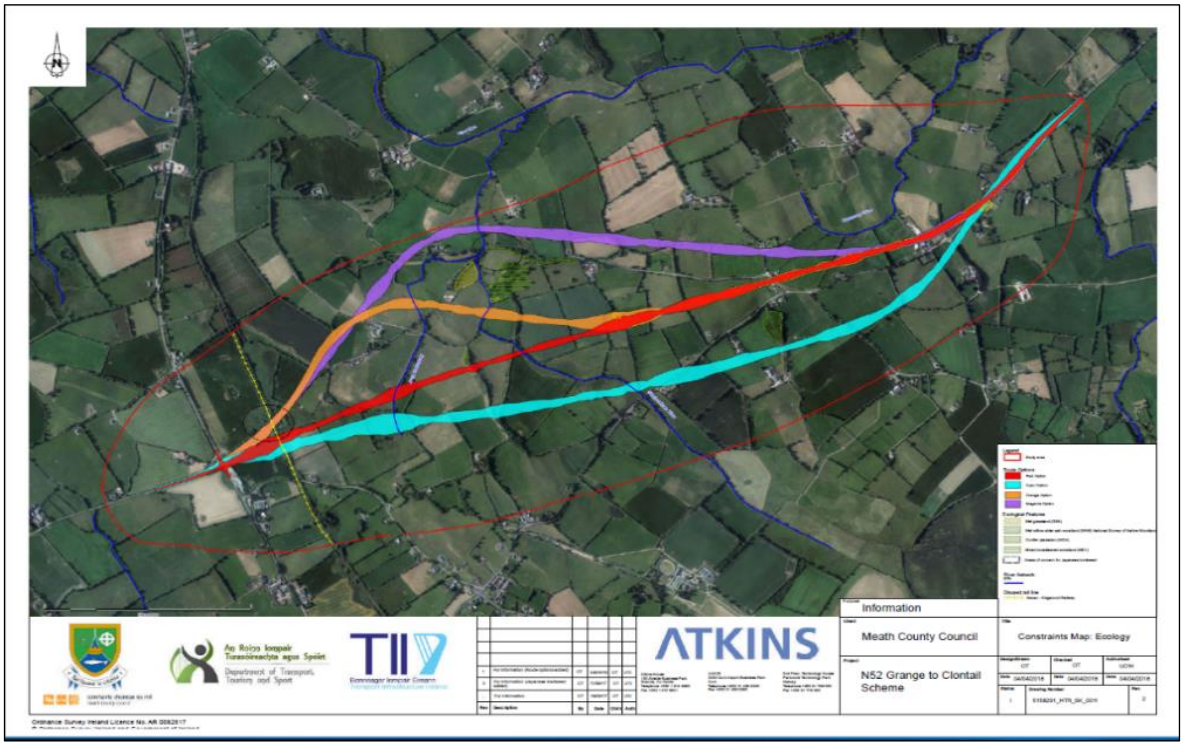


Figure 1. Route Options, with Red Route as emerging preferred route.

Survey Methodology

The footprint of the Red Route along with adjoining lands were surveyed during August 2018 for habitat types. Information on the type, extent and location of habitats within the area of the Red Route was collected. The information was used to prepare a habitat map with the aim to clearly outline the spatial characteristics of semi-natural habitats within the area of the route. Habitats were identified, described, classified and subsequently mapped according to standards outlined in *A Guide to Habitats in Ireland* (Fossitt, 2000) and *Habitat Survey Guidelines* (Smith *et al*., 2011).

The habitats encountered during the survey were also rated for their conservation value and ecological significance using the ecological valuing framework as outlined in *Guidelines for Assessment of Ecological Impacts of National Road Schemes.* (NRA ,2009). The ecological evaluation framework is summarised below in Table 1 - Ecological Evaluation Ratings.

Table 1. Ecological Evaluation Ratings.

Habitat ecological evaluation / rating	
A	Internationally Importance
B	National Importance
C	County Importance
D	Local Importance (higher value)
E	Local Importance (lower value)

Habitat survey and mapping followed *Habitat Survey Guidelines* (Smith *et al*., 2011) published by the heritage council. Where appropriate, information on individual species or other small-scale biodiversity features are also included; however, the primary purpose of the survey is to provide habitat information within the area of the Red Route to inform the Phase 3 – Design stage of the project.

Survey Findings

Habitat types and the location of each habitat along and bordering the Red Route are summarised in Appendix 1: Red Route Habitat Detail. This information outlines the various habitats found along all areas of the route which are listed by chainage location. Details also include Fossit (2000) habitat classification, general description of habitat and the ecological rating of each habitat found during the walkover surveys.

Habitat types along the footprint and bordering the Red Route are mapped in Appendix 2: Habitat Survey Maps 01-05.

Summary of Survey Findings

Agricultural Grassland and Arable Crops (GA1, BC1)

The lands within the red route are dominated largely by intensively managed and highly modified agricultural grasslands (GA1). These improved agricultural grasslands are species poor and as such are of poor ecological value. There are a fewer number of areas (4 no.) where the agricultural land is managed for the production of arable crops (BC1).

The agricultural grassland fields are dominated by rye-grasses (*Lolium* spp.) and white clover (*Trifolium repens*) with meadow grasses (*Poa* spp.) also abundant. The arable lands noted during the survey were dominated by potato and wheat crops. In total the red route passes through 23 no. of improved agricultural grassland fields (GA1) and 4 no. of arable crop fields (BC1) all of which are noted as of low ecologically value.

Hedgerows and Treelines (WL1, WL2)

The proposed Red Route passes through and will impact upon a significant number of field boundaries the vast majority of which are linear scrub and woodland habitats such as hedgerows (WL1) and treelines (WL2). The hedgerows (WL1) and the treelines (WL2) are noted as predominantly made up of hawthorn (*Crataegus monogyna*), ash (*Fraxinus excelsior*) and elder (*Sambucus nigra*) species. Other species noted in less abundance within the hedgerow and treeline habitats include crack willow (*Salix fragilis*), grey willow (*Salix cinereal*), sycamore, blackthorn (*Prunus spinosa*) and leyland cypress (*Cuprocyparis leylandii*).

In total the red route passes through 44 no. hedgerows (WL1) and 7 no. treelines (WL2). Approximately 3,100m of linear hedgerow are found within and therefore are likely to be lost within the footprint of the Red Route. Approximately 290m of linear treelines are found and likely to be lost within the footprint of the Red Route.

Plate 1. Typical hawthorn and ash hedgerows and treelines found along route.

Watercourses (FW3)

The red route crosses 4 no. of small watercourses which are noted as depositing lowland rivers (FW3). The EPA identify 2no. of watercourses as the Headstown and Stephenstown Streams and 2no. are unnamed tributaries of the Stephenstown Stream. Cattle poaching was evident at the Headstown Stream. Water was running clear in all watercourses, no fish species were noted in any watercourse.

Watercourse location details and watercourse habitat descriptions are also noted in Appendix 1: Red Route Habitat Detail and are detailed on maps in Appendix 2: Habitat Survey Maps 01-05.

Plate 2. Watercourses crossed by the route.

Wet Grassland (GS4)

The red route passes directly adjacent to 2 no. areas of wet grassland habitat (GS4). The species noted within the areas of wet grassland areas include young developing willow (*Salix fragilis)*, soft rush (*Juncus effusus*), bulrush (*Typha latifolia*), yellow iris (*Iris pseudacorus*), greater bird's-foot-trefoil (*Lotus pedunculatus*) and meadowsweet (*Filipendula ulmaria*).

Wet grassland habitat is to be found at Ch. 2+070 - 2+110 on the north side of the route. The approximate area of the wet grassland is ca. 700m2 with the footprint of the route encroaching into ca. 230m^2 of this habitat. The wet grassland habitat is considered to have been formed by the flooding of an adjoining watercourse and is dominated by yellow iris (*Iris pseudacorus*) and soft rush (*Juncas effusus*). The wet grassland habitat is bordered by the watercourse to the north and east and by agricultural grassland on the south and west sides.

Wet grassland habitat is also located adjacent to the route at Ch. 3+900. This area of wet grassland is predominantly within the gardens of a private property and has been excavated and altered to form an artificial pond (FL8). A line of young willow woodland is developing on the east side of the wet grassland forming the property boundary. Dominant species within the wet grassland habitat include soft rush (*Juncas effusus*), bulrush (*Typha latifolia*), yellow iris (*Iris pseudacorus*), greater bird's-foot-trefoil (*Lotus pedunculatus*) and meadowsweet (*Filipendula ulmaria*). The wet grassland habitat is bordered on the Red Route side (north side) by amenity grassland (GA2) which has been landscaped with the planting of a number of standard trees including cherry (*Prunus* spp.), rowan (*Sorbus aucuparia*), sessile oak (*Quercus petraea*) and whitebeam (*Sorbus aria*). The approximate area of wet grassland is ca. 2600 - 2800m^2. The footprint of the Red Route does not encroach into this habitat. The Red Route crosses through the amenity grassland (GA2) bordering this area of wet grassland habitat.

Wet grassland locations and survey details are outlined in detail in Appendix 1: Red Route Habitat Detail and are detailed on maps in Appendix 2: Habitat Survey Maps 01-05.

Plate 3. Wet grassland habitat within route at Ch. 2+070.

Plate 4. Wet grassland habitat and pond found adjacent to the route at Ch.3+890.

Scrub (WS1)

The red route passes through 2 no. of areas of scrub habitat (WS1). Scrub is noted as dominant habitat along the embankments of a disused railway line where the predominant species are dense bramble (*Rubus fructicosus*) ground cover and common nettle (*Urtica dioica*) with occasional young willow (*Salix fragilis*) developing sporadically on the upper slopes of the railway embankments. Scrub habitat is dominant along the railway embankments and is sparser on the top of the embankments / track lines.

The route also passes through a small hillside of scrub habitat (WS1) at Ch. 1+300 where gorse (*Ulex europaeus*) is the dominant species creating this area of scrub, bramble (*Rubus fructicosus*) also present throughout. This area is heavily cattle poached with bank erosion noted in a number of places along this relatively steep slope. The scrub is bordered to the north by a larch (*Larix sp.*) planation (WD4) and by a hawthorn (*Crataegus monogyna*) hedgerow (WL1) to the east. The area of scrub within the footprint of the route is ca. 700m^2.

Scrub habitat survey details are noted in Appendix 1: Red Route Habitat Detail and are detailed on maps in Appendix 2: Habitat Survey Maps 01-05.

Plate 5. Gorse scrub habitat found at Ch. 1+300.

Recolonising Bare Ground (ED3)

The red route passes through 1 no. areas where the habitat is categorised as recolonising bare ground (ED3). This area is noted as an old unused and closed off section of road with ash (*Fraxinus excelsior*) treeline to the south and ash (*Fraxinus excelsior*) and hawthorn (*Crataegus monogyna*) hedgerow to the north. The artificial surface is noted as having greater than 50% vegetation coverage with ivy (*Hedera helix hibernica*) and bramble (*Rubus fructicosus*) predominant. Occasional fern species (*Dropteris* spp., *Phyllitis scolopendrium*) and sycamore saplings (*Acer pseudoplatanus)* are also evident throughout this habitat.

Recolonising bare ground habitat survey details are noted in Appendix 1: Red Route Habitat Detail and locations are detailed on maps in Appendix 2: Habitat Survey Maps 01-05.

Plate 6. Recolonising bare ground found at Ch.0+230 (west of R162).

Conifer Plantation (WD4)

The red route passes directly adjacent to 1 no. conifer plantations (WD4). This small plantation is noted as comprising of approx. 30 no. of mature larch (*Larix decidua*) in an area that is heavily grazed resulting in no natural understory habitat. The small larch plantation is bordered by patchy mature Hawthorn (*Crataegus monogyna*) hedgerow (WL1) and gorse (*Ulex europaeus*) scrub habitat WS1.

Plate 7. Larch plantation found adjacent to route at Ch. 1+320.

Other Habitats

The red route also passes through 7 no. gardens belonging to private residences. These habitats are noted as amenity grassland (GA2) and are species poor and of low ecological value in terms of native plant species and semi-natural habitats.

The route passes through one area of bare ground (ED2) where hardcore/stone is in situ.

Aside from the existing N52 road surfaces, the proposed red route passes through 4 no. artificial surfaces and/or buildings (BL3) which are noted as private residences or small business premises.

Grass verges (GS2) are noted in 2 no. of road side locations.

Conclusions

Habitats found within the area of the Red Route are predominately improved agricultural grassland (GA1). The route passes through twenty-three agricultural grassland fields (GA1) with four fields of arable lands (BC1) also found within the footprint of the route. The route crosses forty-four hedgerows (WL1) and seven treelines (WL2) with the predominant tree species found within these habitats being semi mature hawthorn and semi mature ash. The route crosses one area of wet grassland habitat (GS4) with dominant species being soft rush and yellow iris. The route passes adjacent to a second more species diverse area of wet grassland.

The route crosses three relatively small watercourses (FW3) and six drainage ditches (FW4). Two areas of scrub (WS1) are considered likely to be lost with dominant species within this scrub habitat noted as gorse (*Ulex europaeus*) and bramble (*Rubus fructicosus*). One small area of recolonising bare ground (ED3) is also likely to be lost. The route also passes through the gardens (GA2) of seven properties.

No rare or protected habitats was found within or alongside the footprint of the Red Route during the surveys.

Appendix 1: Red Route Habitat Detail

Mainline West of R162 Roundabout.

Chainage	Location	Within land take of preferred route	Habitat Classification	Detail	Rating
0+000-0+240	South side of selected route. (West side of R162 Roundabout)	Y	WL1	Predominantly young ash (*Fraxinus excelsior*) hedgerow with young hawthorn (*Crataegus monogyna*) and occasional young sycamore (*Acer pseudoplatanus*) and elder (*Sambucus nigra*). Managed/cut roadside hedgerow ca. 2-2.5m in height. Bordered by N52 on north side and GA1 on south side. Length of hedgerow within route footprint ca. 240m.	E
0+000-0+120	North side of selected route. (West side of R162 Roundabout)	Y	WL1	Predominantly young ash (*Fraxinus excelsior*) hedgerow with young hawthorn (*Crataegus monogyna*) throughout. Managed/cut roadside hedgerow ca. 1.5- 2m in height. Occasional semi mature ash (*Fraxinus excelsior*) tree (4 no.) throughout. Bordered by N52 on south side and GA1 on north side. Length of hedgerow within route footprint ca.120m.	E
0+120-0+170	North side of selected route. (West side of R162 Roundabout)	Y	BL2	Grassed earth bank ca. 1-1.5m in height. Bordered by N52 on south side and GA1 on north side.	E
0+170-0+180	North side of selected route. (West side of R162 Roundabout)	Y	WL2	2 no. of semi mature copper beech (*Fagus sylvatica 'atropurpurea'*) and 4 no. of semi mature whitebeam (*Sorbus aria*). Ornamental / garden planting bordering entrance laneway to property. Sporadic irregular placing of trees, random treeline ca. 15m in length.	E
0+190-0+260	North side of selected route. (West side of R162 Roundabout)	Y	WL1	Semi mature ash (*Fraxinus excelsior*) hedgerow on earth bank. Hedgerow ca. 6-8m in height. Bordered by N52 on south side and GA1 on north side. Length of hedgerow within route footprint ca.70m.	E
0+230-0+300	Intersecting selected route. (West side of R162 Roundabout)	Y	WL1	Predominantly young ash (*Fraxinus excelsior*) hedgerow with young hawthorn (*Crataegus monogyna*) and occasional sycamore (*Acer pseudoplatanus*) and elder	E

Chainage	Location	Within land take of preferred route	Habitat Classification	Detail	Rating
				(*Sambucus nigra*). Managed/cut roadside hedgerow ca. 2-2.5m in height. Bordered by N52 on north side and GA1 on south side. Length of hedgerow within route footprint ca.70m.	
0+230-0+270 and roundabout footprint	Intersecting south side of selected route. (West side of R162 Roundabout)	Y	WL2 along ED3	Semi mature ash (*Fraxinus excelsior*) treeline ca. 10m+ in height, situated on north and south sides of old original N52 road. Dense ivy cover on majority of ash trees. Treeline has occasional young hawthorn (*Crataegus monogyna*) and young sycamore (*Acer pseudoplatanus*) understory. Old tarmac road way is heavily overgrown with ivy (*Hedera Hibernica*), bramble (*Rubus fructicosus*) and ferns (*Dryopteris* spp., *Phyllitis scolopendrium*) between treeline and adjacent hedgerow and is noted as recolonising bare ground (ED3). Length of treeline within route footprint ca.40m.	E
0+250-0+335	Intersecting south side of selected route. (West side of R162 Roundabout)	Y	WL1	Predominantly young ash (*Fraxinus excelsior*) hedgerow with young hawthorn (*Crataegus monogyna*) and occasional sycamore (*Acer pseudoplatanus*). Hedgerow is ca. 6-7m in height and bordered recolonising laneway located to the south. Length of hedgerow within route footprint ca. 85m.	E
0+230-0+330	Along mainline of selected route. (West side of R162 Roundabout)	Y	GA1	Improved agricultural grassland field.	E
0+000-0+020	West side of R612 alignment. (North side of R162 Roundabout)	Y	WL1	Semi mature ash (*Fraxinus excelsior*) hedgerow on small earth bank and grass verge. Hedgerow ca. 6-8m in height. Bordered by R162 on east side and GA1 on west side. Ca. 20m of hedgerow within area of route.	E
0+000-0+070	East side of R612 alignment. (North side of R162 Roundabout)	Y	ED2	Bare ground. Maintained area in corner of GA1 field. Hardcore stone in situ west side of alignment with some but limited grass and wildflower recolonising vegetation.	E

Chainage	Location	Within land take of preferred route	Habitat Classification	Detail	Rating
0+000-0+050	West side of R612 alignment. (South side of R162 Roundabout)	Y	WL1	Young ash (*Fraxinus excelsior*) and hawthorn (*Crataegus monogyna*) hedgerow with occasional elder (*Sambucus nigra*). Managed/cut roadside hedgerow ca. 1-1.5m in height. Bordered by R162 on east side and GA1 on west side. Ca. 50m of hedgerow within footprint of route	E
0+000-0+040	East side of R612 alignment. (South side of R162 Roundabout)	Y	BL3	Car park / storage yard area. Hardcore stone in situ around properties.	E

Mainline East of R162 Roundabout.

Chainage	Location	Within land take of preferred route	Habitat	Detail	Rating
0+030-0+045	North side of mainline selected route	Y	WL1	Young hawthorn (*Crataegus monogyna*) and ash (*Fraxinus excelsior*) hedgerow. Managed/cut roadside hedgerow ca. 2m in height. Bordered by N52 on south side and GA1 on north side. Ca. 15m of hedgerow within footprint of route	E
0+000-0+070	Intersecting mainline selected route	Y	WL1	Hawthorn (*Crataegus monogyna*) and ash (*Fraxinus excelsior*) hedgerow with occasional elder (*Sambucus nigra*) and 1 no. of semi mature ash (*Fraxinus excelsior*) tree. Managed/cut roadside hedgerow ca. 2m in height. Bordered by N52 on north side and GA1 on south side. Ca. 70m of hedgerow within footprint of route	E
0+030-0+205	Directly along/ in line with mainline selected route	Y	WL1 on FW4	Hedgerow comprising of semi mature ash (*Fraxinus excelsior*), semi mature hawthorn (*Crataegus monogyna*) and elder (*Sambucus nigra*) ca. 4m in height along 1-1.5m deep drainage ditch. No flow in drainage ditch. Bramble (*Rubus fructicosus*) and nettle (*Urtica dioica*) understory in places along hedgerow. Hedgerow occasionally managed / maintained with lower sections showing signs of being cut back. Bordered by GA1 on north side and BC1 (potato crop) on south side. Ca. 175m of hedgerow within footprint of route	E
0+030-0+210	Along mainline of selected route.	Y	GA1	Improved agricultural grassland field.	E
0+205-0+230	Intersecting mainline selected route diagonally in approx. north-south direction	Y	WL1 on FW4	Hedgerow comprising of semi mature hawthorn (*Crataegus monogyna*) and blackthorn with 1no. of semi mature ash (*Fraxinus excelsior*) tree. Hedgerow along 1m deep drainage ditch with flow. Hedgerow occasionally maintained with lower sections showing signs of being cut back. Bordered by GA1 on west side and BC1 on east side. Ca. 65m of hedgerow within footprint of route	E
0+210-0+230	Along mainline of selected route.	Y	BC1	Small corner of arable crop field. Potato crop. Small corner left unmanaged with grasses predominant.	E
0+230	Intersecting mainline selected route diagonally in approx. north-south direction	Y	WL1 on FW4	Patchy, gappy semi mature hawthorn (*Crataegus monogyna*) hedgerow with occasional semi mature ash (*Fraxinus excelsior*). Along drainage ditch ca. 1m deep with flow. No evidence of being managed with bramble (*Rubus*	E

Chainage	Location	Within land take of preferred route	Habitat	Detail	Rating
				fructicosus) understory throughout. Bordered by BC1 on west side and GA1 on east side. Ca. 62m of hedgerow within footprint of route	
0+230-0+300	Along mainline of selected route.	Y	GA1	Improved agricultural grassland field. Northwest corner of field is predominantly unmanaged /uncut grasses with meadowsweet (*Filipendula ulmaria*) throughout. This area is noted as wet ground possibly prone to occasional flooding from adjacent wet drainage ditch.	E
0+300	Intersecting mainline selected route diagonally in approx. north-south direction	Y	WL1	Dense semi mature hawthorn (*Crataegus monogyna*) and elder (*Sambucus nigra*) hedgerow ca. 7m in height along bottom of railway embankment. Dense bramble (*Rubus fructicosus*) and nettle (*Urtica dioica*) understory with no evidence of being managed/ cut. Bordered by Ga1 on west side and railway embankment with scrub (WS1) on east side. Ca. 38m of hedgerow within footprint of route	E
0+300-0+320	Intersecting mainline selected route diagonally in approx. north-south direction	Y	WS1	Scrub along railway embankment. Embankments ca.4m in height densely vegetated with bramble (*Rubus fructicosus*) predominant along both banks with rail track area less vegetated. Occasional young willow and young ash (*Fraxinus excelsior*) developing along upper slopes of embankments. Bordered by hawthorn (*Crataegus monogyna*) hedgerow on either side. Ca. 600m2 of scrub within footprint of route	E
0+325	Intersecting mainline selected route diagonally in approx. north-south direction	Y	WL1	Dense semi mature hawthorn (*Crataegus monogyna*) and elder (*Sambucus nigra*) hedgerow ca. 6m in height along bottom of railway embankment. Predominantly dense bramble (*Rubus fructicosus*) and nettle (*Urtica dioica*) understory. Bordered by railway embankment scrub (WS1) on west side and arable crop (BC1) on east side. Ca. 31m of hedgerow within footprint of route.	E
0+320-0+500	Directly along/ in line with mainline selected route	Y	WL1	Dense semi mature hawthorn (*Crataegus monogyna*) hedgerow ca. 6-8m in height with occasional semi mature ash (*Fraxinus excelsior*) on east end of hedgerow. Some evidence on maintenance/cutting back with high grasses and bramble (*Rubus fructicosus*) sporadic along understory. Bordered by GA1 on the north side and	E

Chainage	Location	Within land take of preferred route	Habitat	Detail	Rating
				BC1 on south side. Ca. 180m of hedgerow within footprint of route.	
0+320-0+500	Along mainline of selected route.	Y	BC1	Arable crop, wheat field.	E
0+500	Intersecting mainline selected route diagonally in approx. north-south direction	Y	WL1	Mature hawthorn (*Crataegus monogyna*) hedgerow ca. 6m in height with sporadic bramble (*Rubus fructicosus*) understory. Bordered by BC1 on west side and GA1 on east side. Ca. 40m of hedgerow within footprint of route.	E
0+500-0+675	Along mainline of selected route.	Y	GA1	Improved agricultural grassland field. Gorse developing in northwest corner of the field.	E
0+670-0+730	Intersecting mainline selected route diagonally in approx. northwest direction	Y	WL1 on FW4	Semi mature hawthorn (*Crataegus monogyna*) hedgerow ca. 6m in height along drainage ditch with bramble (*Rubus fructicosus*) understory. Bordered by GA1 on either side. Ca.57m of hedgerow within footprint of route.	E
0+730	Intersecting mainline selected route in approx. north-south direction	Y	WL1	Mature and semi mature hawthorn (*Crataegus monogyna*) hedgerow with semi mature ash (*Fraxinus excelsior*) trees and 1 no. of mature ash. Bordered by GA1 on either side. Ca. 15m of hedgerow within footprint of route.	E
0+730-0+750	Intersecting mainline selected route in approx. east-west direction	Y	WL2 on FW4	Semi mature ash (*Fraxinus excelsior*) treeline ca. 8-10m with semi mature hawthorn (*Crataegus monogyna*) understory along 1m deep drainage ditch with flow. Bordered by GA1 on either side. Ca. 33m of hedgerow within footprint of route.	E
0+680-0+940	Along mainline of selected route.	Y	GA1	Improved agricultural grassland field.	E
0+940	Intersecting mainline selected route in approx. north-south direction	Y	WL1	Patchy, gappy hedgerow ca 5-6m in height, predominantly hawthorn (*Crataegus monogyna*) with elder (*Sambucus nigra*) and sycamore (*Acer pseudoplatanus*) throughout. Hedgerow runs alongside FW2 watercourse. Bordered by GA1 on either side. Ca. 105m of hedgerow within footprint of route.	E
0+940	Intersecting mainline selected route in approx. north-south direction	Y	FW2	Depositing lowland stream. Approx. 1.5m in width and average depth of approx. 10cm. Water noted as running clear with fast flow. Stoney silty substrate with calcium build up on stone and leaf litter. Pond skaters (*Gerris lacustris*), cased caddis fly	D

Chainage	Location	Within land take of preferred route	Habitat	Detail	Rating
				(*Trichoptera* spp.) and freshwater shrimp (*Gammarus pulex*) noted.	
0+940-1+035	Along mainline of selected route.	Y	GA1	Improved agricultural grassland field.	E
1+005-1+035	Intersecting mainline selected route in approx. north-south direction	Y	WL1 on BL1	Hedgerow ca. 7m in height along 1.5m high old stone retaining wall. Hedgerow consists of semi mature ash (*Fraxinus excelsior*) with elder (*Sambucus nigra*) and hawthorn (*Crataegus monogyna*) noted throughout. Eastern GA1 field level is to top of wall with a 1.5m difference in field levels at this location. Hedgerow is planted on upper level / top of retaining wall. Bordered by GA1 on either side. Ca. 68m of hedgerow within footprint of route.	E
1+035-1+300	Along mainline of selected route.	Y	GA1	Improved agricultural grassland field. Large field divided by fence lines.	E
1+300-1+320	North of mainline selected route	N	WD4	Conifer plantation on edge of selected route. Mature larch (*Larix* sp.) plantation on steep slope with occasional mature hawthorn on boundary edges. Approx. 30no. larch trees in plantation. Heavily grazed area with no understory.	E
1+300-1+320	Intersecting mainline selected route in approx. north-south direction	Y	WS1	Dense gorse (*Ulex europaeus*) and bramble (*Rubus fructicosus*) scrub developing alongside hedgerow on ridge slopes, predominantly on the western slope. Area is heavily cattle poached with some bank slippage and bare ground noted in some localised areas of slopes. Scrub and hedgerow habitat are highly elevated compared to surrounding field levels. Ca. 700m^2 of scrub within footprint of route.	E
1+320	Intersecting mainline selected route in approx. north-south direction	Y	WL1	Dense mature hawthorn (*Crataegus monogyna*) and mature ash (*Fraxinus excelsior*) hedgerow ca. 6m in height with bramble (*Rubus fructicosus*) understory, hedgerow situated along high ridge. Noted as unmanaged hedgerow with dense gorse scrub habitat to west and GA1 to east. Ca. 58m of hedgerow within footprint of route.	E
1+320-1+525	Along mainline of selected route.	Y	GA1	Improved agricultural grassland field.	E
1+525	Intersecting mainline selected route in approx.	Y	WL1	Mature hawthorn (*Crataegus monogyna*) hedgerow ca, 8m+ in height. Occasional ash (*Fraxinus excelsior*) and elder (*Sambucus nigra*)	E

Chainage	Location	Within land take of preferred route	Habitat	Detail	Rating
	north-south direction			throughout hedgerow. 1 no. of mature ivy-covered ash ca. 10m+ in height noted on north side of route selection. Bordered by GA1 on either side. Ca. 40m of hedgerow within footprint of route.	
1+525-1+570	Along mainline of selected route.	Y	GA1	Improved agricultural grassland field.	E
1+570	Intersecting mainline selected route in approx. northwest direction	Y	WL1	Mature hawthorn (*Crataegus monogyna*) and semi mature ash (*Fraxinus excelsior*) hedgerow ca. 6-8m in height. No understory. Bordered by GA1 on east side and laneway on west side. Ca. 32m of hedgerow within footprint of route.	E
1+575	Intersecting mainline selected route in approx. northwest direction	Y	ED2	Bare ground. Old well established and well used laneway. Artificial surface, laneway comprising of compacted bare ground.	E
1+580	Intersecting mainline selected route in approx. northwest direction	Y	WL2	Semi mature ash (*Fraxinus excelsior*) treeline ca. 10m+ in height with understory of mature hawthorn (*Crataegus monogyna*) and mature elder (*Sambucus nigra*). Treeline runs on east side of laneway and west side of watercourse. Ca. 32m of treeline within footprint of route.	E
1+580	Intersecting mainline selected route in approx. northwest direction	Y	FW2	Depositing lowland stream. Approx. 2m in width and 20cm in depth with slow flow. Silty substrate with vegetation throughout, predominantly fools watercress (*Apium nodiflorum*) and duckweed (*Lemna* spp.) species. Pond skaters (*Gerris lacustris*) noted on water surface. Water noted as running clear with some evidence of calcium build up on leaf litter. West side of watercourse is bordered by WL2. East side is bordered by BC1 although the area of arable field directly adjacent to the watercourse has been left unmanaged with rush (*Juncas effusus*), Great Willowherb (*Epilobium hirsutum*) and Silverweed (*Potentilla anserine*) dominant.	D
1+580-1+830	Along main line of selected route	Y	BC1	Arable crop, wheat field. Approx. 20m of western side of field has been left unsown and uncut with tall grasses and rush (*Juncas effusus*) and Silverweed (*Potentilla anserine*) abundant up to watercourse where Great Willowherb (*Epilobium hirsutum*) is predominant.	E

Chainage	Location	Within land take of preferred route	Habitat	Detail	Rating
1+830	Intersecting mainline selected route in approx. north-south direction	Y	WL1	Dense semi mature hawthorn (*Crataegus monogyna*) hedgerow ca. 4m in height. Occasional elder (*Sambucus nigra*) throughout. Managed hedgerow cut to height with dense bramble (*Rubus fructicosus*) in understory. Bordered by BC1. Ca. 38m of hedgerow within footprint of route.	E
1+830-2+005	Along main line of selected route	Y	BC1	Arable crop, wheat field.	E
2+005	Intersecting mainline selected route in approx. north-south direction	Y	WL1	Dense semi mature hawthorn (*Crataegus monogyna*) hedgerow ca. 4-6m in height, with occasional semi mature ash (*Fraxinus excelsior*) and understory of bramble (*Rubus fructicosus*). 1 no. of mature ash (*Fraxinus excelsior*) tree on northern side of hedgerow. Ca. 62m of hedgerow within footprint of route.	E
2+005-2+110	Along main line of selected route	Y	GA1	Improved agricultural grassland field. Wet grassland (as detailed below) and 1 no. of mature ash (*Fraxinus excelsior*) ca. 7m in height and 2 no of young hawthorn (*Crataegus monogyna*) within field boundaries.	E
2+070-2+110	North side of mainline selected route	Y	GS4	Wet grassland. It is estimated that approx. one third of this wet grassland habitat lies within the land take of the preferred route. Area prone to being flooded by adjoining small watercourse. Wet grassland species are rush (*Juncas effusus*) and Yellow Iris (*Iris pseudacorus*). A mature ash (*Fraxinus excelsior*) tree is located on the west edge of the wet grassland and 2no. of young hawthorn (*Crataegus monogyna*) are noted on the southern side. The wet grassland area is ca. 700m2 with ca. 230m2 within footprint of route.	E
2+110	Intersecting mainline selected route in approx. north-south direction	Y	FW2	Depositing lowland stream. Stream with fast flow noted as running clear, width approx. 2m and ca. 5-10cm in depth with a pebble and gravel substrate. Heavy calcium build up is noted on river substrate with active Tufa formation. Pond skaters (*Gerris lacustris*) and diving beetle (*Dytiscidae* spp.) species noted throughout.	D
2+115	Intersecting mainline selected route in approx. north-south direction	Y	WL2	Dense ivy-covered treeline predominantly semi mature ash (*Fraxinus excelsior*) with occasional elder (*Sambucus nigra*) ca. 10-12m in height. Treeline on edge of small watercourse. Understory of dense bramble (*Rubus fructicosus*), nettle	E

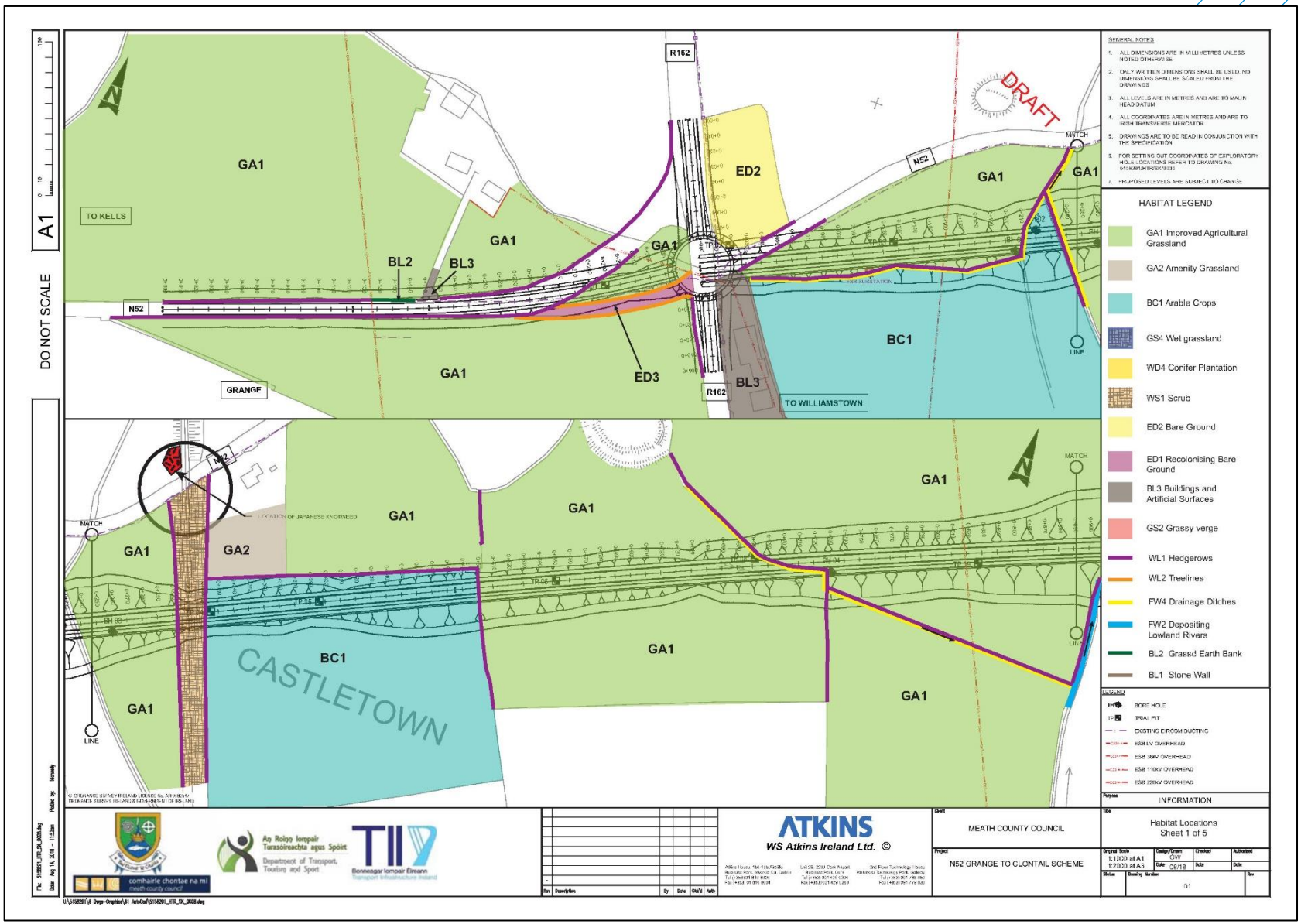
Chainage	Location	Within land take of preferred route	Habitat	Detail	Rating
				(*Gerris lacustris*) and Great Willowherb (*Epilobium hirsutum*). Ca. 75m of treeline within footprint of route.	
2+115-2+120	Intersecting mainline selected route in approx. north-south direction	Y	ED2	Bare ground. Farm access / laneway.	E
2+120-2+230	Along main line of selected route	Y	GA1	Improved agricultural grassland field.	E
2+230	Intersecting mainline selected route in approx. north-south direction	Y	WL2	Treeline predominantly semi mature ash (*Fraxinus excelsior*) with occasional sycamore (*Acer pseudoplatanus*) ca. 10-12m in height. Understory species include hawthorn (*Crataegus monogyna*) and elder (*Sambucus nigra*) showing signs of being managed / cut back. The treeline has 2no. of mature ivy-covered ash (*Fraxinus excelsior*) and 1 no. of mature sycamore (*Acer pseudoplatanus*). Bordered by GA1. Ca. 56m of treeline within footprint of route.	E
2+230-2+410	Along main line of selected route	Y	GA1	Improved agricultural grassland field.	E
2+410	Intersecting mainline selected route in approx. north-south direction	Y	WL2 on FW4	Semi mature ash (*Fraxinus excelsior*) treeline ca. 10m in height. Understory is comprised of semi mature hawthorn (*Crataegus monogyna*) and occasional elder (*Sambucus nigra*). Treeline located on 1m dry ditch with bramble (*Rubus fructicosus*) and fern (*Dryopteris* spp.) species predominant along ditch. Bordered by GA1. Ca. 65m of treeline within footprint of route.	E
2+410-2+855	Along main line of selected route	Y	GA1	Improved agricultural grassland field.	E
2+810-2+855	South side of selected route	Y	WL1	Closely cropped / managed hawthorn (*Crataegus monogyna*) hedgerow ca.2.5m in height. Hedgerow forms property boundary on garden extent. Ca. 55m of hedgerow within footprint of route.	E
2+810-2+855	South side of selected route	Y	GA2	Amenity Grassland. Garden area of property	E
2+855	Intersecting mainline selected route in approx. northwest	Y	WL1	Closely cropped / managed young hawthorn (*Crataegus monogyna*) hedgerow with occasional beech (*Fagus sylvatica*), ca.2.5m in height. Hedgerow forms property boundary on	E

Chainage	Location	Within land take of preferred route	Habitat	Detail	Rating
	direction (west side of N52 crossing)			garden extent with N52 roadway to east. Ca. 30m of hedgerow within footprint of route.	
2+868	South side of selected route (east side of N52 crossing)	Y	WL1	Closely cropped / managed hawthorn (*Crataegus monogyna*) hedgerow ca.3m in height. 1 no. of semi mature holly and 1 no. of elder (*Sambucus nigra*) within hedgerow. Hedgerow forms property boundary on garden extent with N52 roadway to west. Ca. 80m of garden and roadside hedgerow within footprint of route.	E
2+870-3+145	Along main line of selected route	Y	GA1	Improved agricultural grassland field.	E
3+145	Intersecting mainline selected route in approx. northeast direction	Y	WL1	Dense mature and semi mature hawthorn (*Crataegus monogyna*) and elder (*Sambucus nigra*) hedgerow ca. 5m in height. Bordered by GA1. Ca. 43m of hedgerow within footprint of route.	E
3+145-3+415	Along main line of selected route	Y	GA1	Improved agricultural grassland field.	E
3+415	Intersecting mainline selected route in approx. north-south direction	Y	WL1	Dense hawthorn (*Crataegus monogyna*) and elder (*Sambucus nigra*) hedgerow with occasional semi mature ash (*Fraxinus excelsior*). Hedgerow ca. 6m in height and develops into treeline to the south, treeline is outside the area of the selected route. Bordered by GA1. Ca. 30m of hedgerow within footprint of route.	E
3+415-3+590	Along main line of selected route	Y	GA1	Improved agricultural grassland field.	E
3+590	Intersecting mainline selected route in approx. north-south direction	Y	WL1	Dense ivy covered hedgerow ca. 5-6m in height. Hedgerow predominantly semi mature hawthorn (*Crataegus monogyna*), mature blackthorn (*Prunus spinosa*) and occasional elder (*Sambucus nigra*). Hedgerow is bordered by GA1 to the west and BL3 property to the east. Ca. 40m of hedgerow within footprint of route.	E
3+590-3+640	Along main line of selected route	y	BL3	Buildings and artificial surfaces. Warehouse/barn and storage yard area.	E
3+610-3+640	Along south side main line of selected route	y	GA2	Amenity Grassland. Garden area of property	E

Chainage	Location	Within land take of preferred route	Habitat	Detail	Rating
3+640	Intersecting mainline selected route in approx. northwest direction	Y	WL1	Managed Leyland Cypress (*Cupressocyparis leylandii*) hedgerow ca.4-5m in height. Ca. 40m of hedgerow within footprint of route.	E
3+640-3+738	Intersecting mainline selected route in approx. northwest direction	Y	GA1	Improved agricultural grassland field. Small rocky outcrop located to north of selected route	E
3+738	Intersecting mainline selected route in approx. north-south direction	Y	WL1	Patchy, gappy mature hawthorn (*Crataegus monogyna*) hedgerow ca. 5m in height with 1no. of semi mature ash (*Fraxinus excelsior*). Bordered by GA1. Ca. 40m of hedgerow within footprint of route.	E
3+738-3+990	Along main line of selected route	Y	GA1	Improved agricultural grassland field.	E
3+890-3+950	South of selected route	N	GS4	Wet grassland area is outside the footprint of selected route. Wet grassland dominated by rush (*Juncas effusus*), bull rush (*Typha latifolia*) and Greater birds-foot-trefoil (*Lotus pedunculatus*). Wild Angelica (*Angelica sylvestris*), Marsh Thistle (*Cirsium plustre*) and Horsetail (*Equisetum* spp.) are also present. Area managed and developed by landowner with artificial pond created. Includes small area of young developing willow (*Salix fragilis*) hedgerow. Ornamental planting of standard trees in garden between wet grassland area and roadside, Ornamental trees include cherry (*Prunus* spp.), rowan (*Sorbus aucuparia*), sessile oak (*Quercus petraea*) and whitebeam (*Sorbus aria*). The approximate surface area of the wet grassland is ca. 2800m2.	E
3+935	South side of selected route in approx. east-west direction	Y	WL1	Small hedgerow line of young and semi mature willow (*Salix fragilis*) ca. 6m in height. Bordered by GA1 and GS4. Bulk of treeline outside the area of selected route. Ca. 8m of hedgerow within footprint of route.	E
3+935-3+975	South side of selected route	Y	GA1	Improved agricultural grassland field. Bordered by wet grassland area to south east and willow treeline to south	E
3+990	North side of selected route	Y	WL1	Dense semi mature hawthorn (*Crataegus monogyna*) hedgerow ca. 5m in height. Hedgerow forms boundary to property. Ca.16m of hedgerow within footprint of route.	E

Chainage	Location	Within land take of preferred route	Habitat	Detail	Rating
3+990-4+020	North side of selected route	Y	BL3	Buildings and artificial surfaces. Small bungalow and out buildings and small driveway	E
3+990-4+020	North side of selected route	Y	GA2	Amenity Grassland. Garden area of property	E
4+020-4+050	North side of selected route	Y	WL1	Hedgerow on property / garden boundary. Dense, thick hedgerow consisting predominantly of Leyland Cypress (x *Cuprocyparis leylandii*) and occasional elder (*Sambucus nigra*) ca. 4-5m in height. Ca. 35m of hedgerow within footprint of route.	E
3+975-4+070	South side of selected route	Y	GS2	Grass Verge. Managed /cut grass verge on roadside	E
4+000-4+075	South side of selected route	Y	WL1	Hedgerow on property / garden boundary. Managed / cut hawthorn (*Crataegus monogyna*) hedgerow ca. 2.5m in height. Ca. 90m of hedgerow within footprint of route.	E
4+000-4+075	South side of selected route	Y	GA2	Amenity grassland. Garden area of property	E
4+080-4+160	Along main line of selected route	Y	GS2	Grass Verge. Managed /cut grass verge on roadside	E
4+080-4+290	Along main line of selected route	Y	WL1	Semi mature hawthorn (*Crataegus monogyna*) hedgerow with occasional semi mature ash (*Fraxinus excelsior*) ca. 4-6m in height, along fence line. Ash (*Fraxinus excelsior*) trees prominent on road side of hedgerow. Hedgerow managed / cut on field side. Bordered by N52 and GA1. Ca. 140m of hedgerow within footprint of route.	E
4+080-4+290	Along main line of selected route	Y	GA1	Improved agricultural grassland field.	E
4+290	Intersecting mainline selected route in approx. north-south direction	Y	WL1	Mature and semi mature hawthorn (*Crataegus monogyna*) hedgerow with occasional semi mature ash (*Fraxinus excelsior*) ca. 5m in height. Semi mature ash with large even crown. Bordered by GA1. Ca. 40m of hedgerow within footprint of route.	E
4+290-4+470	Along main line of selected route	Y	GA1	Improved agricultural grassland field.	E
4+290-4+470	Along main line of selected route (south side)	Y	WL1	Mature hawthorn hedgerow ca. 7m in height with no understory. Bordered by N52 and GA1. Ca. 180m of hedgerow within footprint of route.	E
4+470	Intersecting mainline selected route in approx. north-south direction	Y	WL1	Semi mature hawthorn (*Crataegus monogyna*) hedgerow with occasional semi mature ash (*Fraxinus excelsior*) ca. 6m in height. Ca. 20m of hedgerow within footprint of route.	E

Chainage	Location	Within land take of preferred route	Habitat	Detail	Rating
4+470-4+560	Along main line of selected route (south side)	Y	GA1	Improved agricultural grassland field.	E
4+490-4+685	Along main line of selected route (north side)	Y	WL1	Managed/cut roadside hedgerow consisting of hawthorn (*Crataegus monogyna*) and ash (*Fraxinus excelsior*) ca. 1-1.5m in height. Ash trees, ca. 8m+ in height spaced along hedgerow with 7 no. of semi mature ash and 1 no. of mature ash noted. Ca. 200m of hedgerow within footprint of route.	E
4+560	Intersecting mainline selected route in approx. northwest direction	Y	WL2	Semi mature ash (*Fraxinus excelsior*) treeline with occasional hawthorn (*Crataegus monogyna*) and grey willow (*Salix cinereal*) and sporadic bramble (*Rubus fructicosus*) understory. Bordered by GA1. Ca. 10m of treeline within footprint of route.	E
4+560-4+940	Along main line of selected route	Y	GA1	Improved agricultural grassland field.	E
4+560-4+730	Along main line of selected route (south side)	Y	WL1	Managed/cut roadside hedgerow consisting of hawthorn (*Crataegus monogyna*) and ash (*Fraxinus excelsior*) ca. 1-2m in height. Ca. 170m of hedgerow within footprint of route.	
4+685-4+715	Along main line of selected route (north side)	Y	BL3	Buildings and artificial surfaces. Layby area in front of private residence.	E


DRAFT
GA1
GA2
BC1
ED2
ED3
BL2
BL3
R162
N52
TO KELLS
GRANGE
TO WILLIAMSTOWN
CASTLETOWN
LOCATION OF JAPANESE KNOTWEED
MATCH
LINE
HABITAT LEGEND
GA1 Improved Agricultural Grassland
GA2 Amenity Grassland
BC1 Arable Crops
GS4 Wet grassland
WD4 Conifer Plantation
WS1 Scrub
ED2 Bare Ground
ED1 Recolonising Bare Ground
BL3 Buildings and Artificial Surfaces
GS2 Grassy verge
WL1 Hedgerows
WL2 Treelines
FW4 Drainage Ditches
FW2 Depositing Lowland Rivers
BL2 Grassd Earth Bank
BL1 Stone Wall
INFORMATION
Habitat Locations Sheet 1 of 5
MEATH COUNTY COUNCIL
N52 GRANGE TO CLONTAIL SCHEME
ATKINS
WS Atkins Ireland Ltd. ©
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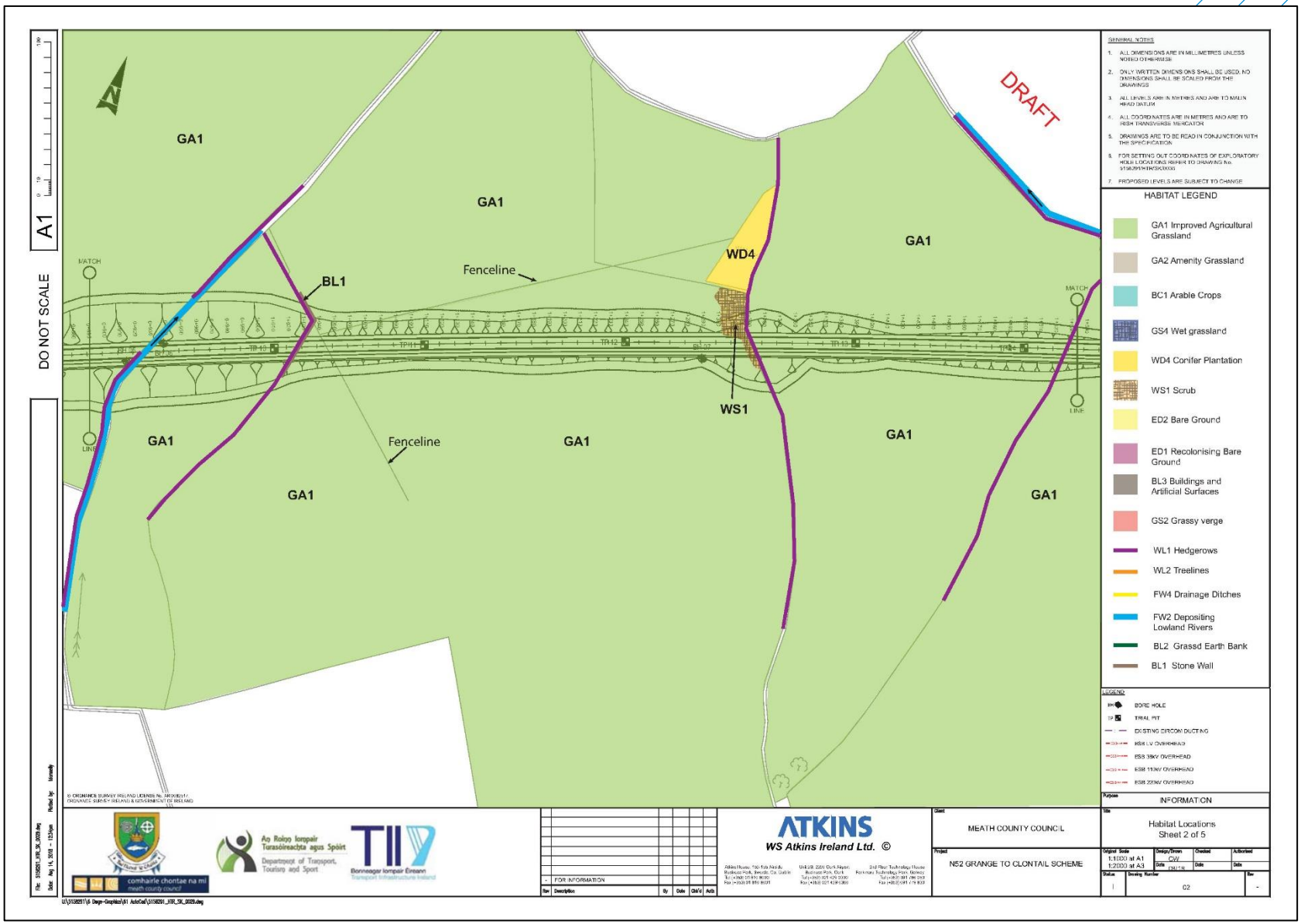
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GA1
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GA1
GA1
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WD4
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MATCH
LINE
HABITAT LEGEND
GA1 Improved Agricultural Grassland
GA2 Amenity Grassland
BC1 Arable Crops
GS4 Wet grassland
WD4 Conifer Plantation
WS1 Scrub
ED2 Bare Ground
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BL3 Buildings and Artificial Surfaces
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WL1 Hedgerows
WL2 Treelines
FW4 Drainage Ditches
FW2 Depositing Lowland Rivers
BL2 Grassd Earth Bank
BL1 Stone Wall
GENERAL NOTES
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE
2. ONLY WRITTEN DIMENSIONS SHALL BE USED. NO DIMENSIONS SHALL BE SCALED FROM THE DRAWINGS
3. ALL LEVELS ARE IN METRES AND ARE TO MALIN HEAD DATUM
4. ALL COORDINATES ARE IN METRES AND ARE TO IRISH TRANSVERSE MERCATOR
5. DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE SPECIFICATION
6. FOR SETTING OUT COORDINATES OF EXPLORATORY HOLE LOCATIONS REFER TO DRAWING No. 5158291WIN0X0000
7. PROPOSED LEVELS ARE SUBJECT TO CHANGE
LEGEND
BORE HOLE
TRIAL PIT
EXISTING EIRCOM DUCTING
ESB LV OVERHEAD
ESB 38KV OVERHEAD
ESB 110KV OVERHEAD
ESB 220KV OVERHEAD
Purpose
INFORMATION
Title
Habitat Locations Sheet 2 of 5
ATKINS
WS Atkins Ireland Ltd. ©
Client
MEATH COUNTY COUNCIL
Project
N52 GRANGE TO CLONTAIL SCHEME
Original Scale
1:1000 at A1
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CW
Checked
Authorised
Status
Drawing Number
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Rev
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FOR INFORMATION
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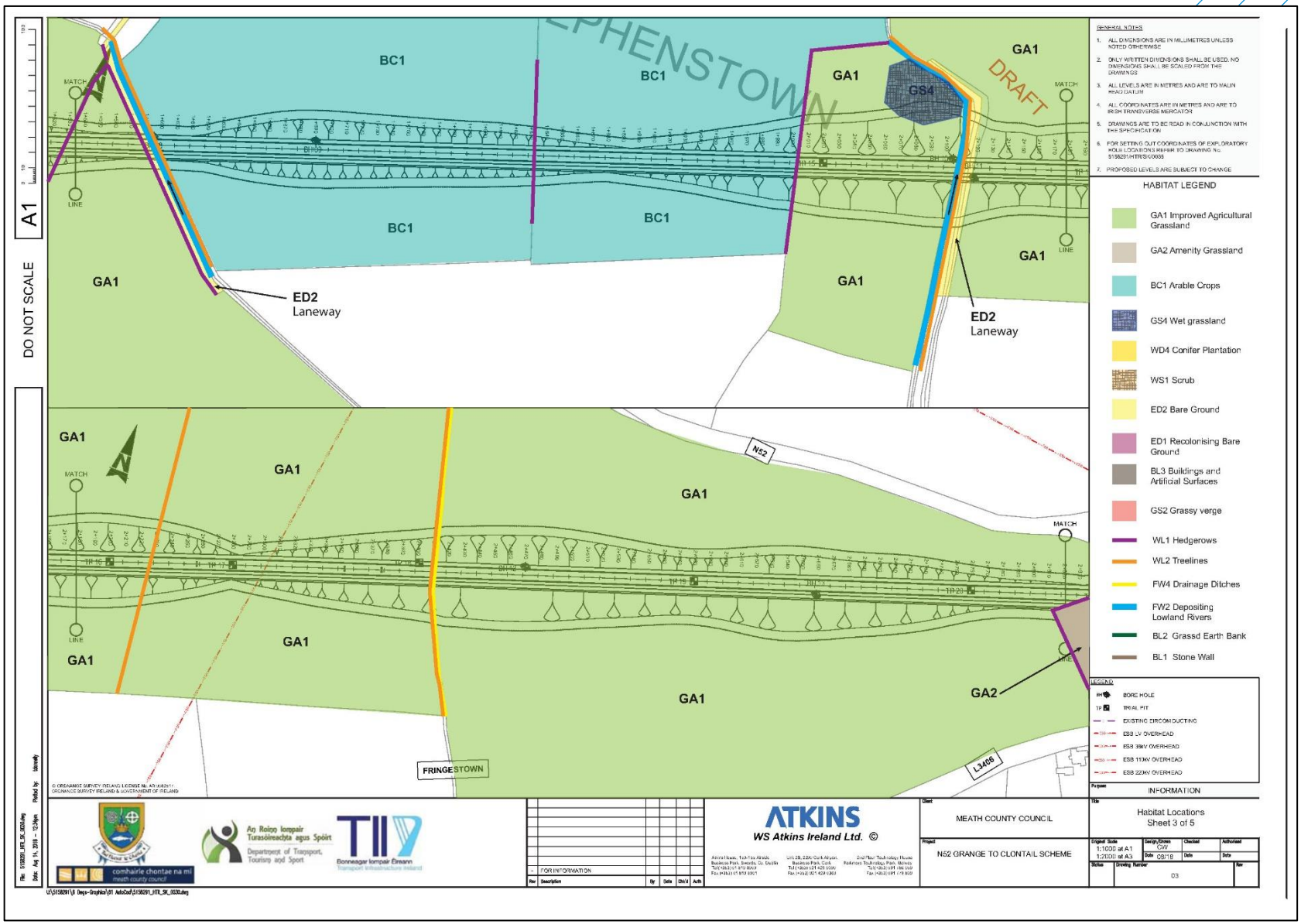
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GS4
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L3406
GA2
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GA2 Amenity Grassland
BC1 Arable Crops
GS4 Wet grassland
WD4 Conifer Plantation
WS1 Scrub
ED2 Bare Ground
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BL3 Buildings and Artificial Surfaces
GS2 Grassy verge
WL1 Hedgerows
WL2 Treelines
FW4 Drainage Ditches
FW2 Depositing Lowland Rivers
BL2 Grassd Earth Bank
BL1 Stone Wall
INFORMATION
MEATH COUNTY COUNCIL
N52 GRANGE TO CLONTAIL SCHEME
Habitat Locations
Sheet 3 of 5
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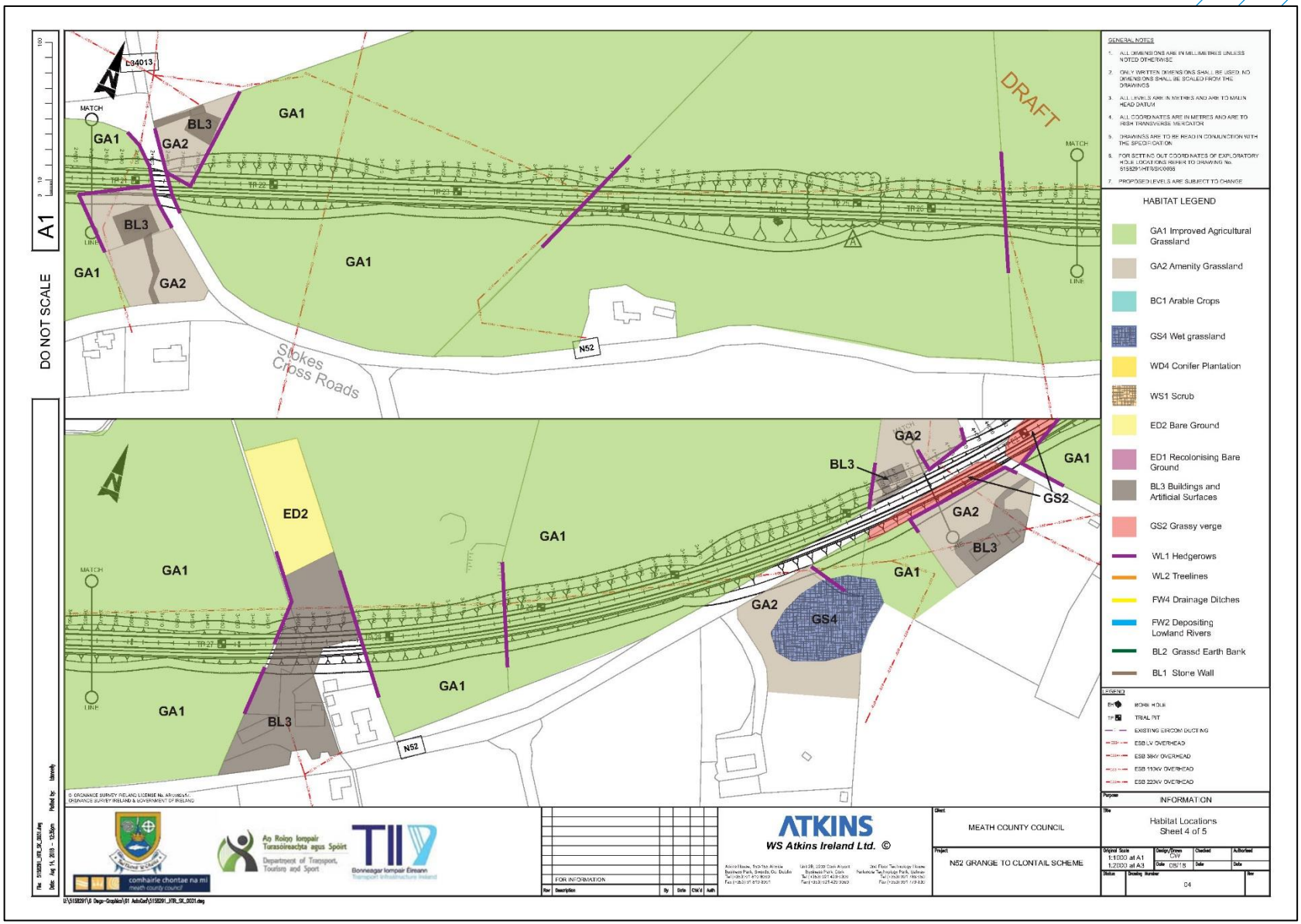
DRAFT
DO NOT SCALE
A1
GA1
GA2
BL3
ED2
GS2
GS4
Stokes Cross Roads
N52
MATCH
LINE
HABITAT LEGEND
GA1 Improved Agricultural Grassland
GA2 Amenity Grassland
BC1 Arable Crops
GS4 Wet grassland
WD4 Conifer Plantation
WS1 Scrub
ED2 Bare Ground
ED1 Recolonising Bare Ground
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BL2 Grassd Earth Bank
BL1 Stone Wall
GENERAL NOTES
ATKINS
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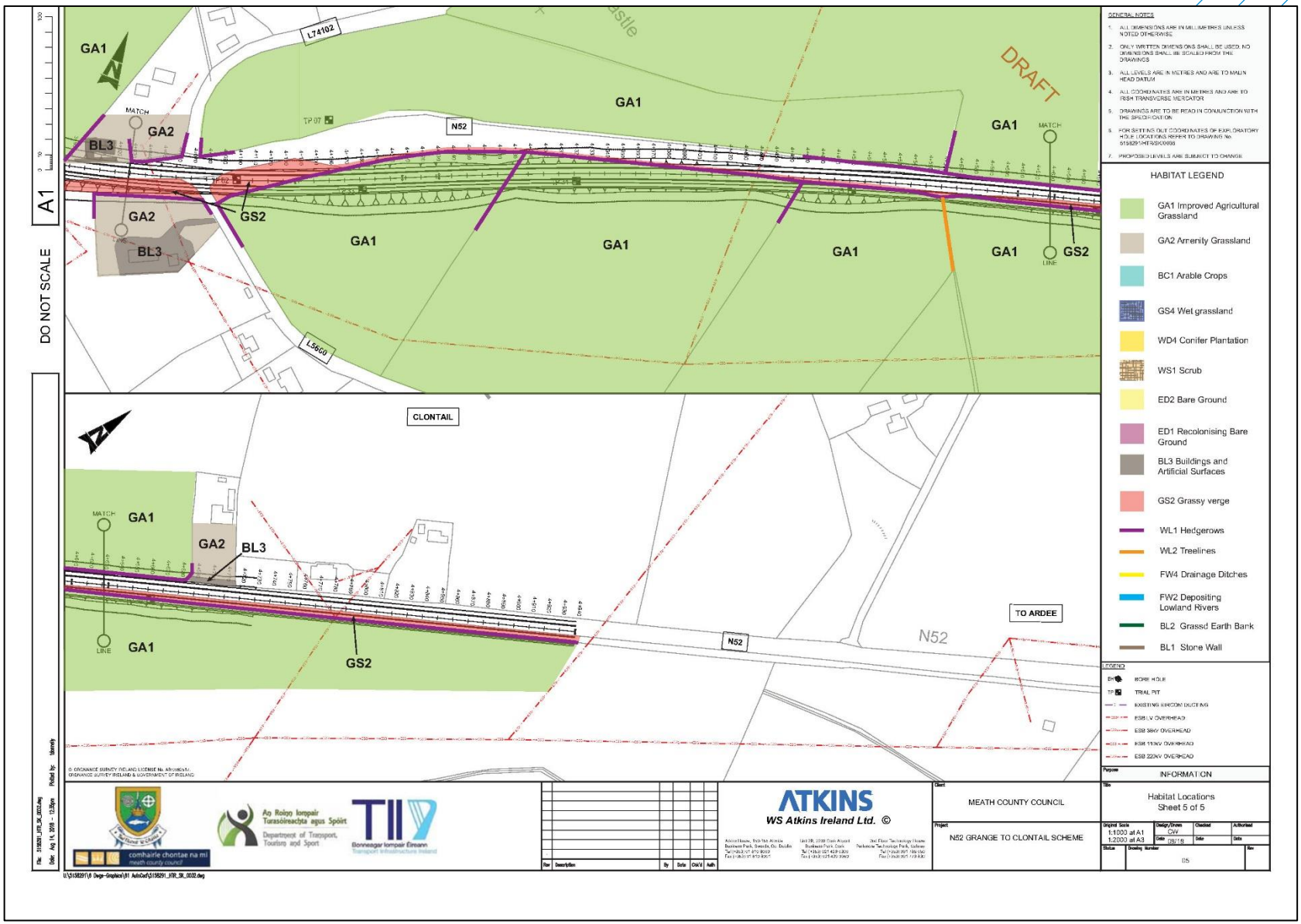
MEATH COUNTY COUNCIL
N52 GRANGE TO CLONTAIL SCHEME
Habitat Locations
Sheet 4 of 5
INFORMATION
comhairle chontae na mí
meath county council
Ar Roinn Iompair Tarasóireachta agus Spóirt
Department of Transport, Tourism and Sport
Bonneagar Iompair Éireann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DO NOT SCALE
A1
GA1
GA2
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GS2
MATCH
LINE
TP 07
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TP 04
N52
L74102
L5600
CLONTAIL
TO ARDEE
GENERAL NOTES
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LEGEND
BH BORE HOLE
TP TRIAL PIT
EXISTING ESBCOM DUCTING
ESB LV OVERHEAD
ESB 38kV OVERHEAD
ESB 110kV OVERHEAD
ESB 220kV OVERHEAD
Purpose
INFORMATION
comhairle chontae na mí meath county council
Ard Rúnaíocht Iompair Turasóireachta agus Spóirt
Department of Transport, Tourism and Sport
TII
Bonneagar Iompair Éireann
Transport Infrastructure Ireland
ATKINS
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Client
MEATH COUNTY COUNCIL
Project
N52 GRANGE TO CLONTAIL SCHEME
Title
Habitat Locations
Sheet 5 of 5
Original Scale
1:1000 at A1
1:2000 at A3
Designed/Drawn
CW
Checked
Authorised
Date
09/18
Status
Drawing Number
05
Rev

END

Technical Note

Project:	5158291		
Subject:	Mammal Surveys: N52 Grange to Clontail Scheme		
Author:	Colin Wilson	Atkins No.:	5158291DG0095
Date:	28/09/2018	Icepac No.:	
		Project No.:	5158291
Distribution:		Representing:	

The purpose of this technical note is to document mammal surveys carried out on the emerging preferred route of the N52 Grange to Clontail Road Scheme.

Introduction

The N52 Grange to Clontail Scheme has been subject to a Phase 2-Stage 2 Route Options process where four route options (magenta, red, orange and cyan) where considered. The study area of the scheme and the routes of these four options are detailed below in Figure 1. Route Options.

The route selection process has determined that the Red Route is the emerging preferred route.

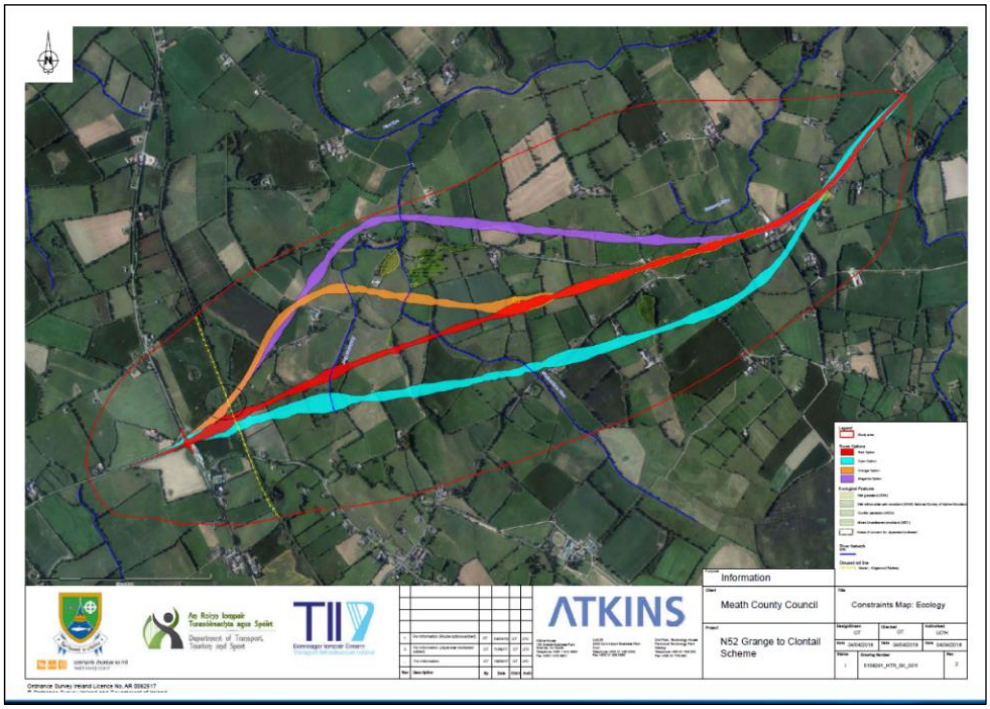

Figure 1. Route Options, with Red Route as emerging preferred route.

As part of the Phase 3-Design stage a series of ecological surveys were undertaken along the Red Route. This technical note details the findings of mammal surveys undertaken along this route as well as the adjoining lands.

Documented Rare and Protected Mammal Species

Prior to undertaking the mammal surveys records of rare and protected mammal species within the study area were sourced from the National Biodiversity Data Centre[i]. The reviewed NBDC data sets outline terrestrial mammal species, protected under either the Wildlife Acts or under the EU Habitats Directive, which have been previously noted and recorded within the extents of the survey area.

The rare and protected mammal species records, dated within the last 12 years, detail 10 no. of protected mammal species within the survey area. The mammal surveys along the Red Route therefore focused on these protected species. The Red Route was surveyed for mammals, with particular attention given to the following terrestrial mammal species: -

- Badger (*Meles meles*)
- Lesser Noctule (*Nyctalus leisleri*)
- Pipistrelle (*Pipistrellus pipistrellus sensu lato*)
- Soprano Pipistrelle (*Pipistrellus pygmaeus*)
- Daubenton's Bat (*Myotis daubentonii*)
- Otter (*Lutra lutra*)
- Pine Martin (*Martes martes*)
- Pygmy Shrew (*Sorex minutus*)
- Red Squirrel (*Sciurus vulgaris*)
- Hedgehog (*Erinaceus europaeus*)

Survey Methodology

Mammal survey techniques followed the NRAs guidelines[ii] for ecological surveying and the Bat Conservation Trust UK guidelines[iii] for bat surveying. Walkover surveys were undertaken during daylight hours in August 2018 and noted areas of breeding and resting places for the listed protected mammal species. The survey area focused on the footprint of the Red Route and also extended ca. 30m either side of the route to ensure the broader habitats were also assessed for mammalian activity.

For non-volant mammal species linear features such as hedgerows, treelines, watercourses, banks and ditches were surveyed for evidence of mammal activity including signs of mammal holes, prints, trails, faecal deposits, snagged hair and mammal feeding, scratching and scraping marks.

For volant mammal species trees and buildings were inspected for holes, cracks and crevices that have the potential to be used as roosting sites. These potential roosting sites were inspected with the use of binoculars for any signs of activity such as evidence of faecal droppings and urine staining.

Signs and evidence of mammal refugia and mammal activity along and adjacent to the Red Route were mapped and are detailed in Appendix 1: Mammal Survey.

Survey Findings

Badger (*Meles meles*)

No badger setts were found within the footprint of the Red Route nor within ca. 30m either side of the route. One possible badger print was recorded within the survey area although it must be noted that ground conditions were noted as dry and hard underfoot and conditions were not conducive to mammal print

determination. Distinct evidence of mammal trails were noted on several field boundaries which are likely to be as a result of badger or fox activity.

Substantial digging and scratching marks was noted in one area. Due to the extent of the digging and several distinguishable claw marks, it is considered that this digging is as a result of badger foraging activity.

Badger faecal deposits were found in 5 no. of areas. Two of these areas are noted as latrines where small holes were dug and two or more faecal deposits were noted in within these holes. The faecal deposits were determined to be badger due to their shape, smell and composition.

Badger hair was found snagged on barbed wire at one hedgerow boundary crossing point, the hair was determined to be badger using techniques outlined in mammal hair identification guide[iv].

Details of badger activity findings along the Red Route are listed below in Table 1. Badger Activity Findings. The locations of these findings are also detailed in Appendix 1: Mammal Survey Maps

Table 1. Badger Activity Findings.

Badger Activity	Location
Latrine	Ch. 0+375 north of Red Route
Mammal trail	Ch.0+380 - 0+400 within Red Route
Latrine	Ch. 0+730 south of Red Route
Faecal Deposit	Ch 0+740 within Red Route
Badger scrapes	Ch.1+580 north of Red Route
Faecal Deposit	Ch. 1+620 south of Red Route
Faecal Deposit	Ch.1+760 south of red Route
Badger hair	Ch. 1+890 south of Red Route
Mammal trail	Ch. 1+890 – 1+930 south of Red Route
Mammal trail	Ch. 2+000 south of Red Route
Partial Badger Print	Ch. 2+100 north of Red Route

Bats

The Red Route passes through a significant number of hedgerows and treelines with a number of mature trees found within these habitats. Mature trees within the footprint of the Red Route were surveyed for signs of cracks, holes and crevices deemed suitable as bat roosting habitat.

A total of 6 no. of trees were noted as having potential as bat roosting habitat. One building is noted as having potential as bat roosting habitat. These potential bat roosting habitats along the Red Route and the scale of their potential is outlined below in Table 2. Potential Bat Roosting Habitat along the Red Route.

The locations of these findings are also detailed in Appendix 1: Mammal Survey Maps.

Table 2. Potential Bat Roosting Habitat along the Red Route.

Habitat	Location	Potential as Bat Roosting Site
Mature Ash Tree (*Fraxinus excelsior*)	Ch. 0+730 within Red Route on south side	Limited Potential as bat roosting habitat. Viewed by binoculars, 2 no. of holes noted in smaller upper limbs of mature ash. No evidence of urine staining. Rest of limbs and trunk noted as smooth with no cracks or crevices
Mature Ash Tree (*Fraxinus excelsior*) with ivy coverage along treeline	Ch. 1+525 within Red Route	Limited Potential as bat roosting habitat. Dense mature ivy cover providing crevices suitable for bat roosting sites. Ivy cover very dense which would restrict flight access to crevices
Mature Poplar Tree (*Poplus* spp.)	Ch. 2+080 north of Red Route	Good Potential as bat roosting habitat. Mature Poplar with multiple holes and crevices in mid and upper sections of main truck. Holes observed using binoculars with no urine staining or marks visible.
2 no. of Mature Ash Trees (*Fraxinus excelsior*) with dense ivy cover	Ch. 2+230 within Red Route	Limited Potential as bat roosting habitat. 2 no. of ivy covered mature ash trees along ash treeline. Multiple crevices along main trunks due to dense, thick ivy coverage. Flight paths limited due to dense ivy foliage.
Building	Ch. 4+010	Moderate potential as bat roosting habitat. Small cottage with tiled roof. No access within property, no access inside roof space. Building to be resurveyed following access.
Mature Ash Tree (*Fraxinus excelsior*) with dense ivy cover	Ch. 4+675	Limited potential as bat habitat. Large mature ivy-covered ash with some holes and cracks evident is suitable roosting habitat but it is in poor isolated location. Adjacent to busy roadway (N52) with no hedgerow connectivity.

Otter (*Lutra lutra*)

There are three small watercourses crossed by the Red Route the largest of which is ca. 30cm in depth at its deepest. The streams banks and riparian habitat were surveyed for evidence of otter activity including signs of prints, spraints, couches and holts. No evidence of otter activity was noted within or either side of the footprint of the Red Route. There are no watercourses within the footprint of the Red Route which are large enough to accommodate otter foraging or resting habitat.

Red Squirrel (*Sciurus vulgaris*)

No evidence of Red Squirrel was noted within, or either side of, the footprint of the Red Route. A small Larch (*Larix decidua*) plantation located outside the footprint of the Red Route at Ch. 1+310 north is noted as the most likely squirrel habitat. The trees were observed with binoculars for signs of squirrel activity with no activity noted. Fallen cones were inspected for signs of squirrel feeding activity with no stripped cones or pulled out scales noted within the leaf litter.

Hedgehog (*Erinaceus europaeus*) and Pygmy Shrew (*Sorex minutus*)

Areas of soft muddy ground were inspected throughout the footprint of the Red Route for evidence of mammal prints. No prints belonging to hedgehog or pygmy shrew were noted in the inspected areas. Surveys for mammal prints were limited due to hard dry ground conditions. Multiple small tunnels in the ground vegetation were noted in areas where hedgerow undergrowth extended into the field margins although these cannot be confirmed as being formed either by hedgehog or pygmy shrew. It is considered likely that the tunnels formed in the groundcover vegetation are as a result of rabbit (*Oryctolagus cuniculus*) and/or rat (*Rattus norvegicus*) activity as signs of their refugia was noted as wide spread throughout the Red Route.

Other Noted Mammalian Activity

Irish hare (*Lepus timidus hibernicus)* was sighted at Ch. 4+350. Multiple prints of Brown Rat (*Rattus norvegicus*) were observed during these inspections most predominantly along the riparian corridors and scrub habitat found within Red Route. Rabbit (*Oryctolagus cuniculus*) burrows and droppings were noted along a number of hedgerows. Red fox (*Vulpes vulpes*) prints and faecal deposits were noted along several hedgerows and field boundaries.

Conclusions

No badger setts were found within the footprint of the Red Route although survey evidence, including badger hair and badger latrines, does indicate that the Red Route crosses through the foraging routes of badgers within the localised area. Badger activity was most noticeable between Ch. 1+550 and 2+000.

No confirmed bat roosts were identified within the footprint of the Red Route; however 5 no. of trees within the Red Route footprint have limited potential as bat roosting habitat and one property has moderate potential as a bat roosting site. It is recommended that access is obtained to property at Chainage 4+010 to adequately survey the roof space of this property. It is further recommended that if the poplar tree with multiple holes and cracks, located outside the footprint of the Red Route at Ch. 2+080 north is to be affected during the construction phase that a detailed bat survey of this tree is undertaken prior to works commencing.

No evidence or otter activity was noted during the surveys and it is considered that the watercourses crossed by the Red Route are not of sufficient size, nor are they suitably close to the River Dee, to accommodate otter feeding, foraging and resting sites.

No evidence of hedgehog (*Erinaceus europaeus*) or pygmy shrew (*Sorex minutus*) activity was noted during the surveys although it must be noted that ground conditions were not favourable for capturing mammal prints.

No evidence of red squirrel (*Sciurus vulgaris*) was noted during the mammal surveys and it is considered that squirrel foraging areas within or near the route are very limited and isolated.

It is concluded that the construction of the Red Route should not cause a detrimental effect on protected mammalian species found within the environs of the route. It is considered that the Red Route does pass through badger territory and further badger surveys should be undertaken prior to the construction phase. Pre-construction bat surveys should also be undertaken during warmer weather around the potential bat roosting habitat identified during the surveys.

[i] https://maps.biodiversityireland.ie/Map.

[ii] National Roads Authority (2009) *Ecological Surveying Techniques for Protected Flora and Fauna during the Panning of National Road Schemes.*

[iii] Collins, J., (2016). *Bat surveys for Professional Ecologists: Good practice guidelines (3rd Edition)*. Bat Conservation Trust.

[iv] Cornally, A. and Lawton, C. (2016) *A guide to the identification of Irish mammal hair*. *Irish Wildlife Manuals*, No. 92. National Parks and Wildlife Service.

A1

DO NOT SCALE

R162

TO KELLS

N52

GRANGE

R162

TO WILLIAMSTOWN

DRAFT

MATCH

LINE

ESB SUBSTATION

BH 01

BH 02

BH

TP 01

TP 02

TP 03

N52

LOCATION OF JAPANESE KNOTWEED

MATCH

LINE

BH 03

TP 04

TP 05

TP 06

BH 04

TP 08

TP 09

MATCH

LINE

CASTLETOWN

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6. FOR SETTING OUT COORDINATES OF EXPLORATORY HOLE LOCATIONS REFER TO DRAWING No. 5158291/HTR/SK/0036
7. PROPOSED LEVELS ARE SUBJECT TO CHANGE

Legend

- Mammal Trail
- Latrine
- Faecal Deposit
- Mammal Scrape
- Badger Hair
- Badger Print
- Potential Bat Habitat

LEGEND

- BH — BORE HOLE
- TP — TRIAL PIT
- EI — EXISTING EIRCOM DUCTING
- ESB — ESB LV OVERHEAD
- ESB — ESB 38kV OVERHEAD
- ESB — ESB 110kV OVERHEAD
- ESB — ESB 220kV OVERHEAD

Purpose: INFORMATION

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Department of Transport, Tourism and Sport

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Client: MEATH COUNTY COUNCIL

Project: N52 GRANGE TO CLONTAIL SCHEME

Title: Mammal Survey Maps

Original Scale	Design/Drawn	Checked	Authorised
1:1000 at A1 1:2000 at A3	CW Date 09/18	Date	Date

Status | Drawing Number: 01 of 5 | Rev

File: 5158291_HTR_SK_0028.dwg
Date: Aug 14, 2018 - 11:52am
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Legend

- Mammal Trail
- Latrine
- Faecal Deposit
- Mammal Scrape
- Badger Hair
- Badger Print
- Potential Bat Habitat

LEGEND

- BH — BORE HOLE
- TP — TRIAL PIT
- EI — EXISTING EIRCOM DUCTING
- ESB — ESB LV OVERHEAD
- ESB — ESB 38kV OVERHEAD
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A1

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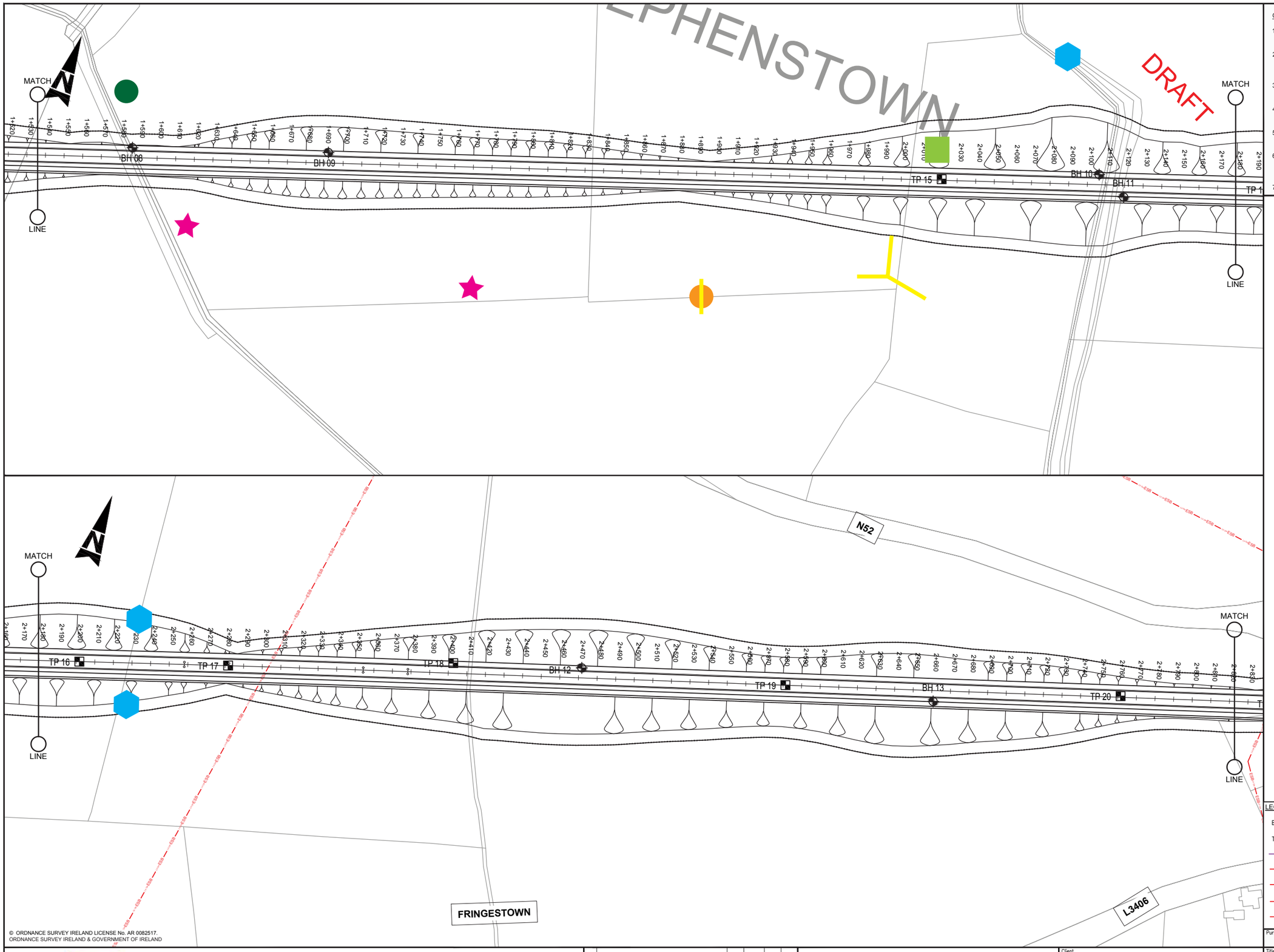

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Project: N52 GRANGE TO CLONTAIL SCHEME

Purpose: INFORMATION

Title: Mammal Survey Maps

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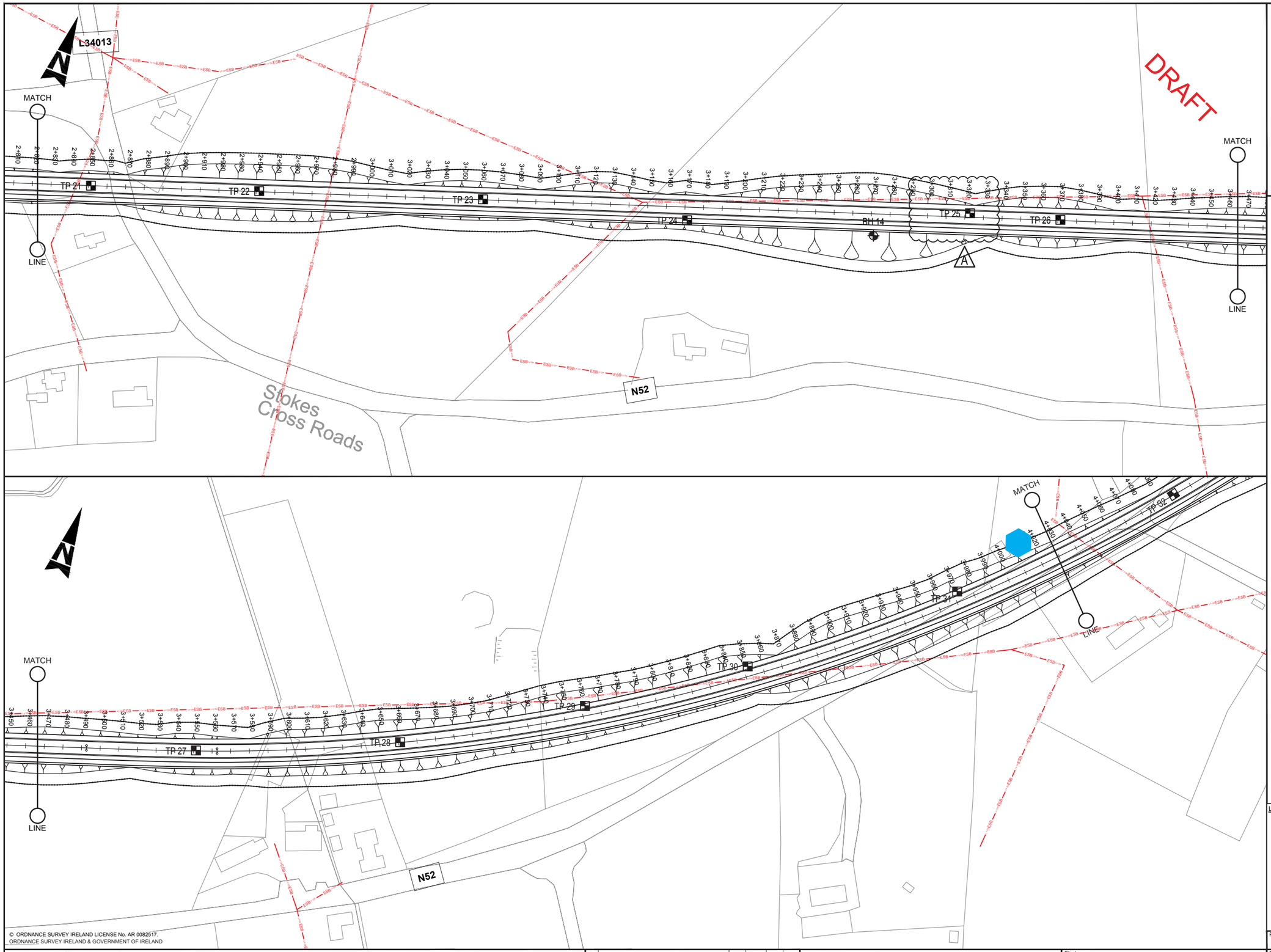

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LEGEND

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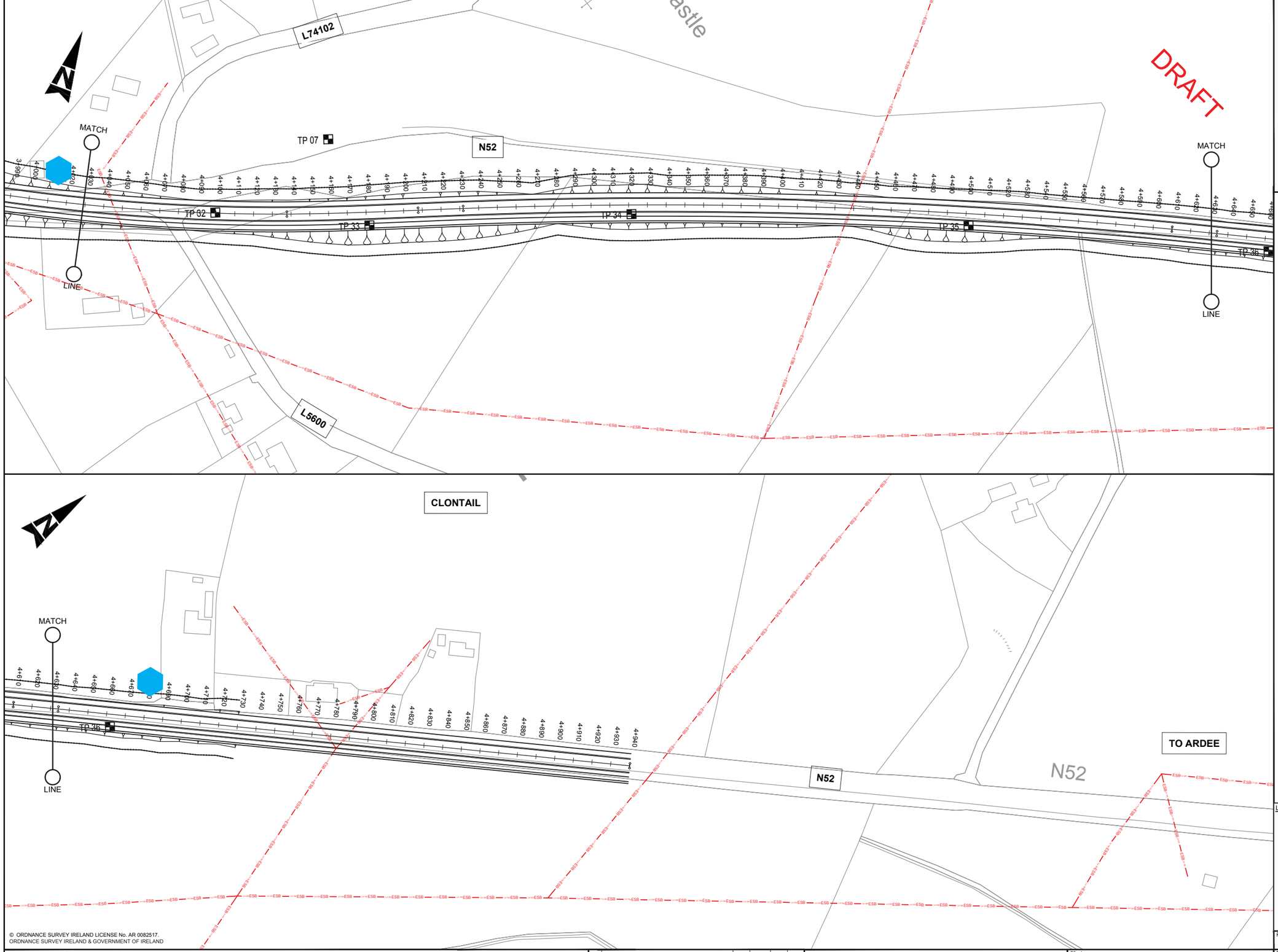

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Project: N52 GRANGE TO CLONTAIL SCHEME

Purpose: INFORMATION

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Technical Note

Project:	5158291		
Subject:	Bird Surveys: N52 Grange to Clontail		
Author:	Colin Wilson	Atkins No.:	5158291DG0096
Date:	27/09/2018	Project No.:	5158291
Distribution:		Representing:	

The purpose of this technical note is to document bird surveys carried out on the emerging preferred route of the N52 Grange to Clontail Road Scheme.

Introduction

The N52 Grange to Clontail Scheme has been subject to a Phase 2-Stage 2 Route Options process where four route options (magenta, red, orange and cyan) were considered. The study area of the N52 Grange to Clontail Scheme and the four route options are detailed below in Figure 1. Route Options.

The route selection process has determined that the Red Route is the emerging preferred route. As part of the Phase 3-Design stage a series of ecological surveys are to be undertaken along the Red Route. This technical note details the findings of initial bird surveys carried out within the footprint of the Red Route. The need for any further surveys is also recommended where appropriate.

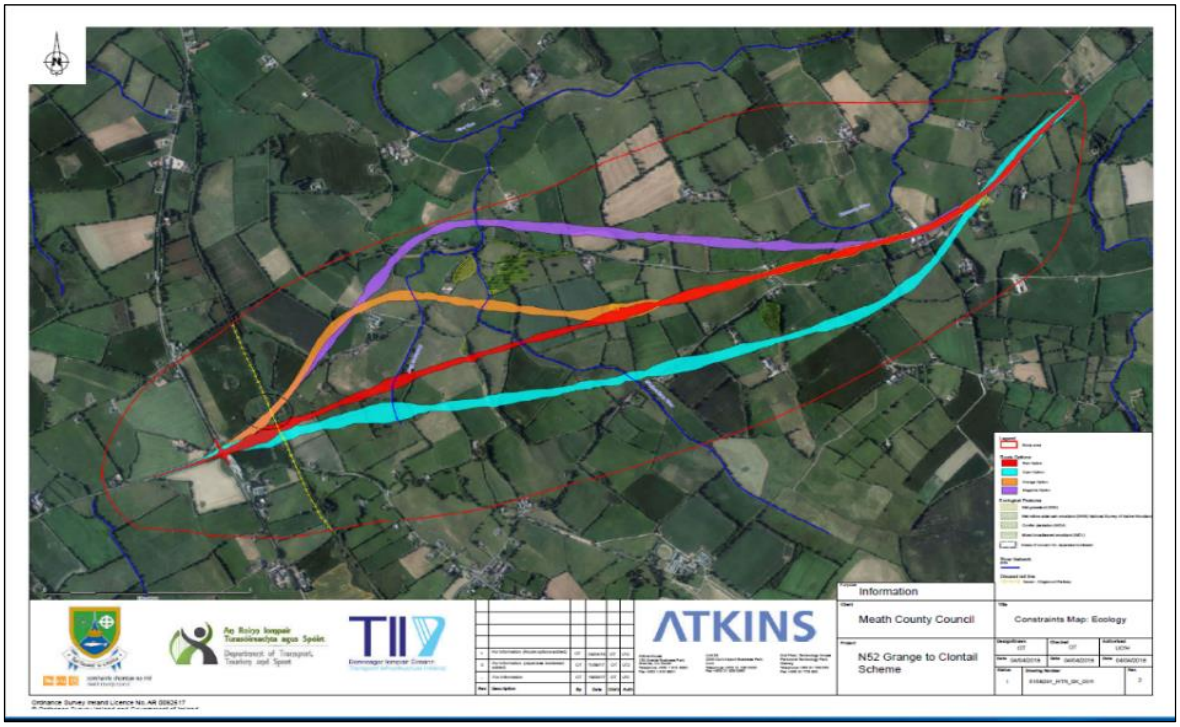

Figure 1. Route Options, with Red Route as emerging preferred route.

Survey Methodology

Bird surveys were undertaken over three days during August 2018 and involved a walk over survey of all habitats found within the footprint of the Red Route and adjoining lands. Habitats within the route are predominantly agricultural grassland with associated boundary hedgerows and treelines. The route also passes over three watercourses, alongside one small larch plantation and near two small areas of wet grassland. The survey focused on any habitat features with potential value as breeding and roosting sites.

The visual survey sought to determine which species are present on the route with particular focus being paid to surveying for evidence of post-breeding behaviour. The Red Route was slowly walked over in a manner which enabled quiet approach to habitats so as to cause the least disturbance allowing for the best visual identification of birds within the area. The survey also focused on identifying potential nesting habitat suitable for barn owl (*Tyto alba*) a protected and threatened species which has previously been recorded in the local environs. The barn owl nesting survey involved inspecting mature trees containing holes and rotted out cavities of greater than 80mm which would be large enough to accommodate barn owl. Any mature trees with such cavities were also visually inspected for signs of pellets, droppings and feathers.

Sightings of birds, potential breeding activity and potential roost and nesting sites were noted and plotted on maps. Surveys followed methodologies outlined in the NRA techniques for ecological surveying of flora and fauna[1] and also followed barn owl survey techniques for use in ecological assessment.[2]

[1] National Roads Authority (2009) *Ecological Surveying Techniques for Protected Flora and Fauna during the Panning of National Road Schemes.*

[2] Shawyer, C. R. (2011). Barn Owl *Tyto alba* Survey Methodology and Techniques for use in Ecological Assessment: Developing Best Practice in Survey and Reporting.

Survey Limitations

Bird surveys of the Red Route were carried out within the first two weeks of August 2018. Breeding activity at this time of year would be less prevalent than in spring and early summer periods. Weather conditions played a factor on one of the survey days where rainfall was persistent throughout the day and numbers of bird sightings was notably reduced.

Survey Findings

A total of 55 no. confirmed sightings and 1 no. possible sightings of various bird species were recorded during the surveys over the three days. A total of 15 no. of bird species were recorded during the bird surveys of the Red Route with one sighting where species could not be comprehensively determined.

Bird species recorded within and around the footprint of the Red Route along with the number of sightings of each species are detailed below in Table 1: Red Route Bird Sightings.

Table 1: Red Route Bird Sightings

Bird Species	Number of Sightings
Rook (*Corvus frugilegus*)	9
Starling (*Sturnus vulgaris*)	8
Blackbird (*Turdus merula*)	7
Wood Pigeon (*Columba palumbus*)	6
Thrush (*Turdus* spp.)	5
Swift (*Apus apus*)	4
Sparrow (*Passer* spp.)	3
Hooded Crow (*Corvus cornix*)	3
Magpie (*Pica pica*)	2
Chaffinch (*Fringilla coelebs*)	2
Pheasant (*Phasianus colchicus*)	2
Grey Wagtail (*Motacilla cinerea*)	1
Blue Tit (*Cyanistes caeruleus*)	1
Buzzard (*Buteo buteo*)	1
Robin (*Erithacus rubecula*)	1
Linnet (*Carduelis cannabina*)	1*

*possible sighting

The majority of the sightings were along the hedgerows and treelines with the following species spotted in flight over the area of the Red Route: 1 no. of Buzzard (*Buteo buteo*), 4 no. of Swift *(Apus apus*), 2 no. of Magpie (*Pica pica*) and 5 no. of Rook (*Corvus frugilegus*).

There were 8 no. sightings of starling (*Sturnus vulgaris*) at one location in a hawthorn tree. A probable sighting of a linnet (*Carduelis cannabina*) is noted at Ch. 1+310 within gorse scrub although observation was limited due to poor weather conditions and the fleeting nature of the sighting.

Potential Nesting Activity

The areas surveyed in the field were predominantly hawthorn and ash hedgerows; these support good dense nesting habitat due to the presence of abundant and dense vegetation cover, combined with ample feeding and foraging areas.

Surveys recorded four instances where bird species were seen in pairs in suitable breeding habitat. Both a hen and cock pheasant (*Phasianus colchicus*) were flushed from ground cover at Ch. 2+000. A pair of blackbirds (*Turdus merula*) were noted along dense hawthorn hedgerow at Ch. 0+450. Two pairs of wood pigeon (*Columba palumbus*) were noted in two separate locations Ch. 0+320 and Ch. 3+590 where in both instances the birds were disturbed from elder trees within hedgerows.

A small plantation of larch trees is located alongside the footprint of the Red Route at Ch 1+310 north. The upper limbs of two of these trees showed evidence of nests which are of comparable size and shape so as to accommodate rooks (*Corvus frugilegus*). These nests were observed with the use of binoculars and it is considered that they are either last year's nests or are abandoned due to their dilapidated nature.

Mature trees were surveyed with binoculars for any evidence of holes large enough to support barn owl. Large mature trees along the Red Route are noted as predominantly ash species. A significant number of mature hawthorn are found within the Red Route although the upper limbs of the hawthorn trees were noted as generally too small to support large holes and crevices.

One hole of significant size was noted in the lower section of the trunk of a semi mature ash tree outside the footprint of the Red Route at Ch 1+590 south. The surrounding area was inspected with no evidence of feathers, droppings or pellets being found. The hole was accessible and the inside was photographed for any evidence of roosting or nesting activity within. No evidence of bird activity was noted.

One mature poplar tree, located adjacent to the Red Route at Ch 2+100 is noted to have a large hollow in the lower section of the main trunk and smaller holes in the upper trunk and limbs. The hollow in the lower section was inspected with no evidence of bird activity found within. This hollow is considered unlikely nesting habitat due to its proximity to the ground making it vulnerable to predators. The holes noted in the upper sections of the poplar tree were considered to be too small to support barn owl but are a size capable of supporting smaller bird species and/or bat species.

The locations of sightings of the various bird species and the areas of potential nesting pairs are detailed on maps in Appendix 1: Bird Survey Sightings

Conclusions

The dense hedgerows noted along the footprint of the Red Route are capable of providing excellent nesting and feeding habitat for a wide range of native bird species. During the three-day survey there were 55 no. of confirmed sightings of 15 no. of different bird species noted along the area of the Red Route.

Although only four pairs of birds were noted during the August survey, it is considered that bird nesting activity would have been significantly increased and more evident along the route during the spring and early summer months.

No evidence of barn owl roosts or nests were found during the surveys which is considered to be due to the fact that suitable barn owl nesting habitat is very limited within the footprint of the Red Route.

No rare or endangered bird species were recorded during the surveys.

Appendix F. Land Parcel Drawings

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- UNREGISTERED AREA
- STUDY AREA

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Purpose: INFORMATION

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Title: LANDOWNER PARCELS WITHIN THE STUDY AREA

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Rev: A

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